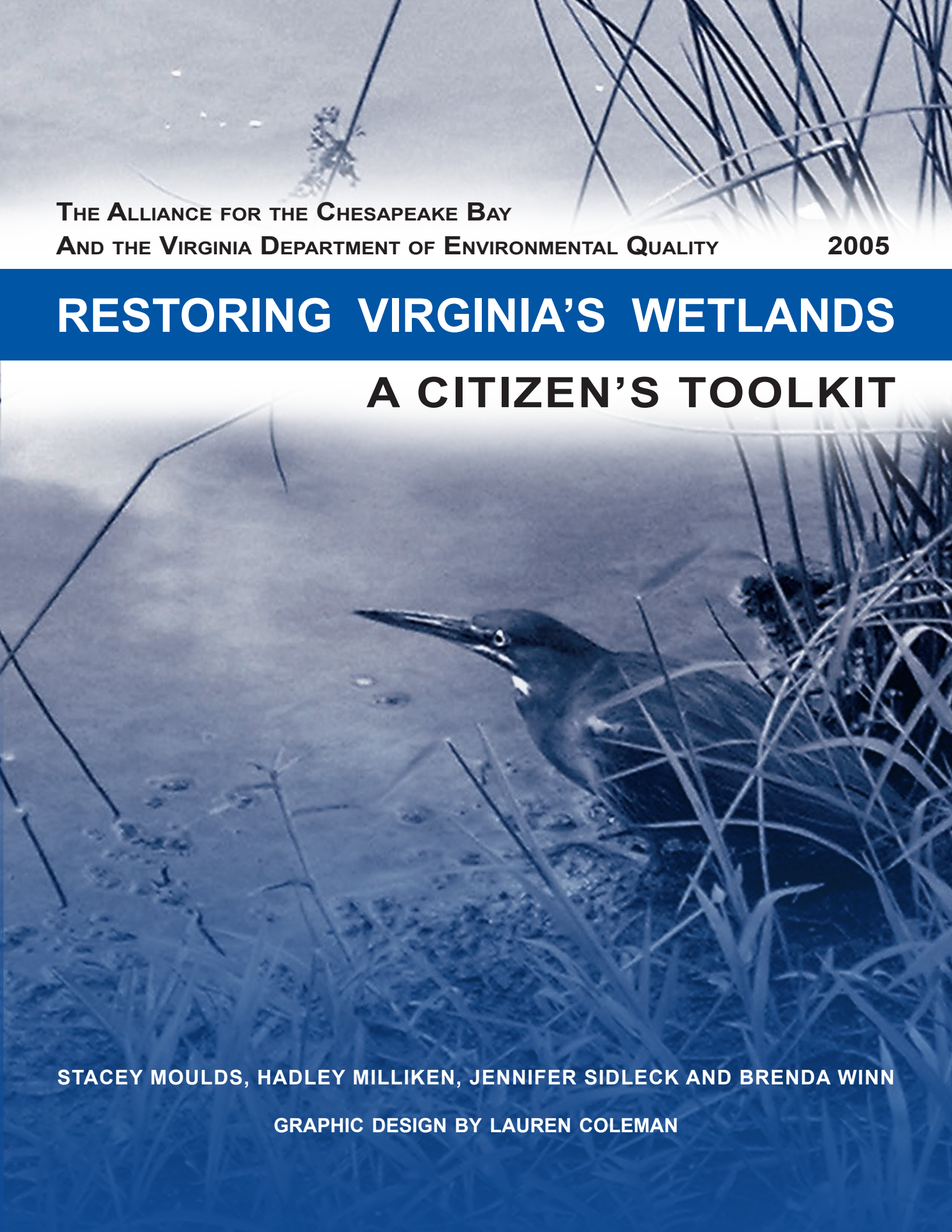

THE ALLIANCE FOR THE CHESAPEAKE BAY
AND THE VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY 2005

RESTORING VIRGINIA'S WETLANDS

A CITIZEN'S TOOLKIT

STACEY MOULDS, HADLEY MILLIKEN, JENNIFER SIDLECK AND BRENDA WINN

GRAPHIC DESIGN BY LAUREN COLEMAN

You Are Invited

All across Virginia, wetlands are serving many important functions. They promote water recharge in streams and rivers, provide vital wildlife habitat, support biodiversity, help cleanse polluted waters, help alleviate flooding and provide a variety of other important biological functions. Healthy wetlands greatly contribute to a healthy environment.

You are invited to learn more about Virginia's wealth of wetlands and help make them as pristine and plentiful as they can be for the health of the environment, our aesthetic enjoyment, and educational opportunities, for current as well as future generations. Take a look inside and contribute to Virginia's wetlands.

So the time is now to face what's at hand
To clean up the water and clean up the land
And we owe it to the future to preserve and protect
The gift that we have
It's not ours to neglect

~Don Shappelle from the song, *"Chesapeake Dream"*

Forward

The purpose of "Restoring Virginia's Wetlands – A Citizen's ToolKit" is to provide the Citizens of Virginia with information concerning wetlands and to promote the voluntary protection, enhancement, restoration and creation of wetlands on private as well as public lands within the Commonwealth. This ToolKit provides information to Virginia's landowners, both private and public, on the status of wetlands, various options for the use and management of their wetlands, current regulatory protection as well as voluntary efforts, and technical and financial resources for protection, enhancement, restoration and creation projects. This ToolKit guides you through the background information necessary to understand wetland functions and values. Included in this ToolKit are the basics regarding wetland identification, types and classification as well as types of wetland monitoring to learn more about wetlands.

Acknowledgements

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Disclaimer

Although this project was funded through the EPA, it does not necessarily reflect the opinion, position or policy of the EPA or the DEQ. The user of this ToolKit is responsible for keeping up to date with changes in the Federal, state and local permit regulations and requirements, scientific literature, web page locations or resource information provided in this ToolKit.

Photos: Front cover: Green Heron at Lewis Ginter Botanical Gardens, Richmond VA – photograph by Stacey Moulds. Back Cover: Marsh Periwinkle snails in salt marsh on Virginia's Eastern Shore – Photograph by Mara Dovis, freelance photographer www.marafoto.com.

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"All Life has its roots in the meeting of earth and water" ~ T.H. Watkins

What's Your Watershed Address?

To find out what watershed you live in, visit the U.S. Environmental Protection Agency's (EPA's) "Surf Your Watershed" web site: **http://www.epa.gov/surf/**

Introduction to Wetlands

Before trekking off into the world of wetlands, it is necessary to define a word that most of you know but some may not! This word is **watershed**. A watershed is an area of land that drains to a common waterway, including a wetland, stream, river, lake, or even an ocean. Imagine that when it rains, all the water within a watershed ultimately flows to the same waterway. Watersheds can vary in size, from just a few square feet for a **vernal pool** or for thousands of square miles for huge watersheds such as the Chesapeake Bay. Recent environmental movements have focused their attention on watershed stewardship and restoration. Wetlands make up an integral part of watersheds no matter how large or small!

Virginians use their diverse land types in many different ways — for living, working, farming, ranching, and recreation, to name a few. These uses often encroach on and affect wetlands, lands where water is the dominant factor determining soil, plant and wildlife diversity. These impacts raise difficult questions of balancing land use needs and environmental effects: How can we balance the needs of property owners to farm or build on their land while maintaining the beneficial functions of natural wetlands? How can we respect individual property rights and assure that necessary development and traditional land uses continue while conserving both publicly and privately owned wetlands? The answers to these questions will continue to be addressed with public education on the values and functions of wetlands and how our land-use choices affect these precious environmental resources (McCarthy, 2001).

It is obvious that wetlands offer much more subtlety, surprise, mystery and value than superficial observations may suggest. We encourage you to continue to learn about the wondrous areas where land meets the water, where life abounds and the sights and sounds of the natural world come alive. That way you can better appreciate just how unique and valuable they are to Virginia's natural resources!

What is a Wetland?

Wetlands…the word alone invites your senses to travel to a wet and wonderful place teeming with life. Wetlands are magical wet, soggy or boggy places. Wetlands force you to slow down and take notice of the sights, smells, and sounds of nature as your boots get stuck in the muddy ground below. When you enter a wetland it is as if a curtain is pulled back revealing a secret oasis and a symphony of sound; tall grasses sway in the breeze creating soothing music, the moist ground provides a rich home for melodious spring peepers, beautiful yet endangered lady slipper orchids, or the elusive Virginia rail. They are places of diversity and beauty, where odd-shaped pitcher plants capture insects for nutrients, a chorus of bullfrogs fill the night air, or the call of the Prothonotary Warbler echoes in the spring (Thomson & Luthin, 2004). Wetlands fill the onlooker with awe and a reverence for the diversity and beauty of nature.

Wetlands are the link between the water and the land. "Wetlands" is the collective term for marshes, swamps, bogs, and similar areas typically found between land and water along the edges of streams, rivers, lakes and coastlines. Although most wetlands have standing or flowing water for at least part of the year, many are dry for part of the year. In fact, some of the most important wetlands are only seasonally wet. Many different wetland types occur throughout Virginia due to our commonwealth's variability in **topography**, climate, soil, **hydrology**, **salinity**, vegetation and other factors (White, 1989). Wetlands provide vital habitat for thousands of aquatic plants and animals, providing food as well as critical nursery grounds for these species. Wetlands help absorb excess nutrients and sediment before they reach streams and rivers. They slow and absorb floodwaters and recharge groundwater supplies. Wetlands serve as rich educational venues for all ages as well as serene places to canoe, bird watch, hike, fish or to just "be" in the silence of nature (United States Environmental Protection Agency [EPA], September 2001).

Wetland Definitions

Part of the complexity and confusion with defining wetlands is that they are very diverse. Additionally, the definition varies depending on the audience and the purpose. Due to the sheer diversity of wetlands, the need to perform periodic inventories, of them and the regulation of their uses, science and politics both play a role in the "tweaking" of wetland definitions (Firehock, Graff, Middleton, Starinchak & Williams, 1998).

Regulatory Definitions

The following is a regulatory definition used by the U.S. Army Corps of Engineers (Corps), EPA and the Virginia Department of Environmental Quality (DEQ) to legally define wetlands and enforce Section 404 of the Clean Water Act, which is discussed in detail in *Section 3, Regulations*:

> "Wetlands are those areas that are **inundated** or **saturated** by surface or ground water 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. Wetlands generally include swamps, marshes, bogs and similar areas."

The Natural Resource Conservation Service (NRCS) modified this wetland definition with a focus on wetlands soils for the purpose of protecting wetlands on agricultural lands. This definition helped implement the "Swampbuster" provision of the Food Securities Act of 1985 preventing some agricultural lands from being drained (Firehock et al., 1998). According to the NRCS:

> "Wetlands are defined as areas that have a predominance of **hydric soils** and that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of **hydrophytic vegetation** typically adapted for life in saturated soil conditions…"

Scientific Definition

The most commonly used scientific definition was published in 1979 in the report, "Classification of Wetlands and Deepwater Habitats of the United States (Cowardin, Carter, Golet & LaRoe, 1979), for the U.S. Fish and Wildlife Service (FWS). This definition is utilized by the FWS to conduct wetland inventories within the United States:

> " Wetlands are lands transitional between terrestrial and aquatic systems where the **water table** is usually at or near the surface or the land is covered by shallow water…Wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominately **hydrophytes**, 2) the substrate is predominately undrained hydric soil, and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at sometime during the growing season of each year."

Despite the subtle wording variations and focus of each of the definitions provided above, three features are common to all:

- **Presence of water** above or near the soil surface for at least a portion of the growing season (referred to as wetland hydrology)
- **Specific types of soils** that develop under wet conditions (referred to as hydric soils)
- **Distinctive plants** adapted to wet conditions (referred to as hydrophytes, or wetland vegetation)

One important thing to note is that the two regulatory definitions require that all three features be present (under normal circumstances) for a wetland to be defined as such. In the scientific definition, only one feature is required.

There is no need to get "bogged down" with wetland definitions! These three definitions are simply ways of describing the physical attributes of wetlands and are used chiefly to identify wetlands for regulatory or scientific purposes.

Perhaps the best way to truly understand a wetland is to listen to the more eloquent descriptions of non-scientists: Writer Phillip Johnson, a leading author on Darwinian evolution, calls wetlands "mysteriously fertile couplings of land and water." Author B. Douglass Richter describes how, in ages long past, these unique areas at the edges of continents and rivers served as nurseries for the beginnings of terrestrial plant life. Alternatively, as T. H. Watkins, another prominent environmental writer, put it: "All life has its roots in the meeting of earth and water." (Alliance for the Chesapeake Bay [Alliance], n.d.).

What Makes it a Wetland? A more in depth look at wetland hydrology, soils, vegetation and animals

"Hydrology is probably the single most important determinant of the establishment and maintenance of specific types of wetlands and wetland processes" ~Mitsch & Gosselink

Some people may think that determining if an area is a wetland should be an easy task. If the area is wet – it is a wetland, if the area is dry – it is not. If only it were that simple! The truth is, wetlands have many distinguishing characteristics other than the presence of standing water, which are used for identification and classification. In fact, many wetlands only have standing water or saturated soils for a small portion of the growing season and appear dry for most of the time.

Therefore, it is important to look closely at the combined hydrology, soils and vegetation of an area to determine if it is a wetland. In the following section, we will examine these three features used to identify and classify wetlands.

How are Wetlands Wet? Understanding Wetland Hydrology

Hydrology is used to describe the movement and storage of water in an area (Black, 1996). When applied to wetlands – hydrology describes water movement and storage in a wetland. Wetlands become saturated and inundated with water from precipitation, groundwater inputs, surface runoff, tides and floodwaters (Mitsch & Gosselink, 2000).

As the diagram to the right shows, inputs of water to a wetland include: precipitation, surface runoff, tides, stream flow and groundwater inputs. Water exits wetlands through **evapotranspiration**, surface runoff, stream flow and groundwater. It is important to recognize that many of these inputs and outputs of water in a wetland are occurring simultaneously and are interrelated. Water in a wetland can be present above the soil surface, at the soil surface or just below the soil surface in the root zone for a portion of the growing season (Firehock et al., 1998). This is why wetlands may not always appear wet, which can make identification and **delineation** difficult and has led to many common wetland "misconceptions".

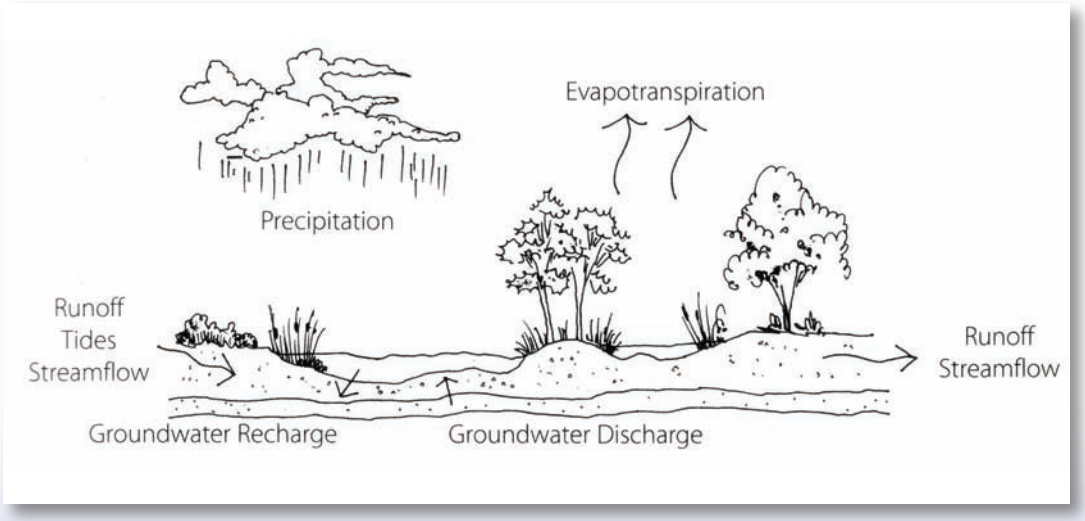
Water collects in a wetland because it is usually a transitional zone between terrestrial and aquatic systems where water collects and is poorly drained (Mitsch & Gosselink, 2000). There are many different types of wetlands each with a unique **hydroperiod** (Mitsch & Gosselink, 2000). A hydroperiod describes water movement and transfer within a wetland over time. It can also be thought of as the "seasonal fluctuating pattern of the water level" (Firehock et al., 1998, p. 18). Hydroperiods are affected by both weather and wetland inputs and outputs, which cause changes in wetland "wetness" over time.

Signs of Wetland Hydrology

Wetland hydrology is easy to identify if the area has water above the ground surface. However, when there is no surface water present, it becomes more difficult and you must look more closely at the hydrology of the site.

Before discussing signs of wetland hydrology it is important to understand the difference between two words used frequently when discussing wetlands: inundation and saturation. Areas that are inundated have standing water, whereas, areas that are saturated have no standing water but do have wet soils.

To more fully understand the distinction, picture yourself outside after a big rainstorm. If you are walking through a large puddle wishing you had on rain boots you are walking through an inundated wetland. If you waited a few hours to a few days and went back outside to the same spot, there may no longer be a puddle. If you took off your sneakers and walked through the same area in your socks, they would probably become saturated with water, indicating saturation at the ground surface. Depending on the wetland, if you waited a couple more hours or days and visited the same spot, your socks may not get wet at all. However, if you dug a hole about a foot into the ground, water would seep in from the sides or the hole would fill with water, indicating saturation within a foot of the surface.



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Example Field Indicators of Wetland Hydrology

- Inundation – Standing water
- Saturation – Damp or wet feeling soils
- Water Pooling or Water Seeps – if hole dug into the ground (12-18" deep), fills with water or seeps from the walls
- Water Marks – Trees have water lines or other evidence of high water
- Sediment Deposits – Evidence on leaves and other materials that suggests flooding
- Drift lines – Leaves and trashy debris that looks like its been washed up against roots, tree trunks, fences and other obstacles by moving flooded water.
- Swollen Bases on Tree Trunks

Going Down Under- Understanding Wetland Soils

"Each soil has had its own history. Like a river, a mountain, a forest or any natural thing, its present condition is due to the influences of many things and events of the past." ~Charles Kellogg

Wetland soils have unique characteristics resulting from the presence of water above, below or at the soil surface. Due to the unique hydrology of a wetland, wetland soils are known as hydric soils. Hydric soils form from a lack of oxygen present in the soil due to the presence of water (Mitsch & Gosselink, 2000). When oxygen is low or absent it is referred to as an anoxic environment or **anaerobic condition**. There are two main types of wetland soils that result from the lack of oxygen in the soil: **mineral** and **organic soils**. Without getting into complicated definitions describing the percent of carbon in the soil, mineral and organic soils differ in a number of ways.

Signs of Hydric Soils

(*To Observe Soils*: Dig a hole in the ground that is 12-18")

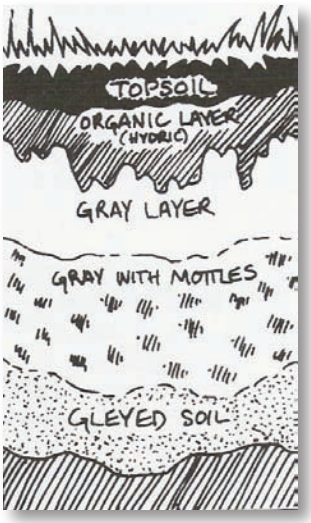
- *Rotten Egg Smell* – Caused by sulfur in soil
- *Soil Color* – Look for soils with a grayish or greenish hue
- *Mottling* – Concentrations of highly oxidized particles
- *Oxidized* **Rhizospheres** – Rusty orange material around the roots in the root zone

Organic Soils

Organic soils result from the decomposition of plant material that accumulates in anaerobic conditions (Mitsch & Gosselink, 2000). Organic soils have more organic carbon, lower densities and higher water-holding capacities (Mitsch & Gosselink, 2000). The plant materials usually accumulate rather than decompose because composting is slow and difficult in cool anoxic environments, which are characteristic of wetlands with organic soils (Ripple & Garbisch, 2000). Organic soils are often referred to as peats and mucks and are characteristic of areas with mosses or herbaceous emergent vegetation (Ripple & Garbisch, 2000).

Mineral Soils

Mineral soils are often composed of sands, silts and clays (Ripple & Garbisch, 2000). Mineral soils are present in areas where organic soils do not have time to accumulate, typically in areas with flowing water, warmer climates, woody vegetation and seasonal saturation. Mineral soils have two distinct characteristics: gleying and mottling (Ripple & Garbisch, 2000)



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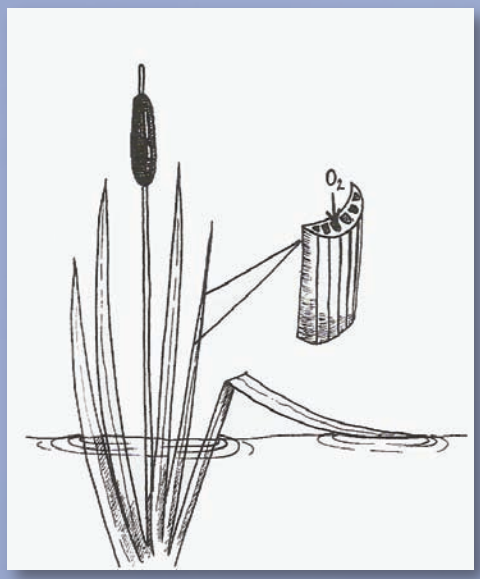
Typical soil profile in a wetland

Gleying results from the reduction of iron and gives the soil a black, gray or greenish bluish-gray appearance or tint (Mitsch & Gosselink, 2000). If you were to examine the soils in a dry upland area, you would they would most likely be orangish-red in color, which results from the **oxidation** of iron (exposure to air) in the soil. You can think of this process as "rusting" because it is similar to what occurs on garden tools left outside. This "rusting" process does not happen in wetland soils that are permanently inundated or saturated because of the lack of oxygen in soil pores, due to the presence of water. Rather than the iron oxidizing in wetland soils it is reduced from the lack of oxygen in the soil and has the characteristic gleyed appearance (Mitsch & Gosselink, 2000).

Mottling occurs when highly oxidized materials are concentrated in the soil (Mitsch & Gosselink, 2000). Mottles look either orange or reddish-brown in soils containing iron or look black or dark reddish-brown in soils with manganese (Mitsch & Gosselink, 2000). Your next question may already be brewing… How are highly oxidized particles found under anaerobic conditions? Here is where we need to go back to our initial discussion of a wetland. As you will remember many wetlands are only periodically inundated or saturated with water. Therefore oxidizing conditions can occur when the wetland is dry, thus allowing the formation of mottles (Ripple & Garbisch, 2000). So, mottling occurs in mineral wetland soils that are dry for part of the time.

Botany Lesson- Understanding Wetland Vegetation

We have already seen that wetland hydrology affects the development of unique soil characteristics. The presence of wetland hydrology also affects the types of plants found in wetlands, known as hydrophytes, or hydrophytic vegetation. Conditions in a wetland are stressful for plants as they struggle to adapt to fluctuating water levels and flooding (Firehock et al., 1998). Plants usually take oxygen into their root system and distribute it throughout their stems and leaves (Kesselheim & Slattery, 1995). Due to the lack of oxygen in the root zone, wetland plants have developed special adaptations that allow them to survive and reproduce in an anoxic environment (Firehock et al., 1998).



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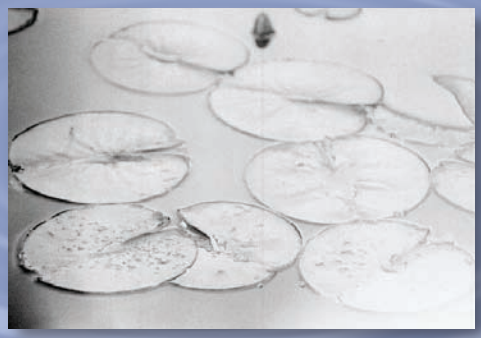
Cattail diagram, showing hypertrophied lenticels

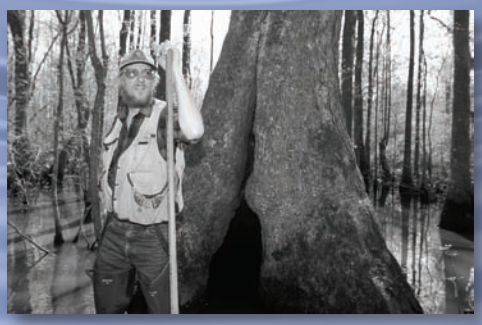
Moulds

Bald Cypress "knees," or pneumatophores



Moulds

Floating Lilypad leaves



FWS/Shallenberger

Buttressed tree trunk in the Great Dismal Swamp

Plant Adaptations to Wetland Hydrology

Morphological

- *Shallow Root Systems* – Root systems that grow close to the soil surface to obtain oxygen
- *Adventitious Roots* – Roots that grow out of the stem above fluctuating water levels
- *Buttressed Tree Trunks* – Swollen tree trunks that provide stability
- *Pneumatophores* – Vertical roots for respiration. Root is erect and protrudes above the soil surface. Common example are Bald cypress "knees"
- *Floating Leaves* – Leaves with a thick waxy coat to prevent water penetration that float on the water surface
- *Inflated Leaves and Stems* – stems and roots with sponge-like tissues, which provide buoyancy and oxygen storage
- *Floating Stems* – Stems that can root and float on the water surface because of large internal air spaces
- *Hypertrophied Lenticels* – pore space on plant stems used for oxygen exchange

Physiological

- Ability to grow in anoxic conditions
- Chemical production adaptations

Reproductive

- *Seed Viability* – Extended seed viability which allows the germination of seeds during a dry time when exposed to air
- *Seed Germination* – the ability to germinate under anoxic conditions while underwater and not exposed to air
- *Changes in Seeds and Seedlings* – floating seeds and flood tolerant seedlings

Morphological adaptations are changes involving the physical structure of the plant, which provide physical support and increased uptake of both oxygen and nutrients (Firehock et al., 1998). Many morphological adaptations involve modifications to root structure and function to increase oxygen uptake. **Physiological** adaptations involve alterations of life processes including the ability to grow in low oxygen conditions (Firehock et al., 1998). Plants also use reproductive adaptations to improve seed viability and germination (Firehock et al., 1998).

Adaptations to salinity: Some wetlands plants not only have to adapt to fluctuating water levels but also the affects of salinity. In order to adapt, plants have root adaptations that prevent them from taking up salt or specialized cells used to excrete salt (Firehock et al., 1998).

Resources for More Information about Wetland Plants and Animals

Life in the Chesapeake Bay: An Illustrated Guide to Fishes, Invertebrates, and Plants of Bays and Inlets from Cape Code to Cape Hatteras. Lippson, A.J. & Lippson, R.L. (1984). Baltimore: The Johns Hopkins University Press.

Chesapeake Bay A Field Guide: Nature of the Estuary. White, C.P. (1989). Centerville, MD: Tidewater Publishers.

Tidal Wetland Plants of Virginia. Silberhorn, G.M. (1976, April). Gloucester Point, VA: Virginia Institute of Marine Science.

Wetland Planting Guide for the Northeastern United States: Plants for Wetland Creation, Restoration and Enhancement. Thunhorst, G.A. (1993). St. Michaels, MD: Environmental Concern Inc.

Animal Adaptations

Animals also have adaptations that allow them to function in a wetland. Some aquatic animal adaptations include higher concentrations of blood pigment used to transport oxygen throughout the body and gills that do not collapse when exposed to air (Firehock et al., 1998). Certain frogs and salamanders have adapted to reproduce in shallow, temporary wetlands that are only seasonally wet. Animals living in salt marshes are often highly specialized to withstand salinity as well as both tidal inundation (White, 1989).

What types of plants and animals are found in wetlands?

Common Wetland Plants and Animals of Virginia

Plants	Animals
Cypress	Bald eagle
Red maple	Osprey
Black willow	Red-bellied woodpecker
Swamp rose	Great blue heron
Buttonbush	Mallard duck
Cattail	Spring Peeper
Soft rush	Bullfrog
Saltmarsh cordgrass	Eastern mud turtle
Salt meadow hay	Beaver
Jewel weed	River otter
Lizard's tail	Raccoon
Skunk Cabbage	White-tailed deer

Wetlands are very important habitats for many plants and animals. The plants and animals found in wetlands vary among the different wetland types. Wetland animals can vary from small, barely recognizable insect larvae to bald eagles and white-tailed deer. Plants can vary from lush, tropical-looking vines and floating vegetation to blueberries, shrubs and trees.

One of the most interesting attributes of wetlands is that many of the plants and animals living in them are transitional in nature, meaning that they have adapted to both wet and dry areas. Wetlands are especially important for animals that seek shelter, food and reproductive habitat in these transitional areas. Plant identification and bird watching are two popular recreational activities that many people partake in while visiting a wetland.

How can I tell if my site is a wetland?

Hopefully, now you are able to understand why you cannot identify a wetland based solely on the presence of standing water. Wetland hydrology drives the changes that take place in the soil and those adaptations of plants and animals. Without examining the hydrology, soils and vegetation of an area collectively, identification of wetland systems is difficult. All of the processes and changes occurring within a wetland system are unique to that environment making wetlands an interesting area to study, recreate and appreciate.

Now that you have successfully read this section, identification of a wetland should be a piece of cake… right? The table below includes a checklist of signs that your site may be a wetland.

Although you should now be better equipped to recognize a wetland, it is still a good idea to consult with a professional to verify that your site is a wetland and to classify it. A professional will also be able to **delineate**, or mark, the boundaries of your wetland. Delineation is discussed in more detail in the *Section 4*, under *Permitting*.

Signs That Your Site May Be A Wetland

- Is there standing, shallow water permanently, or for long periods of time?
- Is there evidence of watermarks or water stains on the trees and woody vegetation?
- Has sediment been deposited on leaves that may suggest flooding?
- Are the leaves matted and grayer in appearance than those on higher ground?
- Can you see drift lines or evidence that leaves and trashy debris were washed against roots, fences or other obstacles?
- Are there depressions and mounds evident in the area?
- Are there distinguishable shallow channels that may have been created during the wet season?
- Are bottles and can filled with sediment?
- Are the bases of trees swollen and bloated looking?
- Are tree and shrub roots shallow and exposed?
- Are cattails present or other vegetation that is adapted to wet environments?
- Are the soils mottled or gleyed?

Wetland Functions and Values

"Wetlands are more than physical places where water is present, soils have unique characteristics and certain plants grow" (Welsch et al., n.d, p.3).

Environmentalists, ecologists, biologists, naturalists and citizens have recognized and defined many of the functions and values that people attribute to wetlands today. Thomas and Luthin (2004) have concisely summed up wetland value and function in the following excerpt:

> *Scientists investigating wetland ecosystems have found that wetlands have many functions and provide numerous benefits to the environment and to us. These benefits may vary from wetland to wetland, and depend on the type of wetland, its size, its proximity to other wetlands and natural ecosystems, and the degree of disturbance, among other factors (p.10).*

Functions of Wetlands

Typical wetland functions include:

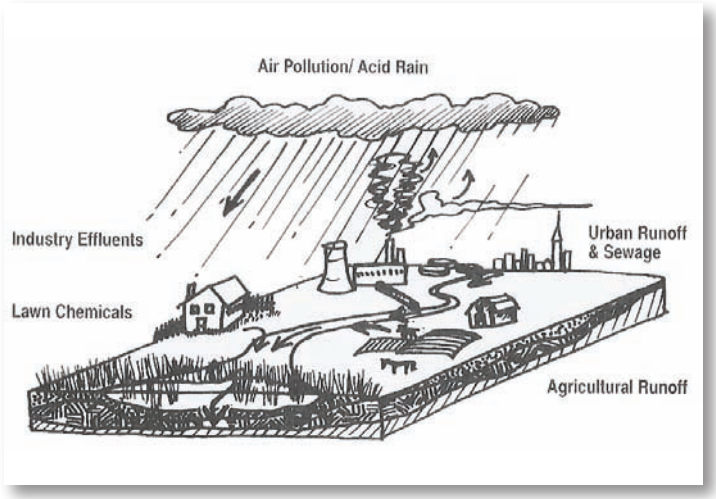
Food Production — The wetlands ecosystem provides critical food sources for a variety of aquatic species such as fish, shell fish, various birds and small mammals

Fish and Wildlife Habitat — Wetlands provide shelter, food, spawning and nesting sites for a multitude of birds, fish, mammals, reptiles and invertebrates

Flood Reduction — Wetlands help to absorb and slow floodwaters acting as a natural "sponge"

Ground Water Recharge and Water Storage — Wetlands, acting as a natural "sponge", hold precipitation, flood waters, and snow melt which recharges ground water supplies

Water Filtration and Cleansing — Wetlands serve as nature's "kidneys," removing and filtering excess nutrients and sediments from entering waterways



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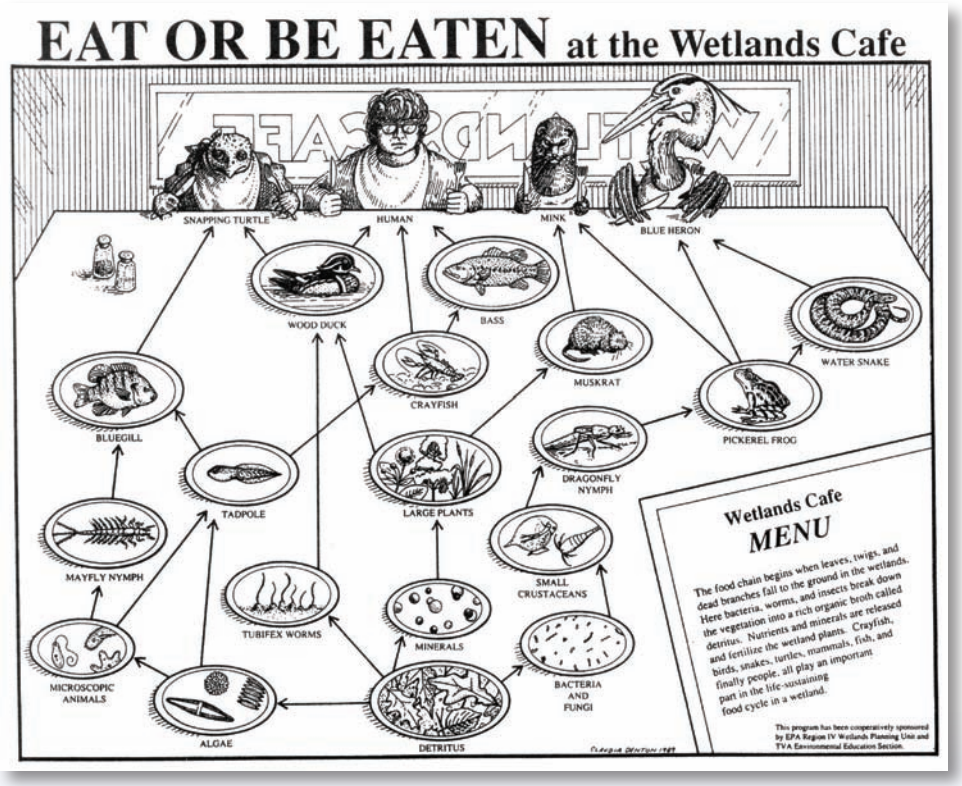
Wetlands serve as nature's kidneys



IWLA/TVA

Wetland Values

The functions that wetlands provide, give them the attributes that we value so much. According to Thomas and Luthin (2004):

> *Many values are associated with these wetland functions. Hunting, fishing, canoeing, bird watching, and aesthetic enjoyment are direct wetland values that offer us obvious and immediate benefits. In addition, wetland functions such as water filtration, flood control, and reduced soil erosion may provide direct or indirect benefits to society and to the environment in general. Some wetland values are subtle and understanding their importance requires a good working knowledge of the land, soils, and hydrology (p.10).*

Primary wetland values include ecological, economic, environmental, aesthetic and recreational.

Moulds

Ecological Values

"Wetlands are our most biologically productive ecosystems, providing habitat for a rich diversity of plant and animal species"(Thomson & Luthin, 2004, p.10). Wetlands serve as spawning grounds for many species of Virginia's fish and aquatic organisms, vital nesting habitat for waterfowl, and are home to a variety of snakes, salamanders, frogs, insects and other organisms that play a vital role in the ecological web of wetland life (Thomson & Luthin, 2004).

Economic Values

It is virtually impossible to put a price tag on the tremendous value wetlands provide. Wetlands often provide direct economic benefits to all of us whether we are aware of them or not. Private properties containing wetlands are greatly valued for their open space, wildlife habitat and aesthetic value. Communities with healthy and protected wetlands benefit from flood control, groundwater recharge, erosion control, improved water quality and recreational opportunities. Many trees and shrubs found in wetland habitats are used for medicinal uses, and food such as blueberries and wild rice are harvested in these habitats as well.

A significant source of income for communities in proximity to wetlands relies on recreational users. Bird watchers, hunters, canoeers, kayakers and sport fishermen spend a significant amount of money on travel related costs such as food and lodging, gas, local crafts and other equipment. (Chesapeake Bay Program [CBP], 1997) Considering the important part wetlands play in maintaining the health of costal waters, it is evident that Virginia's coastal wetlands are essential for supporting the state's fishing industry. Important commercial and recreational species, such as menhaden, flounder, striped bass and clams are dependant on Virginia's wetlands for nursery areas, food sources, and spawning grounds (Stedman & Hanson, n.d.).

According to the CBP (1997), other economic factors include:

- Over 95% of the commercially harvested fish and shellfish species in the United States are at least partially wetland dependant
- Nationally, waterfowl hunters spend over $59.5 billion annually on hunting, fishing, bird watching and photographing wildlife (EPA, 1995).
- Over $100 million worth of seafood is removed from the waters of the Chesapeake Bay annually- many of these species rely on wetlands for critical habitat and food sources

Environmental Values

Wetlands are often considered the first defense in helping to reduce the frequency and intensity of flooding. They filter the excess nutrients, sediment, and chemical pollutants from storm water runoff thereby improving water quality. Wetlands reduce the impact of soil erosion by buffering coastlines and absorbing floodwaters and precipitation and slowly releasing it. Furthermore, wetlands protect stream banks and shorelines from erosion and serve as a source of fresh water to maintain base flows in streams and rivers. (Thomson & Luthin, 2004).

Aesthetic and Recreational Values

Wetlands offer a silent retreat from our busy lives. They provide an opportunity to tune in to the sights and sounds of the natural world. Wetlands can offer a place of solace and allow the visitor a chance for enhanced observation, contemplation, or perhaps a scenic place to paint, draw or take photographs. Wetlands offer a venue for fishing, canoeing, birding, and other recreational uses. Oftentimes, public lands such as national wildlife refuges, state parks, and state natural areas contain extensive wetland areas attractive to visitors for a variety of uses (Thomson & Luthin, 2004).

FWS/Smith

What are wetlands Bad for?

It has already been established that wetlands benefit our environment, economy and wellbeing… So why not build our houses and business on a wetland? According to Thomas and Luthin (2004):

> *Wetlands are <u>not</u> good places for development. High water tables, the potential for flooding, and soils that seasonally shrink and swell can pose severe problems when a home, commercial enterprise, or road is built in a former wetland. Development in wetlands exacerbates flooding and runoff problems. The best thing for a wetland to be is what it was naturally meant to be: a wetland (p.11).*

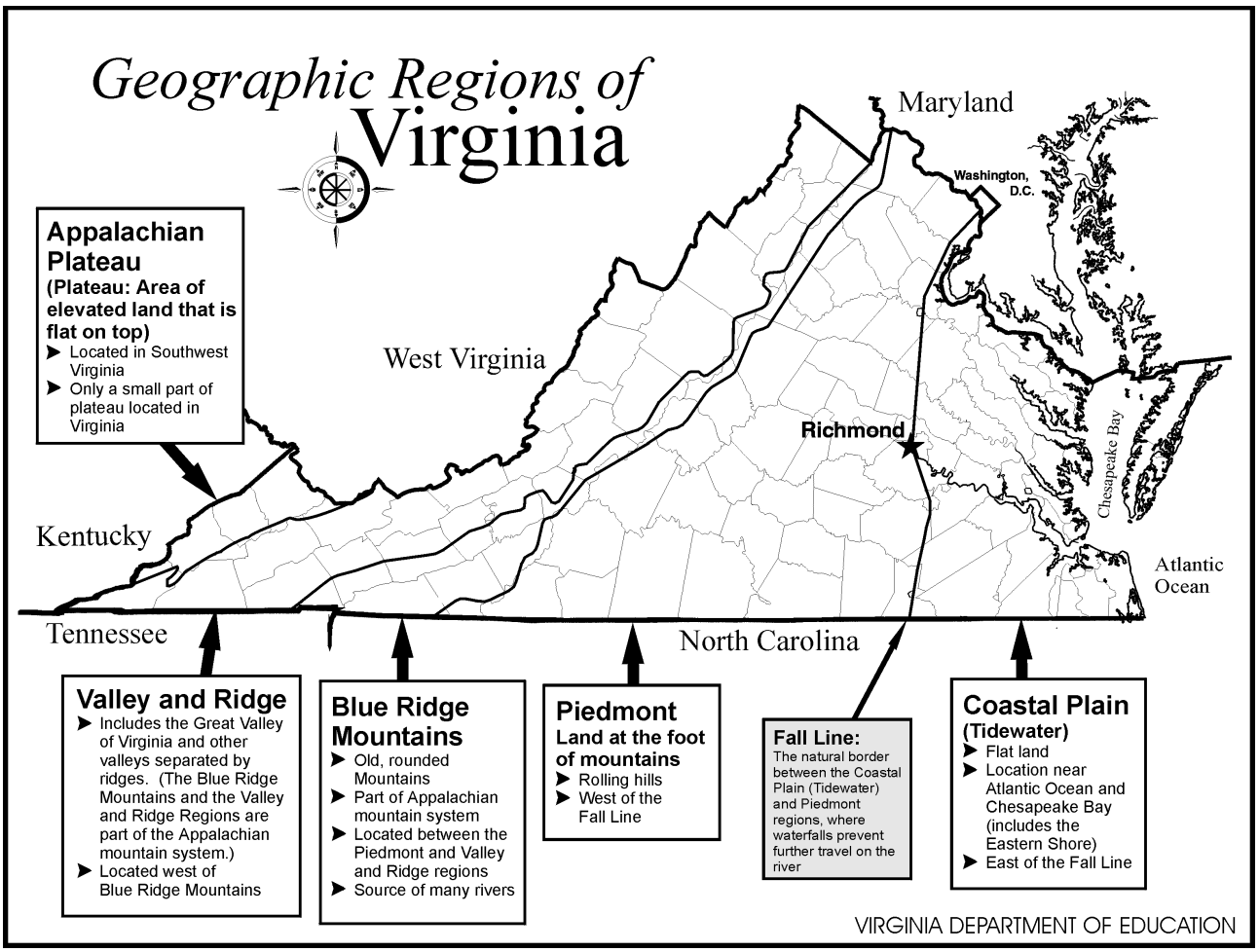
2 Getting to Know Virginia's Wetlands

"When one tugs at a single thing in nature, he finds it attached to the rest of the world." ~John Muir

Our Commonwealth's Wetlands: a "Wealth" of variety, including some that are not that "Common"

Why All The Variety?

"Beginning at sea level at the eastern edge of the state, the surface of Virginia rises gradually in elevation and increases in irregularity, until it reaches maximum elevation and ruggedness in the western part of the state" (Virginia Department of Conservation and Recreation [DCR], Natural Communities of Virginia [NCV], n.d). Virginia possesses a greater variety of natural landscapes, more than any other state in the east, having five major **physiographic providences**, or geographic regions (Woodward & Hoffman, 1991). These five geographic regions are from east to west: the Coastal Plain, the Piedmont Plateau, the Blue Ridge, the Ridge and Valley, and the Appalachian Plateaus (DCR, NCV, n.d.). Each region has its own unique geology and soil composition, as well as unique climatic patterns, influenced by the Commonwealth's diverse topographic relief (Woodward & Hoffman, 1991). It is no surprise then, that Virginia's wetlands are so diverse!



To better understand Virginia's wetlands we have developed a simplified classification system to discuss the various wetland types. The first major classification divides Virginia's wetlands as being either tidal or nontidal.

Tidal Wetlands

"Virginia is well endowed with tidal wetlands… The massive prairie-like appearance of the saltmarshes of the Eastern Shore and the lush, tropical-like vegetation of the freshwater marshes of the Mattaponi and Pamunkey Rivers have a particular gestalt beauty that is indescribable" (Silberhorn, 1976).

Tidal wetlands, also referred to as **estuaries**, are located within Virginia's Coastal Plain. Estuaries are semi-enclosed coastal waterbodies that are affected by both tides as well as freshwater (White, 1989). Estuaries have **salinity gradients** ranging from saltwater at the mouth to freshwater at some upstream limit that is still subject to tidal action.

"Salinity is defined as the measure of dissolved salts in water, usually expressed in parts per thousand (ppt)" (White, 1989, p.14). The salinity at the mouth of the Chesapeake Bay and tidal rivers close to its mouth are considered **saltwater**, approximate to that of seawater (averages 35 ppt) whereas **freshwater** contains few salts (usually less than 0.5ppt). **Brackish** water is broadly defined as a middle range in the salinity gradient between tidal freshwater and seawater. The salinity of estuarine systems varies seasonally and yearly depending on the volume of freshwater flowing into the system from upstream. Generally, salinity levels are lowest during the early spring due to higher amounts of rain and melting snow. The degree of brackishness is therefore "inverse to the seasonal freshwater flow — fresher in spring and saltier in the autumn" (White, 1989, p.18). Along this salinity gradient, every habitat "supports a unique community of plants and animals, each particularly suited to the water chemistry and bottom **substrate** of a given salinity zone" (White, 1989, p.18).

Virginia has four main estuarine systems, all of which ultimately drain into the Atlantic Ocean. The largest of these is the Chesapeake Bay watershed, which drains a large portion of Virginia as well as parts of New York, Pennsylvania, Maryland, Delaware, West Virginia and Washington, D.C. Four Virginia Rivers flow into the Chesapeake Bay including the Potomac, Rappahannock, York and James Rivers, all of which have tidal gradients ranging from saltwater, brackish and tidal freshwater. The next largest is the Chowan watershed. Rivers that drain into the Chowan River system include the Meherrin, Nottoway, and the Blackwater Rivers. These rivers have tidal freshwater portions within Virginia before becoming brackish and joining the Chowan River in North Carolina (Woodward & Hoffman, 1991). North Carolina's Currituck Sound is drained by three waterbodies that originate in Virginia: the Northwest and North Landing Rivers and Back Bay. Although all three waterbodies have tidal portions in Virginia, only Back Bay has brackish portions. Virginia's Coastal Bay, which includes the area between Virginia's Eastern Shore mainland and the Barrier Islands.

In Virginia, tidal wetlands are diverse, consisting of marshes, tidal swamps and **subaqueous lands**. Tidal wetlands are one of the most productive type of ecosystem, providing food, critical habitat, nursery grounds, and shelter to a myriad of animals at various stages in their life cycle. These wetlands perform important filtering functions prior to their drainage into the Atlantic Ocean. They also help stabilize coastlines, preventing erosion during storms (Hutchings, 2003). Tidal wetlands are particularly important habitats for brackish and marine fishes and shellfish, small mammals, migratory shorebirds, various waterfowl, and a variety of wading birds such as herons and egrets. Most commercial and game fishes use tidal marshes and estuaries as nursery and spawning grounds. Striped bass, bluefish, sea trout, croaker, menhaden, and flounder are among the most familiar fishes that rely on tidal wetlands. Shellfish including oysters, clams and shrimp as well as the Blue crab, the prized shellfish of the Chesapeake Bay, also depend on coastal marshes (CBP, 2002).

Tidal marshes are generally dominated by **emergent**, or herbaceous vegetation. Tidal marshes can be freshwater, brackish or salt water due the fluctuation of tides and freshwater input.

Alice Jane Lippson

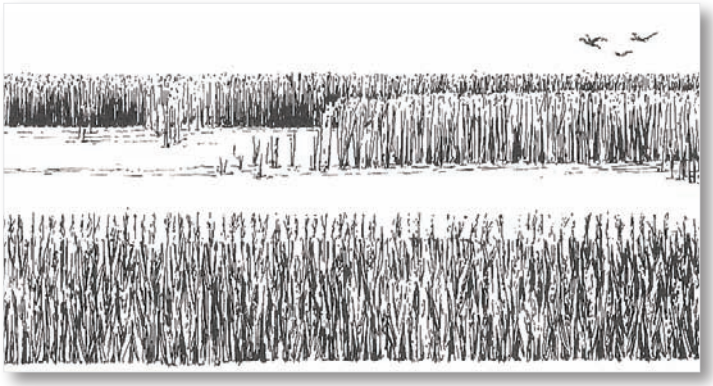
Freshwater Marsh

Tidal Freshwater Marshes – Tidal freshwater marshes border tidal freshwater streams and rivers located in the upper reaches of tides. Tidal freshwaters are regions of narrow salinity gradients (0-0.5 ppt) yet contain daily tidal fluctuations. Salinity zones can fluctuate and can become slightly brackish during summer droughts. The plant community of freshwater marshes is quite diverse and is dominated by emergent aquatic plants such as broad-leaved cattail (*Typha latifolia*), soft rush (*Juncus effusus*), arrow arum (*Peltandra virginica*), pickerelweed (*Pontederia cordata*), reeds, ferns, and sedges or floating-leafed plants such as duckweed and waterlillies (White, 1989).

Tidal Brackish Marshes – Brackish marshes have the most fluctuating salinity levels of tidal marshes and are usually found between salt marshes and freshwater marshes along river systems. Salinity levels in brackish marshes are influenced by tidal action as well as water movement from fresh water marshes (Louisiana Challenge Grant, 1997). Plants and animals living within brackish marshes must tolerate wide swings in salinity levels (White, 1989). It makes sense, then that in terms of plant diversity, brackish marshes are less diverse than freshwater marshes but more diverse than salt marshes (White, 1989). Brackish marshes provide vital habitat and nutrients for many aquatic animals and waterfowl.

Tidal Salt Marshes – Salt marshes have the highest salinity levels of tidal marshes and are generally most affected by the wind and tidal movement (Louisiana Challenge Grant, 1997). Salt marshes generally have two zones: the low marsh, or one that is regularly flooded usually during high tide, and the high marsh, one that is not flooded on a regular basis, only during the highest tides of the year (White, 1989).

As the below diagram by Lippson demonstrates, the low marsh zone is almost completely dominated by saltmarsh cordgrass (*Spartina alterniflora*). The high marsh zone contains slightly greater plant diversity, commonly containing salt meadow hay (*Spartina patens*), salt grass (*Distichilis spicata*) and black needle rush (*Juncus roemeriansus*). (White, 1989). Other pants associated with the high marsh zone include sea lavender (*Limonium carolinianum*) and glasswort (*Salicornia sp.*) (Lippson and Lippson, 1984).



Alice Jane Lippson

Low Salt Marsh Zone comprised almost entirely of saltmarsh cordgrass stands

Alice Jane Lippson

High Marsh Zone showing "tussled" saltmeadow in foreground

Tidal Swamps

Tidal swamps are dominated by woody plants (trees or shrubs) and are tidally flooded. In Virginia, tidal swamps occur in between emergent tidal wetlands and swamp forests or uplands. They can also occur on depositional islands in large meanders of tidal rivers. The herbaceous flora associated with tidal swamps can be very diverse and typically contains species characteristic of both tidal marshes and freshwater swamps.

Types of tidal swamps in Virginia include shrub swamps, tidal bald cypress – tupelo swamps, tidal hardwood swamps and estuarine fringe swamp forests (found only in southeastern Virginia in the North Land and Norwest Rivers) (DCR, NCV, n.d.).

Nontidal Wetlands

Nontidal wetlands are a diverse category of wetlands that are unaffected by tides and are generally characterized by their vegetation type. Their vegetation can be extremely diverse and can be categorized in three main types:

- ***Emergent wetlands***, commonly called marshes and wet meadows, dominated by grasses, sedges and other herbaceous or non-woody plants
- ***Shrub wetlands***, characterized by low to medium-height woody plants
- ***Forested wetlands***, largely wooded swamps and bottomland hardwood forests

(CBP, 2002)

Emergent Wetlands

Nontidal Freshwater Marshes – Nontidal freshwater marshes are similar to tidal marshes yet are not dependant on tidal flow but instead rely on seasonal flooding, rainfall, and runoff for their water supply. Like their tidal counterpart, emergent aquatic plants dominate freshwater marshes. These ecosystems are characterized by shallow water that is frequently or continually above the soil surface and is derived from streams, overland flow and groundwater. They have little or no peat deposition and soils with a high mineral content (Firehock et al., 1998).

Wet Meadows – Wet meadows are a particular type of marsh, found in areas that are only periodically inundated or saturated. Many people have a wet meadow area on their property and would probably not consider it a "wetland." Wet meadows resemble grasslands and are typically drier than other marshes except during periods of seasonal high water. They contain a variety of meadow-like wetland plants including grasses, sedges, rushes, and wildflowers (EPA, 2005).

Moulds

Arrow Arum in freshwater marsh

Shrub and Forested Wetlands

Moulds

Dragon Run Swamp

Swamps – Swamps are dominated by woody plants (trees or shrubs) and are either normally saturated to the surface or flooded by up to a foot of water. Tree and shrub dominated swamps are usually located at the headwaters as well as along the borders of tidal creeks and streams along the landward margins of freshwater and brackish marshes (White, 1989). Swamps are characterized by saturated soils during the growing season, and standing water during certain times of the year. The highly organic soils of swamps form a thick, black, nutrient-rich environment for the growth of water-tolerant trees such as cypress, Atlantic white cedar , and tupelo. Some swamps are dominated by shrubs, such as buttonbush or smooth alder. Plants, birds, fish, and invertebrates such as freshwater shrimp, crayfish, and clams require the habitats provided by swamps (EPA, 2005).

Bottomland forests and wet woods – Two other types of forested wetlands, **bottomland forests** and **wet woods** conceal their water below the surface for most of the year, unlike traditional swamps.

Hydrologically Unique Wetlands – Isolated Wetlands and Headwater Wetlands

Some nontidal wetlands may also be classified based on their hydrologic inputs, discussed in the following paragraphs.

Headwater wetlands – Headwater wetlands are found at the upper ends of wetlands and intercept and modify runoff and shallow groundwater before entering streams that flow into larger rivers and estuaries. Headwater wetlands are extremely valuable for their role with water quality protection and stormwater management. Headwater wetlands also serve as important habitat (Hershner, Havens, Rudnicky & Schatt, 2000).

Isolated wetlands – Isolated wetlands are unique non-tidal wetlands that, as their name implies are, not directly "connected" hydrologically through surface water sources, but rather obtain their hydrologic inputs primarily through precipitation and ground water. Nonetheless, they perform many of the same beneficial functions and values as traditional wetlands such as filtering nutrients and sediments, recharging streams and ground water supplies, and providing critical habitat for a variety of wildlife. Due to their "isolated nature", they support unique and rare animal and plant communities that are adapted to and flourish in this environment. Isolated wetlands are found in a variety of regions in the state and vary widely in their appearance as well as in the plants and wildlife that they support (DEQ, July 2005). Various types of isolated wetlands are discussed below.

Jerrell

Lee County Extension Agent Harold Jerrell showing how large cinnamon ferns (Osmunda cinnamomea) can get.

- **Vernal Pools or Seasonal Ponds –** A vernal pool, or seasonal pond, is a temporary, freshwater wetland that contains water for a portion of the year and supports a fantastic array of plants and animals often not found anywhere else. "Vernal pools are often found in the flood plain of a stream, in seasonally-flooded woodlands, as sinkhole ponds, or where rainwater and snow collect in forest depressions. Vernal pools typically dry up in the summer time and fill up with rainwater during the fall and winter"(Virginia's Vernal Pools, n.d.). Seasonal ponds range anywhere in size from 50 feet to several hundred feet or more in diameter (DCR, Natural Resources Fact Sheet [NRFS], n.d.).

- **Pocosins –** Often tucked between coastal freshwater marshes and deepwater swamp forests of the southeastern Coastal Plain, pocosins are one of Virginia's rarest wetlands. Pocosins generally occur in flat poorly drained areas with a sandy or peaty acidic soil composition (DCR, NRFS, n.d.). The word pocosin comes from the Algonquin Native American word for "swamp on a hill. These wetlands are dominated by small trees and shrubs and have a high water table leaving the soil saturated for much of the year. Pocosins receive most of their water from rainfall and in the drier months of spring and summer, natural fires occur because pocosins periodically become very dry. These fires increase the diversity of shrub and tree species and aid in the germination of seeds (EPA, 2005).
- **Carolina Bays –** The Carolina Bays are elliptical geologic depressions in the sand of the southeastern Coastal Plain of Virginia. They have long been the subjects of scientific curiosity, controversy, and debate since they were first discovered in the Eighteenth Century. Called "bays", they are not ocean inlets, but rather these depressions are usually surrounded by a variety of bay trees such as red bays and sweet bays. The depressions are almost perfectly oval and are unique. They support an abundant community of plant and animal life. The largest concentrations of bays are in North and South Carolina ranging in size from quite small to large (Wheatley Memorial Institute of Information Sciences, 2005).

Jerrell

Caption cottongrass, a rare bog plant. Photo taken in 1980s in a bog along White Branch, located in the Cumberland Mountains on the Virginia-Tennessee border (north of the town of Rose Hill, Lee County, Virginia).

- **Bogs** – Bogs are one of Virginia's most distinctive kinds of wetlands. They are found in areas with poor drainage in the higher elevations of the Blue Ridge and Ridge and Valley regions of Virginia. Spongy peat deposits, acidic waters, and a dense ground cover of sphagnum moss characterize bogs. Bogs receive all or most of their water from precipitation and as a result, bogs are low in the nutrients needed for plant growth, a condition that is enhanced by acid forming peat mosses. Bogs support unique plant life, such as carnivorous plants such as pitcher plants. They also serve an important ecological function in preventing downstream flooding by absorbing precipitation (EPA, 2005).
- **Sea-level Fens –** Sea-level fens are a type of extremely rare coastal wetland located at the upland edges of wide, ocean-side tidal marshes. Not discovered in Virginia until 1991, they receive water and nutrients from underground seeps and like bogs, their soils are acidic and low in nutrients. Sea-level fens support an interesting variety of carnivorous plants such as sundew and bladderwort (DCR, NCV, n.d.).

Moulds

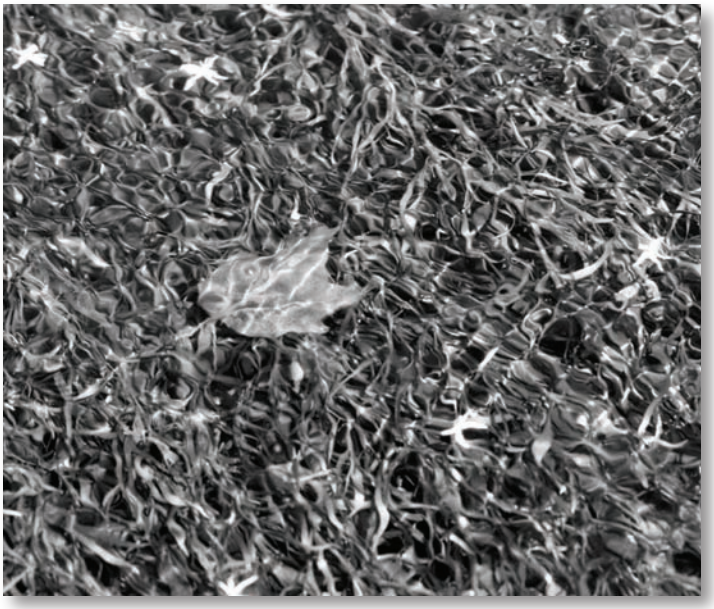
Carnivorous pitcher plant often found in bogs and fens

- **Groundwater seepage wetlands of Coastal Plain and Piedmont** – These unique wetlands, sometimes also called seepage swamps or bogs, are most frequent in the Coastal Plain but sometimes occur in the Piedmont. Seepage wetlands support unusual vegetation and many plants that occur in no other habitats. The most characteristic tree of these wetlands is the sweet bay magnolia , but red maple, loblolly pine, tupelo and sweet gum are often present as well in addition to shrubs. The herbaceous layer is the most unusual containing carnivorous pitcher plants and sundews within thick beds of sphagnum moss (DCR, 1997).
- **Karst Depressional or Sinkhole Wetlands – Karst** depressional, or **sinkhole** wetlands are found in only in the central Shenandoah Valley, in Augusta, Page and Rockingham Counties. They are formed by the decomposition of underlying minerals, which then levels off and intersects with the ground water table (DCR, NCV, n.d.). Springs and seeps permanently feed some, while others are only seasonally saturated from precipitation. (Woodward &Hoffman, 1991) Like many isolated wetlands, these sinkhole wetlands support a unique and rare variety of plants and animals (DCR, NCV, n.d.).

Subaqueous Lands – Wetlands or Deep Water Habitats?

Subaqueous lands are located entirely below the water level surface and include vegetated and unvegetated areas. Vegetated areas are referred to as subaquatic vegetation. Depending on the water depth and the permanency of the water, these habitats may be considered wetlands or instead as deepwater habitats.

Submerged aquatic vegetation (SAV), also sometimes referred to as underwater grass, is found in tidal as well as nontidal waters. These plant communities serve as essential food and habitat for many aquatic species, including waterfowl, shellfish, finfish and invertebrates. SAV beds also oxygenate the water, remove suspended sediments within the water and protect shorelines from erosion (CBP Website). "These aquatic plants are fully submersed, living with their leaves at or below the surface of the water. Like marsh plants, different species are segregated according to salinity and depth and provide habitats for freshwater, slightly to moderately brackish and highly brackish communities" (White, 1989, p.23).



Moulds

Water stargrass, a freshwater SAV species, makes the section of the Upper James River where this photo was taken appear as a "river of grass"

Unvegetated subaqueous lands include mudflats and oyster beds. Mudflats are located adjacent to marshes in tidal areas that are exposed during low tides. These areas are devoid of rooted plants. Blue crabs, wading birds, and waterfowl all forage on mudflats. Oyster beds provide nooks and crannies that offer shelter and food sources for many aquatic animals. Small finfish find shelter among the many shells and large fish, waterfowl and blue crabs forage on the reef. The oyster beds provide a ridged structure resistant to erosion and help dissipate wave energy.

Moulds

Cypress swamp

Wetland Types in Virginia – A Review

Tidal Vegetated

- Tidal Marshes- Freshwater, Brackish or Salt
- Tidal Swamps (shrubs or forests)
- Submerged Aquatic Vegetation (SAV)

Tidal Unvegetated

- Oyster beds and Mudflats

Nontidal Vegetated

Emergent

- Freshwater Marshes
- Wet Meadows

Shrub and Forested Wetlands

- Swamps
- Bottomland Forests and Wet Woods

Submerged Aquatic Vegetation (SAV)

Headwater Wetlands

Isolated wetlands- groundwater or rainfall fed

- Vernal Pools or seasonal ponds
- Pocosins
- Carolina Bays
- Bogs
- Fens
- Groundwater Seepage Wetlands
- Sinkhole or Karst Depressional Wetlands

"A Wetland By Any Other Name" – Understanding the NWI Wetland Classification System

There are many ways to go about describing and classifying wetlands. Over the years, scientists realized the need to more precisely categorize wetlands and develop a uniform "language" so that wetlands could more easily be discussed. After all, it is much easier to discuss something when you are using the same language!

The preceding pages classified wetlands using terminology such as marshes and swamps. Wetlands were classified first by being either tidal or nontidal, followed next by the dominant vegetation type. Lastly, for nontidal wetlands, other characteristics such as unique hydrology, geology or soils came into play in the classification process.

The FWS published the report, "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin et al.) in 1979, and then went on to use this system to identify and map all of the wetlands in the United States (National Wetlands Inventory [NWI]). This classification system has become the national standard for classifying wetlands and arranges wetlands and deepwater habitat types into ecological factors based on hydrology, dominant vegetation, soil types, flooding regime and other factors (Firehock et al., 1998). The Cowardin system is hierarchical and includes several layers of detail for wetland classification including: a *system* (described in following paragraph), a *subsystem* of water flow; *classes* of **substrate** types; *subclasses* of vegetation types and dominant species; as well as flooding regimes and salinity levels for each system.

Example of Wetland Types and their U.S. Fish and Wildlife Service Classification Equivalent

Types, Common Name	Cowardin Classification equivalent
Tidal saltwater marsh	Estuarine intertidal emergent, saline
Tidal freshwater marsh	Estuarine intertidal emergent, fresh
Nontidal freshwater marsh	Palustrine emergent, fresh
Cypress swamp, freshwater tidal	Palustrine forested, needleleaved deciduous, fresh

The FWS classification system uses five categories, or *systems*, to classify wetlands and deepwater habitats based on the location within the landscape. These systems are: marine, estuarine, riverine, **lacustrine** and **palustrine**. *Marine* wetlands are associated with the high-energy coastline. *Estuarine* wetlands occur in estuaries where freshwater and saltwater mix. *Riverine* wetlands are located within freshwater river channels that are dominated by emergents present only during the growing season. *Lacustrine* wetlands are located along the edges of lakes where the water depth is less than 2 meters (6.6 feet). *Palustrine* wetlands are nontidal freshwater wetlands that are neither riverine nor lacustrine (Firehock et al., 1998). Wetlands that fall within a river channel that are dominated by **persistent emergent vegetation** are also considered palustrine. The FWS classification system continues with *subsystems* based on frequency of flooding and *classes* and *subclasses* based on soil type and dominant vegetation. The table below shows some examples of wetland types, listed on the left by their common names and then on the right by Cowardin classification equivalent.

For more information about the FWS Classification system, see Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al., 1979), available online at: http://www.charttiff.com/pub/WetlandMaps/Cowardin.pdf

Wetlands to See, Wildlife to Meet – Visiting Virginia's Public Wetlands

"Conservation is a state of harmony between men and land."
- Aldo Leopold

Extensive educational resources regarding wetlands exist, but for the knowledge and appreciation of these priceless ecosystems to come alive, you must visit one! Virginia is rich with a diversity of public wetlands in which to visit. These locations vary in size and accessibility.

Many Virginia state parks and Natural Area Preserves, maintained by DCR, contain substantial wetland areas that are as natural areas for hiking, canoeing, and environmental education activities. State parks are an ideal place to visit independently or through a guided tour sponsored by the park. In addition to state parks, there are also wetlands such as Wildlife Management Areas, preserves owned by The Nature Conservancy, FWS National Wildlife Refuges, teaching areas owned by the Virginia Institute of Marine Science as well as local and regional parks. Following is a list presenting a few possible wetlands to visit, organized by region, as well as contact information.

Aerial view of Taskinas Creek

NOAA/DOC by Bahen

Kayaking the Upper Chippokes Creek

Moulds

FWS/McCrensky

Birdwatching at Occoquan Bay National Wildlife Refuge

NOAA/DOC by Bahen

Canoeing on Taskinas Creek at York River State Park, also the site of the Chesapeake Bay National Estuarine Research Reserve (CB NERR)

Moulds

"The Wetlands" at Lewis Ginter Botanical Gardens

Wetlands to Visit in Virginia

Central Virginia

- **Douthat State Park** – Seasonally inundated fringe wetlands and vernal pools with interpretive programming and hiking accessibility
- **Folly Mills Creek Fen Natural Area Preserve** –An excellent example of a Shenandoah fen community with several rare plant species
- **Holiday Lake State Park** – Vernal pools that are utilized for interpretative programming by nonprofit organization, Virginia's Vernal Pools
- **James River State Park** – Freshwater marsh area accessible by hiking or viewed on an overlook dock

Eastern Virginia

- **Belle Isle State Park** – Eight distinct wetland types, including both tidal and nontidal marshes can be viewed from multiple hiking trails
- **Blackwater River Preserve** – Owned by the Nature Conservancy. Access limited to a canoe due to very swampy conditions
- **Chippokes Plantation State Park** – Both freshwater marshes and cypress swamps that can be viewed from the road and from hiking trails
- **Great Dismal Swamp National Wildlife Refuge** – The Great Dismal Swamp is the largest swamp in Virginia, with over 111,000 acres of forested wetlands
- **North Landing River Preserve** – owned by The Nature Conservancy. One of the largest expanses of undisturbed freshwater marsh habitat along the entire eastern seaboard. This unusual wetland system provides a habitat for southern species of plants that are rare in Virginia, including sawgrass, an integral part of the Florida Everglades
- **Ragged Island Wildlife Management Area** – Brackish marsh accessible by a boardwalk with an interpretive trail. Hunting is permitted in this area – use caution when visiting.
- **Virginia Coast Reserve** – Extensive salt marshes fringe the inner coast of the Barrier Islands that run more than 60 miles up the Virginia coast. The Nature Conservancy owns all or part of 14 out of 18 Barrier Islands. Visitors must first contact the VCR office.
- **York River State Park** – Salt marshes and tupelo swamps that viewed from boardwalks, hiking trails or guided canoe trips. While canoeing on Taskinas Creek, you can experience tidal salt marsh to tidal fresh water marshes

Northern Virginia

- **Caledon State Park** – Swamps and marshes that are seasonally restricted and require crossing fairly rugged terrain to visit
- **Leesylvania State Park** – Freshwater marshes and fringe wetlands that can be viewed from hiking trails or by canoe
- **Mason Neck State Park** – Swamps and freshwater tidal marshes that can be viewed from hiking trails, boardwalks or guided canoe trips
- **Occoquan Bay National Wildlife Refuge** – Wetlands make up over half of the area in the refuge and include wet meadows, bottomland hardwoods, open freshwater marshes and tidally influenced marshes

Southwest Virginia

- **Deep Run Ponds Natural Area Preserve** – Sinkhole pond system that supports a variety of rare plant and animal species
- **Grayson Highlands State Park** – Unique bog called Sullivan Swamp
- **Fairystone Farms Wildlife Management Area** – Has an 8-acre impounded marsh area. Hunting is permitted in this area – use caution when visiting.
- **Hungry Mother State Park** – Seasonally inundated wetland located along the lake

Resources for Wetland Visitation

Before heading out to visit a wetland, contact the location or research it online first. Some of these locations may be temporarily closed to public access due to maintenance, bird nesting or other reason.

- **National Wildlife Refuge Systems** – 800-344-WILD or http://www.fws.gov/refuges for an alphabetical or state listing of refuges – Contact the National Wildlife Refuge Systems for more information before visiting a refuge
- **Natural Area Preserves** – http://www.state.va.us/dcr/dnh/preserve.htm for an alphabetical listing with more detailed information. Most Natural Area Preserves are owned by the Department of Conservation and Recreation, but some are owned by local governments, universities, private citizens or The Nature Conservancy
- **The Nature Conservancy** – 800-628-6860 or http://www.nature.org – Contact the Nature Conservancy to visit their wetlands preserves
- **Virginia Department of Game and Inland Fisheries Wildlife Management Areas** – 804-367-1000 or http://www.dgif.state.va.us/hunting/wma/index.html – Many of their wildlife management areas with wetlands are popular spots for waterfowl hunting! Use caution when visiting!
- **Virginia Institute of Marine Science (VIMS)** – 804-684-7000 or http://www.vims.edu – Has a teaching marsh and some coastal wetlands that can viewed by scheduling a tour.
- **Virginia State Park System** – 1-800-933-PARK or visit their website http://www.dcr.virginia.gov/parks
- **Virginia's Vernal Pools** – 434-248-5444 or visit their website http://www.lynchburgbiz.com/virginiasvernalpools/index.html – Sponsors educational programs about vernal pools during the spring at state parks.

3 What's Going On with Virginia's Wetlands?

"Nature provides a free lunch, but only if we control our appetites."
~William Ruckelshaus

Trying to get a complete "picture" for our Commonwealth's wetlands — how many and what types we have, their health and what's happening to them — is not an easy job. Part of the complexity has to do with which wetland definition is used as well as available data and technologies and the interpretation of that data. Scientists, managers and regulators in Virginia are constantly working to get a better idea of this true "picture" of our wetlands, both the current conditions as well as what has happened in the past in order to project future conditions.

How Are Our Wetlands Doing? Status and Trends of Virginia's Wetlands

How many wetlands do we have in Virginia?

Based on the FWS's National Wetlands Inventory (NWI) mapping for the state of Virginia, vegetated wetlands occupy about 1.2 million acres, or about 4.5 percent of Virginia's landmass (Hershner, et al., 2003). This statistic is still not 100% accurate for vegetated wetlands, as the NWI is based on aerial photographs and some types of wetlands, especially small forested nontidal wetlands, are difficult to detect and are most likely underrepresented (Hershner et al., 2003).

What types of wetlands are most abundant in Virginia?

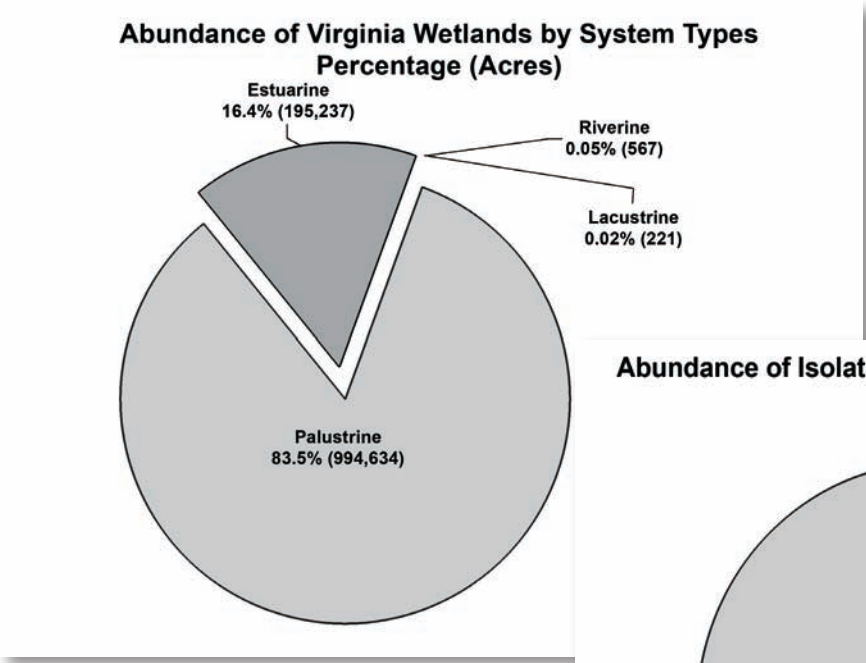
Of the four major NWI wetland classification systems, palustrine wetlands are most abundant, comprising about 83 % (about 1 million acres) of all vegetated wetlands in Virginia. As the pie chart on the next page indicates, estuarine wetlands are the next most prevalent, comprising about 16 % (195,000 acres) of the State's vegetated wetlands. Lacustrine and riverine wetlands account for small percentages, about 220 and 570 acres, respectively (Hershner et al., 2003).

Isolated and headwater wetlands

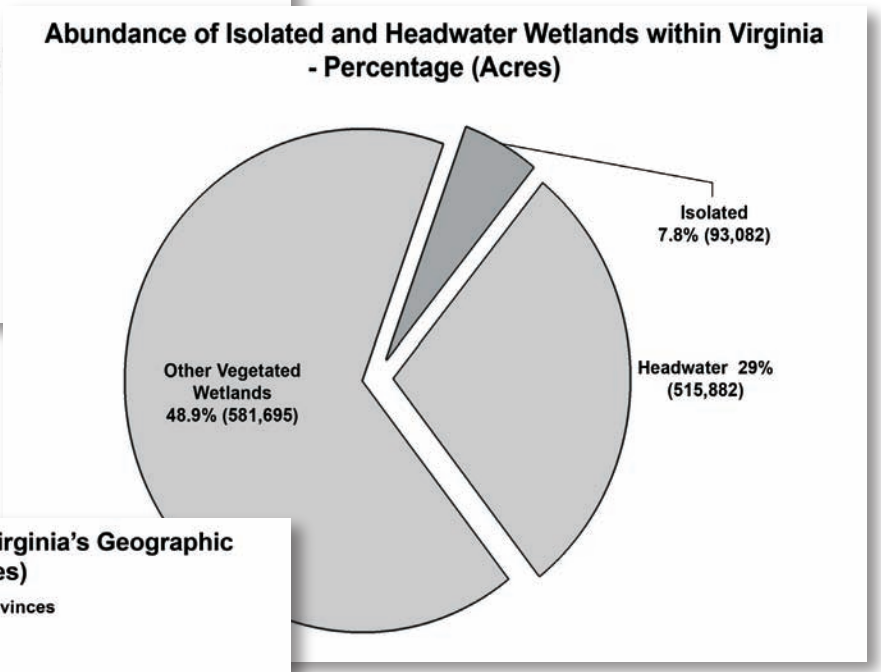
The Virginia Institute of Marine Science (VIMS) recently performed an analysis looking at the abundance of two types of hydrologically unique wetlands, headwater and isolated wetlands. Based on this analysis, it is estimated that these two wetland types represent over 50% of Virginia's vegetated wetlands (Hershner et al., 2003).

Where are Virginia's wetlands located?

As the pie chart on the next page demonstrates, the majority of Virginia's wetlands (72 percent), including all estuarine wetlands, are located entirely within the Coastal Plain region. Nontidal wetlands are distributed throughout the State and are located primarily in bottomlands and in floodplains along stream channels, especially in headwater areas. About 22 percent of the wetlands in Virginia are in the Piedmont region. The remaining wetlands are located in the Appalachian Plateaus, Blue Ridge and Valley regions. (Augustine, 2002).



Adapted from Hershner, et al., 2003.
Note: Analysis includes vegetated wetlands only.



Adapted from Hershner, et al., 2003.
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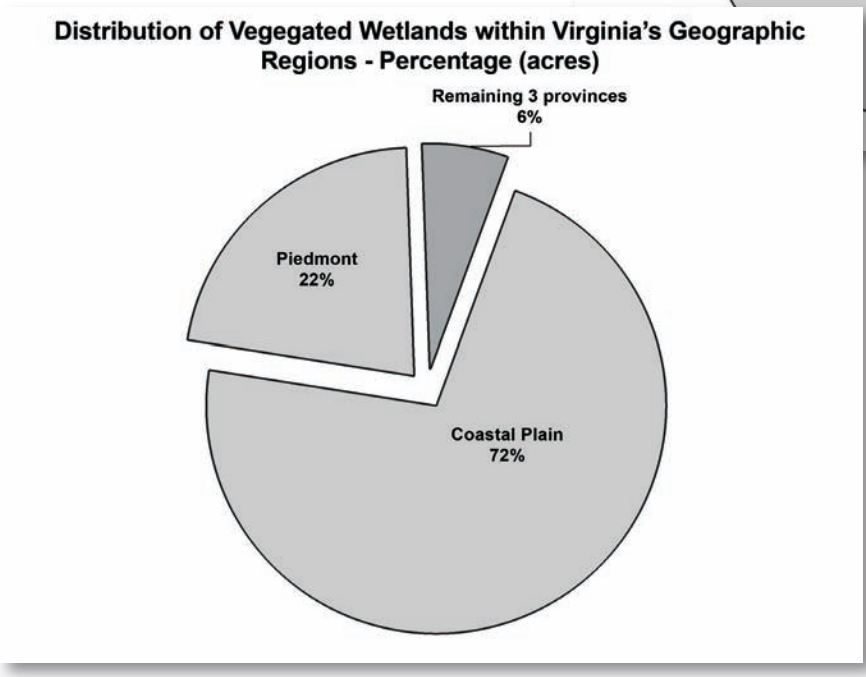


Adapted from Augustine, 2004.

Wetland Loss Hot Spots in Virginia's Chesapeake watershed between 1982-1989 (From CBP, 1997)

***Southeastern* – 4,000 acres of seasonally saturated and temporarily flooded forested wetlands converted into housing developments and farmland**

***Piedmont* – 17,000 acres of palustrine vegetated wetlands lost, 90% of which was converted into lakes, reservoirs or ponds**

***Blue Ridge/Appalachian* – 34 % of region's palustrine emergent wetlands lost, 80% due to conversion to cropland**

***Coastal Plain* – almost 2,000 acres of palustrine vegetated wetlands lost, 65% due to conversion of forested wetlands into ponds**

Although not all of the recent data has been finalized, most experts agree that significant annual wetland losses continued into the 1990s (Augustine, 2004).

Wetland Losses

Virginia, like most of the nation, did not realize the value of wetlands for much of its history and consequently experienced great losses of wetlands during its development. In the 1780's, wetlands are estimated to have covered 1,849,000 acres (more than 7 percent) of Virginia. By the mid-1980's, when permits began to be required for most wetland impacts, it is estimated that only 1,075,000 wetland acres remained -- a loss approximating 42 percent in just 200 years. Activities by man including agriculture, industrial and urban development, and recreation led to the destruction of many wetlands in Virginia through their draining, dredging, ditching, filling, diking and damming (Augustine, 2004).

- **Tulloch Ditching of wetlands** – The term "Tulloch ditching" is used to describe the practice of carefully digging drainage ditches within wetlands to remove all excavated materials from the wetland (Hershner, 1999). The objective of Tulloch ditching is to drain the wetland so that it will no longer be subject to wetlands regulations, creating the potential for alternative uses (Hershner, 1999). The practice became prevalent in Virginia when the United States Court of Appeals for the District of Columbia upheld a ruling, which prevented the Corps from having jurisdiction over this activity to prevent the practice (Hershner, 1999). Between 1998 and 1999, more than 2,500 additional acres of non-tidal wetlands in Virginia were ditched for development, and additional acres of isolated wetlands were destroyed (Augustine, 2004).
- **Headwater and isolated wetlands** – Across the nation, headwater and isolated wetlands were historically the first wetlands areas to be drained and filled. Due to their size or temporary hydrologic nature, they were often not protected because they were not thought to be ecologically important. (Alliance, 2003). These two wetlands types, along with other nontidal wetlands with temporary hydrology are often the most at risk as they are tempting targets for effective drainage via Tulloch ditching (Hershner, 1999).

Luckily, due to changes with Virginia's nontidal wetlands permit program as well as changes with Virginia's Corps permitting program, wetland losses due to Tulloch ditching and in headwaters and isolated wetlands have slowed (Augustine, 2004).

Subaqueous Lands

It should be noted that none of these statistics include Virginia's wealth of subaqueous lands, which include subaquatic vegetation beds and unvegetated areas containing mudflats and oyster beds. Depending on the classification system used and the depth and permanency of the water, these habitats may be considered wetlands or deepwater habitats. Nonetheless, these lands are indeed a valuable resource, providing essential habitat for shellfish, crabs and finfish Virginia Marine Resources Commissioni [VMRC, n.d.]). In the tidal portion alone, Virginia has an estimated 1,472,000 acres of state-owned bottomlands. These submerged lands, harbor 21,000 acres of valuable submerged aquatic vegetation and 350,000 acres of oyster grounds (VMRC, n.d.).

You can still hear the tales of the water so clean
of the shad and the sturgeon and the grasses so green
that grew all over the Bay...
...But the water turned cloudy and the shoreline was paved
the harbor grew cloudy
hardly an effort was made
to preserve all the things that we cherished the most
and are blind to the fact that it all may soon be lost "

~ Don Shappelle,, "Chesapeake Dream"

Submerged aquatic vegetation (SAV) – It is estimated that there was at one time at least 200,000 acres of SAV within the tidal portion of the Chesapeake Bay watershed alone. (CBP, n.d.) By 1984, only 38,000 acres of SAV existed within the Bay and tidal tributaries. Since this time, scientists within the Bay region have committed significant resources to determine the causes for the decline as well as the best methods for protecting and restoring SAV populations.

In 2003, the CBP adopted a goal to achieve 185,000 acres of SAV baywide by the year 2010 (CBP, 2004). Virginia's portion of this goal is 75,093 acres (Dave Wilcox, personal communication, September 16, 2005).

After a period of steady increase from 1984 through 1993, SAV acreage within the tidal portions of Virginia's Chesapeake Bay has fluctuated around an annual average of approximately 30,000-35,000 acres through 2003. In 2004, SAV acreages for Virginia (28,297 acres) reached the lowest levels recorded since 1987. Changes observed between 2003 and 2004 were likely due to the influence of Hurricane Isabel, primarily by washing out large sections of beds along both the eastern and western lower bay shoreline in September 2003. These decreases in SAV highlights the continued importance to further reduce nutrient and sediment pollution flowing into the Bay. (CBP, May 2005).

Oysters – At one time, Crassostrea virginica, the native oyster of the Chesapeake Bay, yielded seasonal harvests of millions of bushels. Even 100 years ago, oyster reefs were so large that they posed a navigational hazard to ships. One traveler commented about our native oyster in 1701:

"The abundance of oysters is incredible. There are whole banks of them so that the ships must avoid them…. They surpass those in England by far in size…they are four times as large. I often cut them in two, before I could put them in my mouth."

- J. Wharton, The Bounty of the Chesapeake: Fishing in Colonial Virginia. University Press of Virginia, Charlottesville, VA (CBP, 2005).

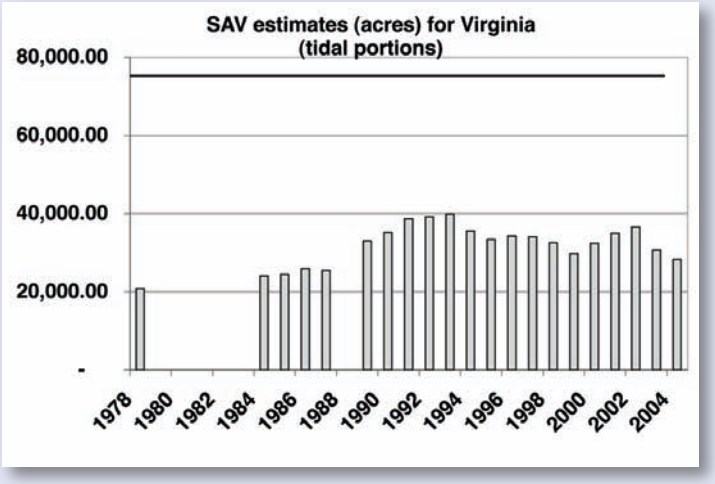
Today, less than 1 percent of the original oyster population remains (CBP, 2005).

Alice Jane Lippson

American Oyster

Alice Jane Lippson

Eelgrass, a type of saltwater SAV, serves as important habitat for a wealth of animals, as demonstrated in this diagram.



Data adapted from VIMS as communicated by Dave Wilcox, Sept 16, 2005.

Note: no data is available for years 1978-1983 or 1988. Due to Hurricane Isabel, some data was also not available in 2003. No statistics are available for submerged vegetation in nontidal areas.

How are Virginia Wetlands Protected? Regulations to Ensure "No Net Loss'

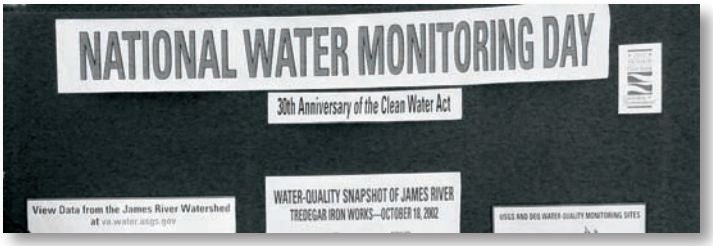
"Ditch It, Fill It, Drain It, Dump It, Dredge It, Dump In It"
– Alliance for the Chesapeake Bay

The above saying was a common sentiment regarding wetlands. People used to view wetlands as a nuisance and something to get rid of. In fact, government polices were even in place to encourage the destruction of wetlands for conversion into agricultural fields and for commercial and residential development (Mitsch & Gosselink, 2000, p. 14).

But over the last quarter century, greater scientific understanding of the functions and values of wetlands has increased the recognition for the need to restore and conserve them. (Heimlich,1988). As a result, direct and indirect public incentives for wetland conversion have ceased, wetland conversion has been regulated in Federal water quality legislation and in numerous State laws, farm program benefits have been tied to wetland conservation, and voluntary programs have been funded to restore cropland formerly converted from wetlands (Heimlich,1988).

Federal Regulations

The Clean Water Act



USGS

Throughout the 1960's, public awareness regarding the quality of our nation's water resources intensified as a result of highly volatile environmental issues. Thousands of dead fish washing ashore, fouled city drinking water, and lakes catching on fire were all indicative of a highly stressed aquatic system. Pollution was readily observable in much of the nation's rivers, streams and lakes. Government agencies attempted to respond to these problems, often without insight as to the social, legal, economic and environmental consequences of their actions. With a high demand for a more effective means to protect and clean the nation's water resources, Congress in 1972, passed the Federal Water Pollution Control Act Amendments (better known as the Clean Water Act, 33 U.S.C. §§ 1251 et. Seq.) (Year of Clean Water, 2001).

The Clean Water Act set the goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Since its passage over thirty years ago, Clean Water Act programs have yielded measurable improvements in water quality. As part of the Clean Water Act movement, national attention was directed to wetlands as more science revealed the important roles that they play in healthy watersheds, and thus water quality (Year of Clean Water, 2001).

For more information about the Clean Water Act, visit the following websites:

- http://www.epa.gov/region5/water/cwa.htm – contains a history of the Clean Water Act and all of the sections of the Act.
- http://www.epa.gov/watertrain/cwa/ – Clean Water Act Training Module

USGS

National Water Quality Monitoring Day Celebrated along the James River in Richmond, Virginia

Two important sections of the Clean Water Act that pertain to wetlands are Section 404 (**33 U.S.C. 344**) and 401 (**33 U.S.C. 1341**):

- **Section 404 – Avoid, minimize and compensate** – This section of the Clean Water Act states that no **discharge** of dredged or fill material into U.S. waters, including wetlands, can be permitted if a practical alternative exists that is less damaging. Potential impacts to wetlands should be minimized and for unavoidable impacts, compensation should be provided through activities to restore or create wetlands. The Corps and the EPA jointly administer Section 404. Additional Federal agencies, including the FWS, NRCS and the National Marine Fisheries Service have advisory roles and offer technical assistance in some instances.
- **Section 401** requires that states ensure that a Section 404 permit does not violate state water quality standards.

No Net Loss Policy

"No net loss" of wetlands is a Federal policy goal that emerged in 1989, and is interpreted to mean wetlands should be conserved wherever possible, and that acres of wetlands converted to other uses must be offset through restoration and creation of other wetlands, maintaining or increasing the total wetland resource base (Heimlich,1988).

Virginia Wetlands Protection – Avoid first, then minimize

Virginia is a leading example among states within the nation for adopting protective regulations for its wetlands. The Commonwealth of Virginia generally regulates impacts for all state waters, including wetlands, through two programs, the Virginia Water Protection Program and the Tidal Wetlands Program.

Following Section 404 requirements, Virginia emphasizes avoidance of wetlands if possible, followed by minimization of impacts.

- **Virginia Water Protection Permit (VWP) Program** – The DEQ regulates impacts to state waters, including wetlands, through the VWP for both tidal and nontidal impacts permitted under Section 404 of the Clean Water Act. This permit program also serves as Virginia's Section 401 Certification process.

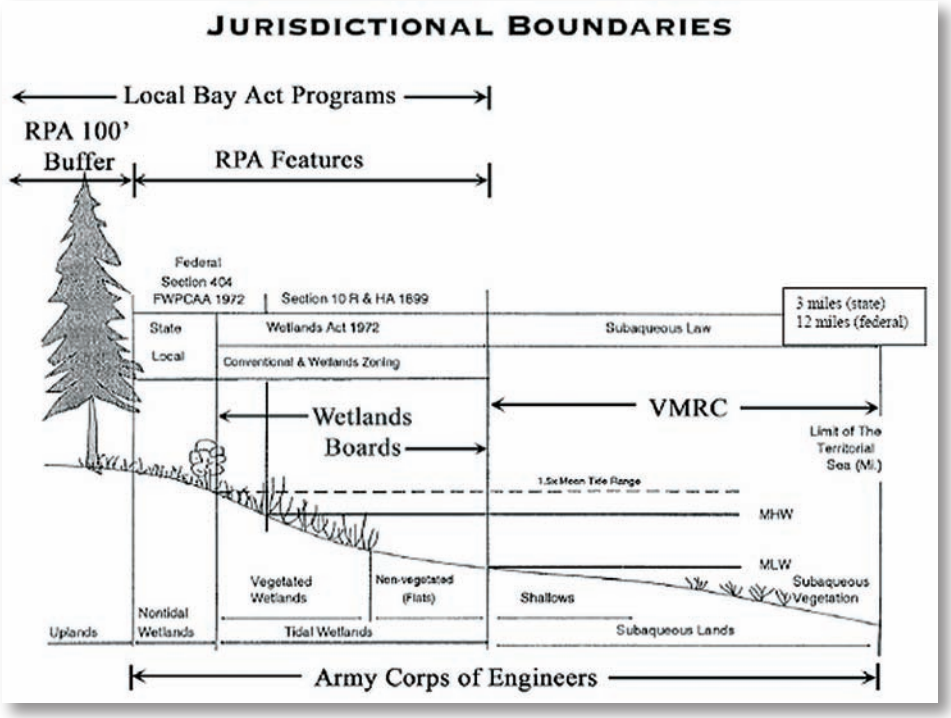


Diagram showing jurisdictional boundaries within Virginia for uplands, nontidal and tidal wetlands, and subaqueous lands. Source: Tidewater Joint Permit Application (JPA), available online at: http://www.nao.usace.army.mil/regulatory/webTidewaterJPA2004.pdf

Other Federal and International Regulations, Policies and Agreements that affect Virginia wetlands

- **Coastal Zone Management Act** (CZMA, 16 U.S.C. §§ 1451 et. Seq.) – Encourages state planning activities in the coastal zone and commits the Federal government to refrain from conducting or permitting activities in the coastal zone that are inconsistent with state plans. Thus, states can use the CZMA to limit wetland activities that require Federal permits.
- **National Environmental Policy Act (1969)** – Federal government agencies must prepare environmental impact statements on major and relevant Federal actions
- **Executive Order 11990 (1977)** – Federal agencies are required to take action to minimize the destruction, loss or degradation of wetlands and to preserve the natural values of wetlands on all Federal lands
- **Federal Rivers and Harbors Act, Section 10 (1899)** – Gives authority to the Corps to prohibit discharge of solids or construction into tidal and **navigable** or adjacent waters. Navigable waters are tidal or have been used or are presently being used for the transport of interstate or foreign commerce.
- **Food Securities Act (Farm Bill)** – Known as the "Swampbuster" Act, denies Federal subsidies for conversion of wetlands to agricultural uses
- **Endangered Species Act** – Protects wetlands that offer unique habitat for endangered and threatened species. Administered by the FWS

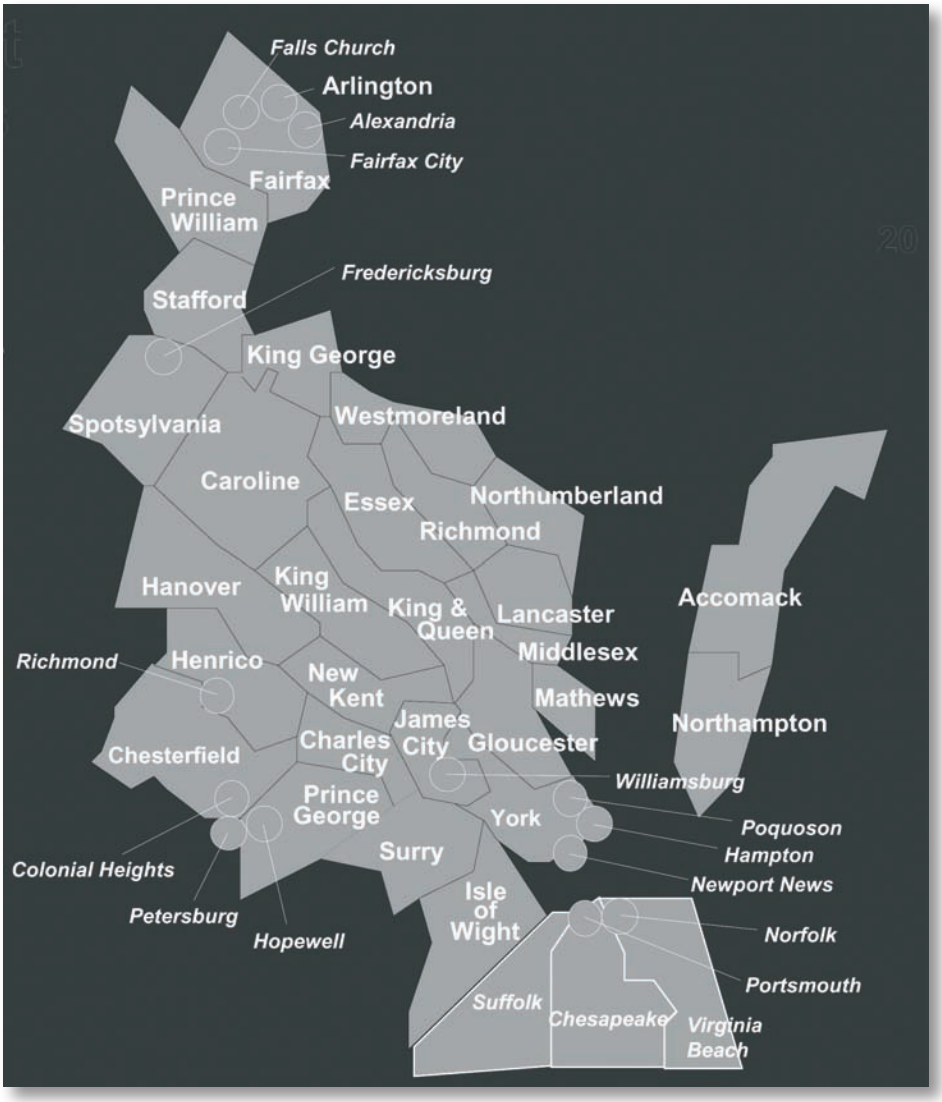
For more on Federal Wetlands Laws and Regulations go to: http://www.epa.gov/owow/wetlands/laws/

International Agreements

- **Ramsar Convention (1975)** – U.S. became a member in 1986. FWS responsible for implementing within the U.S. Partners are obligated to include wetland conservation into their natural resources planning process, to promote the wise use of wetlands and to designate at least one wetland for inclusion in the List of Wetlands of International Importance
- **North American Waterfowl Management Act (1986)** – Managed cooperatively by all three North American countries and sets goals for wetland conservation and waterfowl habitat
- **North American Wetlands Conservation Act** – provides matching grants to public and private entities in North America for wetlands conservation programs

(Information obtained from CBP, 1997; Firehock et al., 1998; and McCarthy, 2001.)

In 2000, the Virginia General Assembly passed the Nontidal Wetlands Act that amended Section 62.1-44.15:5 of the Code of Virginia and removed the dependence of the State Nontidal Wetlands Program on the issuance of a Federal permit to the Corps, thus enabling DEQ to use the VWP Program to regulate activities in all nontidal wetlands (DEQ, August 2005). This was extremely important for wetlands protection because in 2001, the U.S. Supreme Court issued a ruling that removed Federal protection for many isolated wetlands, including headwater wetlands. Because Virginia has a statewide wetland program independent of Federal wetland programs, DEQ regulates isolated wetlands, regardless of Federal jurisdiction. Activities such as certain types of excavation in wetlands (which may not be under Federal jurisdiction) were also added to the activities already regulated through the Section 401 Certification process (DEQ, August 2005).



adapted from JLARC

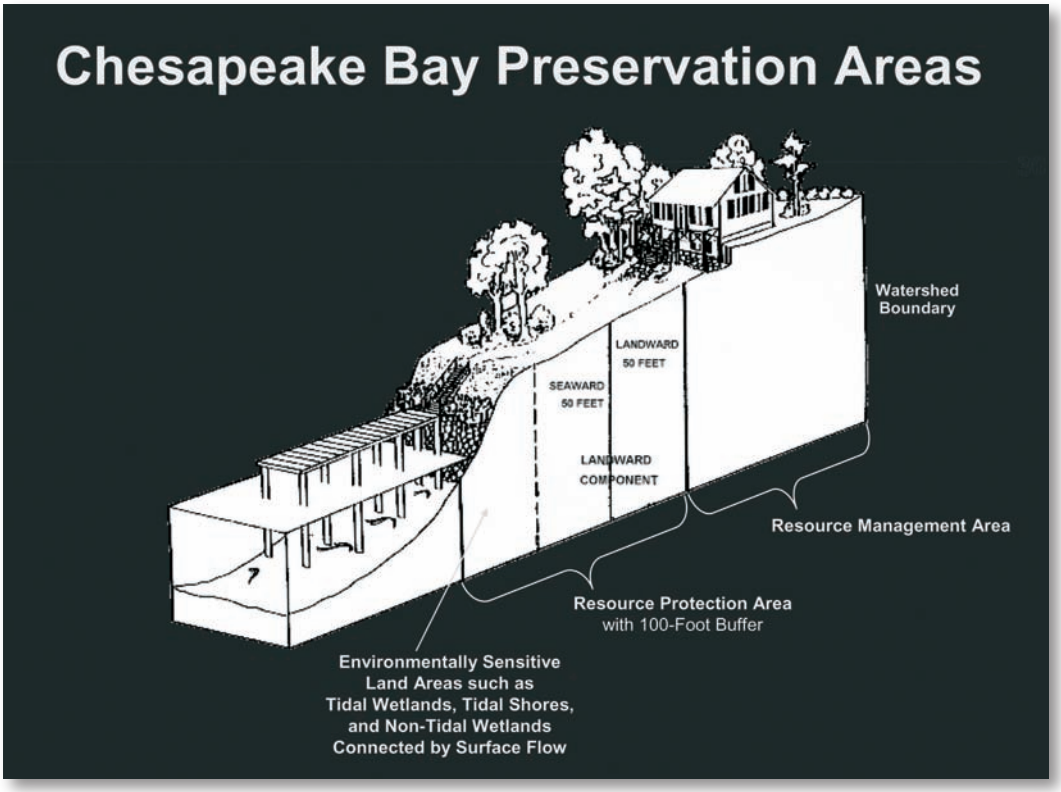
Map showing location of Tidewater, Virginia. This is the location regulated by the Chesapeake Bay Preservation Act as well as localities with Local Wetland Boards

- **Virginia Tidal Wetlands Program** – The VMRC has the responsibility for issuing tidal wetlands permits under Chapters 12 and 13 of Title 28.2 of the Code of Virginia, as a result of the enactment of the Tidal Wetlands Act of 1972. Chapter 12 refers to **subaqueous** lands and Chapter 13 refers to tidal wetlands, both vegetated and nonvegetated (See the *Regulatory Definitions of Tidal Wetlands and Subaqueous Lands* Sidebar for more information). Localities in "Tidewater" have citizen-run Local Wetland Boards (LWBs), which adopt model wetland zoning ordinances for tidal wetlands. These LWBs regulate tidal wetlands. VMRC maintains oversight authority for these Wetland Boards and in areas where boards do not exist; the VMRC remains the main authority. The Virginia Institute of Marine Science (VIMS) provides scientific advice and technical assistance to both VMRC as well as the local Wetland Boards. The Corps maintains a listing of contacts for these wetlands Boards at http://www.nao.usace.army.mil/Regulatory/wetlandsboard.htm. Only VWMC has regulatory authority for submerged aquatic lands.

Regulatory Definitions of Tidal Wetlands and Subaqueous Lands:

Tidal wetlands are tidally influenced areas within Tidewater Virginia, contiguous to mean low water extending landward to an elevation 1 1/2 times the mean tide range at a site and upon which is growing certain listed plant species. Legal tidal wetlands can also include "nonvegetated wetlands" which include unvegetated lands between mean low water and mean high water tides (Association of State Wetland Mangers, 2005).

Subaqueous lands include all beds of the bays, rivers, creeks and shores of the sea that are owned by the Commonwealth. To clarify, VMRC regulates all tidal waterways as well as nontidal, perennial waterways where the upstream drainage area is 5 square miles or greater.



Adapted from JLARC

Restoration and **Creation** are terms explained in more detail under the last part of this section, *Volunteer Efforts for "Net Gain."* A **mitigation bank** is a wetland area that has been restored or created and then earmarked to compensate for future wetland impacts. Rather than mitigating for impacts at or near the site of development, the entity responsible for compensatory mitigation purchases "credits" as part of a mitigation bank (Firehock et al., 1998). An **in-lieu fee fund** is slightly different from a mitigation bank in that, although the developer still pays a fee for unavoidable impacts, the fee is given to a public natural resources agency or a non-governmental organization that then restores or creates wetland resources on other parcels of land (DEQ, 2005).

Compensatory Wetlands Mitigation – meeting "no net loss" goal

The Commonwealth of Virginia supports the Federal "No Net Loss" wetlands policy and is, in fact, mandated by the revised Code of Virginia pertaining to wetlands to achieve "no net loss of existing wetland acreage and function". Additionally, Virginia is a signatory to the **2000 Chesapeake Bay Agreement**, which states that the signatories' regulatory programs must achieve a no net loss of existing wetland acreage and function.

The VWP permit regulations require that all impacts to wetlands that cannot be avoided or minimized must be mitigated. Basically this means that impacted wetlands must be replaced (compensated) by both acreage as well as function. This is termed **compensatory mitigation**.

Compensatory mitigation can generally include:

- Restoration
- Creation
- Purchase or use of mitigation bank credits, or a
- Contribution to an approved in-lieu fee fund
- Preservation

Note: Preservation of wetlands alone cannot be accepted by state regulations. For more information on acceptable wetland compensation options, please refer to the Virginia Administrative Code, Title 9, Agency 25, Chapter 210 (Abbreviated 9-VAC 25-210)

More information on compensatory mitigation as part of Virginia's Water Protection Program may be found at http://www.deq.virginia.gov/wetlands/mitigate.html.

More information on the Virginia Administrative Code may be found at http://leg1.state.va.us/000/reg/TOC.HTM#T0009

Useful Contacts and Links for Virginia Regulations:

- Virginia Department of Environmental Quality's Wetland Program:
  - http://www.deq.virginia.gov/wetlands/homepage.html
- The State Water Control Law (§§ 62.1-44.15 and 62.1-44.15:5 of the Code of Virginia) can be found at:
  - http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+TOC6201000
- Virginia Marine Resources Commission: http://www.mrc.state.va.us/
- Chesapeake Bay Local Assistance Department: http://www.cblad.virginia.gov/
- Virginia Coastal Program: http://www.deq.virginia.gov/coastal/homepage.html

Other Programs and Policies that affect Virginia Wetlands

The **Virginia Coastal Program** is part of a national coastal zone management program, a voluntary partnership between the Federal government, U.S. coastal states and territories authorized by the CZMA. To manage Virginia's coastal resources, the Virginia Coastal Program was established in 1986 and relies on a network of state agencies and local governments to administer the enforceable laws, regulations and policies that protect our coastal resources. The DEQ serves as the lead agency for Virginia's Coastal Program (Virginia Coastal Program [VCP], 2005).

The Chesapeake Bay Preservation Act, commonly known as "The Bay Act," was adopted by the Virginia General Assembly in 1988, and is designed to improve water quality in the Chesapeake Bay and its tidal tributaries by requiring wise resource management practices in the use and development of environmentally sensitive land features, including tidal and nontidal wetlands (CBP, 1997). The Bay Act created the Chesapeake Bay Local Assistance Department (CBLAD) to work with local governments within the "tidewater" Virginia (the same area with wetland boards). These local governments must develop their own Local Bay Act program to incorporate water quality protection into their comprehensive plans, zoning and subdivision ordinances. Each of these localities has been required to develop Chesapeake Bay Preservation Areas, including both **Resource Protection Areas** (RPAs) and **Resource Management Areas** (RMAs). RPAs are sensitive lands at or near the shoreline, which include buffer zones that include tidal and nontidal wetlands. RMAs are contiguous lands landward of the RPAs that have the potential to damage water quality (CBP, 1997 and CBLAD, 2004).

Voluntary Efforts for "Net Gain" of Wetlands in Virginia

In addition to protecting our remaining wetlands, it has become evident that further steps are necessary to enhance our wetland resources. The Commonwealth of Virginia works to achieve "no net loss" of wetlands by requiring compensatory mitigation for impacts that cannot be avoided or minimized. Concurrent to this required mitigation, the Commonwealth is actively pursuing a "net gain" of wetlands through voluntary measures to help further offset historic and impending losses. In fact, the Code of Virginia (Section 62.1-44.15:5) requires that voluntary and incentive based programs be developed to achieve a net resource gain in wetlands.

Goal - Net Gain of 10,000 Wetland Acres by 2010

The Commonwealth of Virginia has embarked on an effort to achieve a net resource gain of 10,000 acres of wetlands statewide by the year 2010 (Virginia Wetlands Restoration Coordinating Committee, 2001). The Commonwealth committed to restoring 6,000 new acres of wetlands within the Chesapeake Bay watershed by June 2010, as part of the 2000 Chesapeake Bay Agreement. In addition, Virginia set a goal to restore 4,000 acres outside of the Bay watershed. In collaboration with other Federal and state agencies and non-profit organizations, voluntary wetland restoration initiatives are under way (DEQ, July 2005).

The Success of Wetlands Net Gain "Rests on Many Shoulders"

In recent years, Federal and state government agencies as well as a number of private non-profit organizations have accomplished voluntary wetland measures on public and private lands. These groups work together and individually to restore wetlands, provide funding sources and to apply for grants. Section 4 describes this process in more detail and lists resources for technical and financial assistance and includes case studies.

Need to Think Outside of the Box – As we move into the future, the success of this wetlands goal relies more than ever on the involvement of cooperative and creative **stakeholders**. A stakeholder is a term for any individual or organization that has an interest in something. When referring to wetlands in the broadest sense, everyone is a stakeholder when it comes to wetlands, because they belong to all of us (Definition adapted from Utah Department of Natural Resources [UDNR], 2005).

Stakeholders include private or public landowners throughout the Commonwealth and can include:

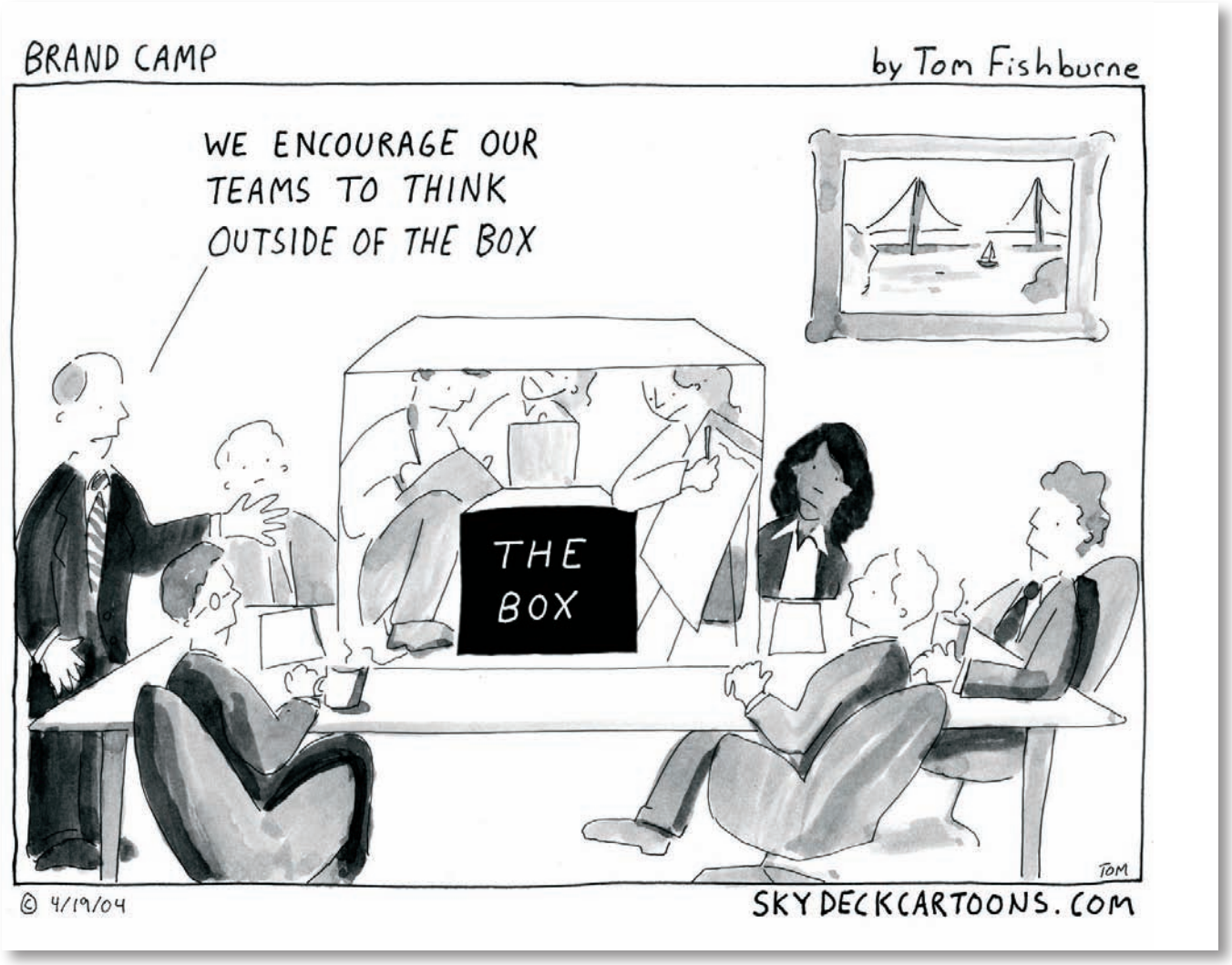
- Federal agencies
- State agencies
- Local governments, including Public Works, Water quality, Natural Resources and Planning Departments
- Regional Planning District Commissions
- Soil and Water Conservation Districts
- Resource Conservation, Development Councils
- Land Trust Organizations
- K-12 schools
- Colleges & Universities
- Business Owners
- Private Citizens
- Civic Associations
- Watershed-based or other environmental organizations

Types of land that can be used for voluntary wetland measures can also vary and may include:

- Municipal Lands
- Agricultural lands
- Reclaimed surface coal mine lands
- Correctional Facilities
- Commercial developments
- Private Residences, urban, suburban and rural
- Educational Institutions
- Parks and Recreational Facilities, including wildlife management areas, refuges and natural preserves

Types of Voluntary Activities

Voluntary wetland activities are often generally referred to as “restoration” and are often used interchangeably. However, there are actually four main types of voluntary wetland activities, Preservation, Enhancement, Restoration and Creation. These terms are defined and described in Section 4 in more detail. To avoid confusion for the purposes of this ToolKit, we will refer to them as *voluntary wetland activities* when discussing them generally as a group.



Microsoft office clip art

Thinking outside of the Box – Voluntary Wetland Measures require creativity and cooperation

4 Taking Action! Voluntary Wetland Activities

Never doubt that a small group of dedicated people can change the world, indeed, it's the only thing that ever has." ~ Margaret Mead

Top and Bottom: Volunteers participating in Growing Native Acorn collection project. Middle photos: 2001 Earth Day participants learning about watersheds and wetlands (All Photos by Moulds, Alliance)

Take Action! Basic Ways to help

We must remember that we have the ability to implement change within our communities. Citizens can play a vital role in protecting one of Virginia's most important natural assets- its wetlands. Do not forget to think "outside the box" and identify a role that you can play in the process of preserving wetlands. Here are a few suggestions for getting started:

Be gentle with your environment – The way we live on the land affects the wetlands and rivers in Virginia. Many things you do at home, such as beneficial landscaping using native plants to filter runoff, reduce erosion and using native plants to conserve water and create wildlife habitat can positively affect our wetlands. Other beneficial actions such as and disposing of oil properly, driving less, using sulfide-free detergents, composting, recycling and conserving water few have positive impacts on the health of the environment, including wetlands.

Join a group that is working to protect wetlands – When we work together, we can accomplish much more. Support a local group working to protect wetlands by contributing your time, energy and talents. Oftentimes, these local conservation groups have hand-on restoration projects involving wetland restoration, creation and maintenance projects. Share your knowledge and concerns with friends and neighbors and encourage them to become involved in the process. If you belong to a civic group, garden club, or outdoor recreation group, help get them involved in wetlands protection in your community. Find a local watershed group in your community or find out other ways to contribute to the conservation of Virginia's wetlands. The Southeast Watershed Forum has an online listing of watershed-based community groups at http://www.southeastwaterforum.org/directory/virginia_sum.asp. If you live in the Chesapeake Bay region, you can also visit the Chesapeake Bay Program web site at http://www.chesapeakebay.net/involved.htm.

Get involved in your local government process – Comment on public notices and attend public hearings concerning wetland permits and regulations. Schedules of public hearings can be found in your local newspaper or by calling your local Corps office. Keep abreast of the environmental issues in your community. Encourage your local government representatives to adopt and support innovative land use planning and low impact development initiatives that would conserve and protect wetlands. Let your voice be heard!

Become knowledgeable about Virginia's wetlands – The more informed you are, the more effective you can be. Local conservation groups, nature centers, state parks and museums offer wetlands trips and courses. Visit and explore wetlands highlighted in Section 2, *Wetlands to See, Wildlife to Visit*, and continue to use this ToolKit to learn about their value and ecology. Find out where wetlands exist in your local community and support their protection and continued educational efforts.

Identify and learn about wetlands on your property – Identify wetlands on your property and avoid these areas if undergoing any construction projects. Continue to learn about the valuable habitat and

functions of your wetland and become familiar with the plants and animals that are found in the area. Take an opportunity to treat it as a unique respite and opportunity to observe and enjoy a unique ecosystem. Your wetland can serve as a lasting educational tool to familiarize your friends and neighbors with the majesty and value of this habitat. See the next chapter within this section of the *ToolKit, Informational Tools*, as well as *Volunteer-Based Wetland Monitoring* (Section 5) to learn how to study and monitor your wetland.

Enhance and restore wetlands on your property where former wetlands have been destroyed or degraded. In addition, maintain vegetative buffer areas around wetlands to conserve habitat values for fish and wildlife. Read the following section, *Hands On Voluntary Wetland Activities*, for more in-depth information about these types of activities you can undertake. Subsequent chapters will teach you about tools for identifying potential sites on which to perform your activities as well as where you can obtain financial as well as technical assistance.

Hands on Voluntary Wetland Activities: Introducing Protection, Enhancement, Creation and Restoration

"In the long run it is the cumulative effect that matters. One can do much. And one and one and one and one can move mountains." ~Joan Ward-Harris

Defining Basic Types of Voluntary Wetland Activities

Voluntary wetland activities are often generally referred to as "restoration" and are often used interchangeably. However, there are actually four main types of voluntary wetland activities: Preservation, Enhancement, Restoration and Creation, defined below (Virginia Wetlands Restoration Coordinating Committee, 2001).

- **Preservation** – The protection of existing wetlands (or other aquatic resources) in perpetuity through the implementation of appropriate legal and physical mechanisms, such as acquisition by purchase or donation, negotiated conservation easement or conservation tax incentive. These protection measures prevent the conversion of a wetland to another use.
- **Enhancement** – The increase of one or more functions or values of an existing wetland or other aquatic resource. Enhancement can include increasing the productivity, habitat, or water quality value of the wetland by modifying environmental parameters (vegetative plantings, for example, to increase wildlife habitat).
- **Restoration** – The re-establishment of a wetland in an area where it historically existed. A common example of restoration includes the re-establishment of wetland hydrology in a wetland that has been drained for cropland.

Top: Young volunteer at SAV restoration project; remaining photos: Alliance volunteers planting wetland plants at the Friends of Bandy Field enhancement project (Photos by Alliance)"

- **Creation** – The establishment of a wetland in an area where one did not formerly exist. Examples include establishing a wetland on an upland site and the filling a pond to produce a wetland.

To avoid confusion for the purposes of this ToolKit, we will refer to all four of these as "*voluntary wetland activities*" when discussing them generally as a group.

Before You Begin – Planning

The type of voluntary wetland activity you decide to undertake depends on who you are, your goals and objectives, resources and limiting characteristics. As with other pursuits, when performing voluntary wetland activities you generally aim for the most "bang for your buck." To do so requires careful planning and often compromises between your goals and limitations.

Step 1 – Determining Goals and Objectives

Oftentimes your organizational identify and jurisdiction alone determine to a large part, the extent of your interest and activities. Examples of each of the four voluntary wetland activities undertaken by different entities are included below:

- **Preservation of an existing wetland**
  Examples include: a private landowner wishing to preserve a family wetland tract through a conservation easement; The Nature Conservancy's Virginia Coast Reserve, a 60-mile stretch of barrier islands that are now a nature preserve, located on Virginia's Eastern Shore;
- **Enhancement of an existing wetland**
  Examples include a Boy Scout troop that builds and installs wood duck boxes in a bottomland wetland that lacks sufficient nesting sites; A National Wildlife Refuge that undertakes an invasive species control project in a wetland
- **Restoration of a former wetland that has been altered**
  Examples include: a local watershed organization that restores a tidal wetland by restoring the tidal connection; a regional nonprofit organization that restores the hydrology and vegetation to a former wetland drained for agricultural purposes (See the Case Study highlights for the Oscar Landing and the Chesapeake Bay Foundation projects)
- **Creation of a wetland where one has never existed**
  Examples include the creation of a vernal pool at a high school to be used as a teaching site

Beyond this, goals need to be further defined in more detail. Although projects should be designed to fulfill multiple goals, at least one major objective, followed by several secondary objectives should be identified (Mitsch & Gosselink, 2000). The enhancement, replacement or creation of functions and values should be an important consideration (Mitsch & Gosselink, 2000). Possible goals include: flood control, stormwater management, water quality improvements, wildlife or fisheries enhancement, and research and education (Mitsch &Gosselink, 2000).

Step 2 – Narrowing the Possibilities

Know your limits: Usually the ultimate goal of wetland voluntary wetland activities is to reverse historical impacts and return the site to its original features. Oftentimes, however, full historic restoration is not feasible due to limits such as financial constraints, timelines and people-power.

Take Advantage of assistance: There are many opportunities for assistance on your project, both technical and financial. Technical and financial assistance is discussed in greater detail in the *Getting Help* portion of this section.

Preservation

Preservation options for Virginia landowners include donation, sale, **conservation easements**, natural area dedications, and registration as a natural area. The first two options are discussed below. More information concerning natural area dedications and registrations may be obtained by contacting the DCR's Office of Land Conservation.

- **Donation** – Landowners can donate property rights to a state agency, local government, and land trust or conservation organization. Donation can also be performed for the future as part of a will. Donations qualify for tax deductions and potentially reduced real estate taxes.
- **Sale** – Landowners can also sell their property at a price below fair market value. The price difference is considered a charitable donation that may be eligible for income tax deductions, reduced estate taxes and minimizing long term capital gain taxes associated with the sale of a large estate
- **Permanent conservation easement** – Conservation easements differ from the donation or sale of land in that ownership is still retained. Under a conservation easement, most development rights are relinquished, but some traditional uses are still retained. A conservation easement is a legally binding and permanent deed to the property. Easements are tailored so that the land's unique characteristics – in this case, wetlands – are protected. Life estates are another option within conservation easements. In this situation, a landowner donates or sells their property to a land conservation organization but continues to live on it until his or her death.

More information about conservation easements:

- DCR's Office of Land Conservation: http://www.dcr.virginia.gov/olc/
- Virginia Open-Space Land Act: http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+10.1-1700
- Virginia Conservation Easement Act: http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+10.1-1009
- Sample Conservation Easement template: www.virginiaoutdoorsfoundation.org/easement.html
- Publications available about land conservation: www.lta.org/publications/easement_lib.htm
- For details on tax advantages for all of these Preservation measures: http://www.dcr.virginia.gov/olc/tools03.htm.

- To download a brochure that details state agencies' programs suited to help you conserve your land: http://www.state.va.us/dcr/olc/landcon.pdf

The *Getting Help* section of this chapter includes contacts for technical and financial assistance with land preservation. To find a Land Trust organization in your area, visit the Land Trust Alliance's webpage for Virginia organizations at http://www.lta.org/findlandtrust/VA.htm.

Narrowing Down the Search for Enhancement, Restoration and Creation Activities

- **Location, location, location!** When considering undertaking a voluntary wetland activity, oftentimes the exact location of the activity may not have been identified. There may be a large area that is under consideration, such as an entire county if the stakeholder is a local government, or an entire watershed if the stakeholder is a watershed organization. If this is the case, you will need to prioritize your search.
- **Restoration and enhancement projects are generally more feasible than creation projects.** When choosing sites, the aim should be to select those with the highest chances of success versus the least amount of cost and difficulty. For restoration and creation activities, sites with the highest chances of success are those where wetland hydrology and vegetation can most easily be achieved. Likewise proper soil conditions are necessary for the successful health of enhancement projects. Restoration and enhancement projects will likely have proper wetland soils as well as seed sources for native plants onsite or nearby. Additionally, it may be easier to achieve wetland hydrology in an enhancement or restoration site than in a location where a wetland never existed previously.
- **Wetland creation can be costly and difficult** and therefore smaller sites are recommended for stakeholders with smaller budgets.

Sites to prioritize in your search:

- Existing wetlands (for enhancement and restoration projects) and areas adjacent to wetland areas that could easily be modified to become a wetland (for creation projects)
- Former wetlands where the hydrology has been removed through the use of drains or ditches for cropland, pastureland, or other purposes (for restoration projects)
- Former tidal wetlands (including those that are still wetlands but are now freshwater) where the tidal connection has been disconnected through the placement of a road, berm or other development (tidal restoration projects)
- Sites where natural inundation or saturation is frequent. The tidal cycle and stage are important in tidal areas
- Former or existing wetlands where the vegetation and soils have been altered through actions such as plowing and tilling on cropland or through grazing on pastureland (for enhancement and restoration projects)

(Adapted from Mitsch & Gosselink, 2000).

Less than ideal locations:

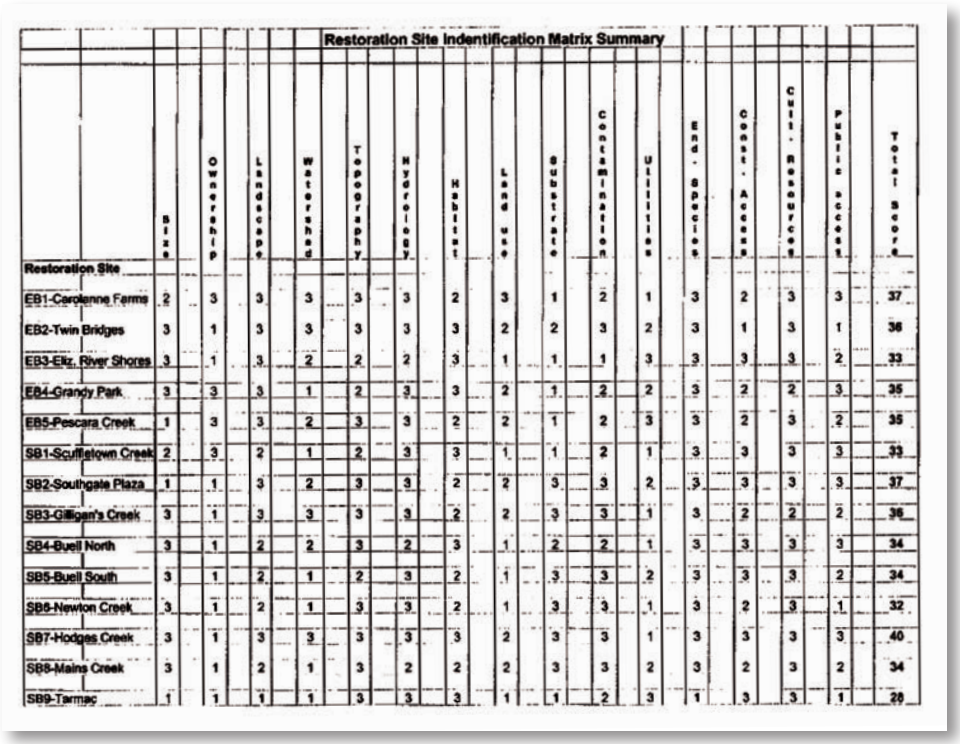
- Areas with highly drainable soils (upland or non-hydric soils) are not likely to have sufficient wetland hydrology
- Areas with moderate to steep topography generally do not have sufficient hydrology to support a wetland
- Areas where the site and adjacent lands are incompatible with a wetland project that will meet desired goals – If the is already developed as a commercial, industrial or residential site (or if such uses are planned and zoned accordingly for the near future) and there is insufficient room remaining on the property for voluntary activities, it is unlikely that it is a worthwhile site to consider.
- For areas where wildlife and fisheries habitat is a goal, if the size of the site is not large enough or is not connected to an ecological corridor such as migratory flyway or spawning runs, the project may be unsuccessful
- Sites with existing valuable habitat, including that which can or does support rare, threatened or endangered species – For example, an upland site that supports a rare plant or animal species is still very valuable even through it is not a wetland. Additionally, the removal of forest habitat to create an emergent wetland is not ideal.

Other considerations:

- Ownership of land – project may be more difficult when you don't own the land
- Size – in general, the larger the better, in terms of return on investment for values and functions
- Maintenance – aiming for sites that require minimal maintenance
- Utilities present or absent? – both above or belowground
- Site contamination – present or absent? Could pose health risk and be expensive to remediate
- Cultural resources – potential for project impacts?
- Public/Construction Access – desirable or undesirable? Available or not?
- Permitting considerations

Develop Screening Criteria For Prioritization

Different stakeholders will have different prioritization methods. For example, the Chesapeake Bay Foundation (CBF), Ducks Unlimited (DU), DGIF and the FWS's Partners for Fish and Wildlife program all focus site prioritization for restoration projects on former wetlands that have been drained or ditched for agricultural purposes. DU additionally prioritizes its activities on establishing waterfowl habitat, whereas the ultimate goal for the CBF is improved water quality for the Chesapeake Bay watershed. Alternatively, an organization that focuses efforts in urban or highly degraded areas may have no other choice than to choose what may seem as "less than ideal" situations to other stakeholder groups.



Restoration Site Indentification Matrix Summary

Restoration Site	Size	Ownership	Landscape	Watershed	Topography	Hydrology	Habitat	Land use	Substrate	Contamination	Utilities	End-species	Coast. Access	Civil-Resource	Public access	Total Score
EB1-Carolanne Farms	2	3	3	3	3	3	2	3	1	2	1	3	2	3	3	37
EB2-Twin Bridges	3	1	3	3	3	3	3	2	2	3	2	3	1	3	1	36
EB3-Eliz. River Shores	3	1	3	2	2	2	3	1	1	1	3	3	3	3	2	33
EB4-Grandy Park	3	3	3	1	2	3	3	2	1	2	2	3	2	2	3	35
EB5-Pescara Creek	1	3	3	2	3	3	2	2	1	2	3	3	2	3	2	35
SB1-Scuffletown Creek	2	3	2	1	2	3	3	1	1	2	1	3	3	3	3	33
SB2-Southgate Plaza	1	1	3	2	3	3	2	2	3	3	2	3	3	3	3	37
SB3-Gilligan's Creek	3	1	3	3	3	3	2	2	3	3	1	3	2	2	2	36
SB4-Buell North	3	1	2	2	3	2	3	1	2	2	1	3	3	3	3	34
SB5-Buell South	3	1	2	1	2	3	2	1	3	3	2	3	3	3	2	34
SB6-Newton Creek	3	1	2	1	3	3	2	1	3	3	1	3	2	3	1	32
SB7-Hodges Creek	3	1	3	3	3	3	3	2	3	3	1	3	3	3	3	40
SB8-Mains Creek	3	1	2	1	3	2	2	2	3	3	2	3	2	3	2	34
SB9-Tarmac	1	1	1	1	3	3	3	1	1	2	3	1	3	3	1	28

Priest/ERP

Example spreadsheet demonstrating how the Elizabeth River Project prioritized its search for restoration sites using a simple spreadsheet

Oftentimes, it all comes down to Ownership of land as main determinant

What to do if you don't own the land? As the majority of wetlands across the nation are privately owned, chances are high that the wetland you are interested in helping is also located on private property (Firehock et al., 1998).

Don't despair – remember to think "outside of the box!" First, contact your local government to research land ownership through tax records. Once you have determined who owns the land (ownership may include multiple entities), there are two main routes that may be taken:

- **Land Acquisition** – Purchasing the land is one option for land preservation and other voluntary wetland activities.
- **Work cooperatively with the landowner(s) to encourage voluntary wetland activities** – This can be especially effective if citizen groups or other stakeholders interested in wetland restoration activities establish a positive dialogue and approach the situation and landowner(s) in a non confrontational manner.

Enhancement

Enhancement activities may include:

- **Native vegetation plantings** – to increase plant diversity as well as to increase habitat for food, shelter and cover for wildlife of interest.
- **Removal of invasive plants** – to aid in native plant establishment. For certain invasive plant species, eradication may not be possible and control may be a better goal.
- **Creation of buffer zones around wetland areas** – planting trees or native grasses in upland areas to protect against disturbance and soil erosion in the wetland area
- **Excluding or limiting domesticated animals** – horses, cattle and even dogs and cats, all of which can be detrimental in some way to wetlands
- **Wildlife control** – may be necessary for unchecked populations of invasive wildlife species that can be detrimental to wetlands such as large populations of resident Canada geese or nutria
- **Restricting off road vehicles** – off-road vehicles can cause soil erosion and damage plant roots
- **Wildlife habitat additions** – strategic placement of birdhouses, nesting boxes and platforms, feeding stations, tree stumps and small brush piles
- **Construction of trails, boardwalks and blinds** – encourages human enjoyment while limiting damage to wetlands by reducing traffic to specific areas. During breeding and nesting seasons, access may need to be restricted or closed

(Adapted from Kellselheim & Slattery, 1995)

A word of caution about enhancement – In pristine situations, wetlands manage just fine without any help from us. There are few wetlands or other natural resources, though, that still qualify as pristine. Nonetheless, more intrusive enhancement actions such as fish stocking, introducing a plant species, or altering water flow can have seriously detrimental effects, such as the introduction of an invasive species (as in the case with fish or plant introductions) or flooding of a neighbor's property for altering flow conditions (adapted from Kellselheim & Slattery, 1995).

Additionally, enhancement actions that may appeal to us may not be the best thing for the wetland. Study a wetland area first to determine enhancement needs. A lack of plant and wildlife diversity when studied in greater detail can help to clue us in as to what enhancement activities would be best for a wetland. (Adapted from Kellselheim & Slattery, 1995). Technical assistance from a wetland professional as to the best types and methods for enhancement measures is highly recommended.

Resources for Creation Projects

A Guide to Creating Vernal Ponds: All the Information you Need to Build and Maintain an Ephemeral Wetland. Bieghauser, T.R. (n.d.). Morehead, KY: USDA Forest Service. Small, handbook aimed for citizen groups with helpful photographs and diagrams. Available for download: http://herpcenter.ipfw.edu/outreach/VernalPonds/VernalPondGuide.pdf

POW! The Planning of Wetlands: An Educator's Guide. Ripple, K.L. & Garbisch, E.W. (2000). St. Michaels, MD: Environmental Concern Inc. Aimed for K-12 educators interested in creating, restoring or enhancing followed by monitoring of a wetland in their schoolyard. Although geared for educators, much of the information is useful for volunteers of all kinds. For more information, contact Environmental Concern Inc., http://www.wetland.org/ P.O. Box P, St. Michaels, MD 21663-0480, Tel. (410) 745-9620.

Resources for Invasive Plant Species Identification and Control

Citizen's Guide to the Control of Invasive Plants in Wetland and Riparian Areas. Alliance for the Chesapeake Bay. (2003) This booklet offers a survey of the efforts of a variety of groups that have mobilized volunteers in order to control invasive plants in natural areas. Available for download: http://www.acb-online.org/pubs/projects/deliverables-251-1-2005.pdf

The Natural Heritage Program has many fact sheets on Invasive Plant Species of concern in Virginia, available for download: http://www.state.va.us/dcr/dnh/bookeduc.htm#invasive

Resources for Restoration and Enhancement Projects

Propagation of Wetland Plants: Herbaceous Plants, Shrubs and Trees. McIninch , S. H. & Garbisch, E.W. (2003). St. Michaels, MD: Environmental Concern Inc. For more information, contact Environmental Concern Inc., http://www.wetland.org/ P.O. Box P, St. Michaels, MD 21663-0480, Tel. (410) 745-9620. Contains information on how to propagate wetland plants, from seed and perennnial plant parts, to be used in wetland projects.

Wetland Habitat Management: a guide for landowners. Ducks Unlimited (DU). (n.d.). Stevensville, MD: Ducks Unlimited, Mid-Atlantic Field Office. A handbook aimed as a reference manual for citizens on wetland enhancement, restoration and management techniques. Contains helpful diagrams explaining common enhancement and restoration practices. Available for downloading: http://www.ducks.org/conservation/Projects/GreatLakesAtlantic/documents/LandownerGuide.pdf

Restoration

- **Restoring tidal connections** to a site that was formerly a tidal wetland by removing berms, roads or other features that disconnected tidal flow
- **Restoring hydrology** to former wetlands that have been drained or ditched for agriculture or development. This can be accomplished by using the following techniques:

  Ditch plugging: Many former wetlands sites have a ditch or several ditches. The Great Dismal Swamp, one of the most studied wetlands in the nation, was severely impacted by human activities including ditching and draining activities (Mitsch & Gosselink, 2000). The least expensive and easiest restoration procedure for reversing ditching is to simply plug the ditch at its lowest point. Plugging may require periodic extensive maintenance. Ditches can also be backfilled. Ditches often are rimmed with an earthen berm that can be pushed back into the ditch and re-contoured (Thompson & Luthin, 2004).

  Disabling of drain tiles: Drain tiles are hollow tubes buried underground, usually in parallel lines. Water collects in the drains and is carried offiste via the tiles. Early tiles were made of wood, followed by clay, concrete and plastic. Drain tiles can be located and then disabled by excavation. Drain tiles can be identified by examining historic aerial photographs or by searching for tile lines with probes. When disabling drain tiles, it is important to remove them and to additionally disable the space created by the compacted soil surrounding the tile lines. Clay tiles can be crushed and reburied (Thompson and Luthin, 2004).

CBF

Old clay drainage tiles

CBF

Photo showing trench where drain tiles have recently been excavated. It is important to fill this area back in with soil to avoid a drainage conduit.

Some final "words of wisdom" for all enhancement, restoration and creation projects

Give the project time – As natural wetlands take time to develop, so will enhanced, restored or created wetlands. Several to many years may be required prior to plant establishment, wildlife habitat or other desired functions to come to fruition (Mitsch & Gosselink, 2000).

You are not alone – Technical assistance from a wetland professional as to the best types and methods for enhancement measures is highly recommended. The Getting Help portion of this section contains information about financial as well as technical assistance for voluntary wetland activities.

Informational Tools for Targeting Potential Sites for Voluntary Wetland Activities

"Maps are a way of organizing wonder. " ~ Peter Steinhart, 1986

This chapter discusses tools such as maps and aerial photographs that are useful for targeting sites for voluntary wetland activities. Information on how to obtain these tools is also provided. These tools will also prove useful for learning more about your site(s) once you have narrowed down your search.

This chapter is divided into six sections: *Topographic Maps; National Wetland Inventory (NWI) Maps; Soil Surveys; Aerial Photographs; Geographical Informational Systems (GIS) Resources;* and *Other Tools*.

Important Points to Make Concerning Informational Tools

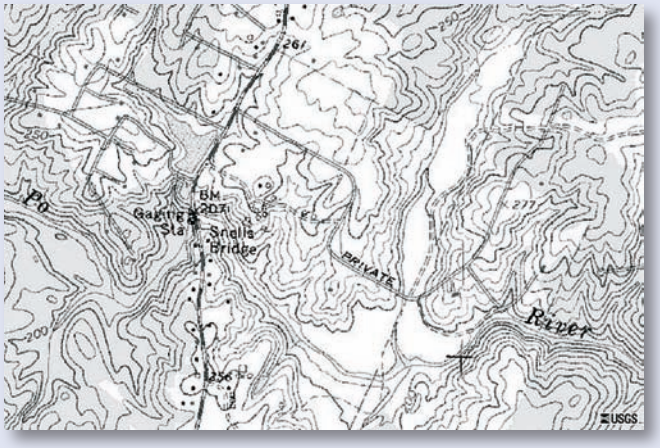
- **None of the tools should be used as "stand-alone" documents** when performing your targeting. In other words, to best narrow down your search, the more tools you have the better in order to obtain a more complete estimate of conditions.
- **Pay attention to the date that each tool was prepared**, remembering that changes in land use could have occurred since that time. Although it may be difficult to find historic copies of the various tools, previous editions of each tool, when used in combination of current editions, can be useful to indicate changes that have occurred to your sites of interest.
- **Remember these are *tools* only, each one its own limitations**. There are always fundamental limitations in mapping scale
- Once you have narrowed your search to one or a few sites, **on-site verification** of your findings should always be performed.
- **Partnering with agencies and organizations** for the use of certain tools and other resources is recommended. An entity that is interested in your area of interest may already have many of the tools you are interested in using and may already know plenty about the conditions and history of your site.

Topographic Maps

Topographic maps are 2-dimentional maps that use contour lines to render the three-dimensional elevation and shape of the land. In addition to showing natural features such as mountains, valleys, plains, lakes, rivers, and vegetation, they also show manmade features such as roads, boundaries, transmission lines, and major buildings (http://erg.usgs.gov/isb/pubs/booklets/topo/topo.html).

The best-known topographic maps are 1:24,000-scale maps produced by the U.S. Geological Survey (USGS), also known as 7.5-minute quadrangles. More than 54,000 7.5-minute maps were made to cover the 48 conterminous States. (http://erg.usgs.gov/isb/pubs/booklets/topo/topo.html). The 7.5-minute map series was officially completed in 1992. The program has recently been replaced by *The National Map*, an online, interactive map service (http://nationalmap.usgs.gov/). All topographic maps from the 7.5-minute program, as well as various derived products, remain available for sale from the USGS.

How to read and use Topographic Maps:



Understanding Features:

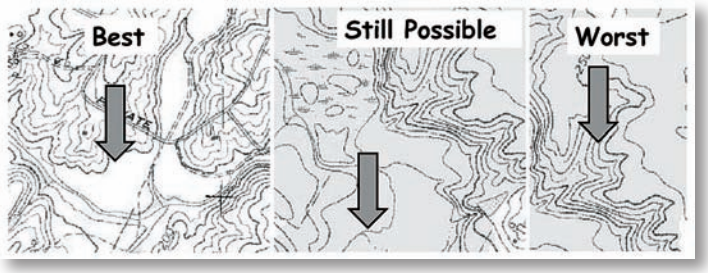
- **Area features**: forested vegetation (indicated as green); water (blue); densely built-up areas (gray or red); information added with update (purple)
- **Line features**: topographic contours (brown); roads, boundaries, railroads, etc.
- **Point symbols**: depict features such as buildings, wells, campgrounds, etc.

Reading Topographic Contours: Topographic contour lines are imaginary lines that join points of equal land elevation. Topographic contours are lines of equal elevation and therefore never cross. Topographic lines are brown. Contours that are very close together indicate steep slopes while lines that are wide apart indicates gradual slope or near level terrain.

More information about how to read topo maps and symbol explanations may be found at: http://erg.usgs.gov/isb/pubs/booklets/symbols/

Tips for using Topographic Maps for identifying potential sites for voluntary wetland activities

- Look for areas adjacent to streams or water bodies, especially areas with wide floodplains
- Look for low-lying areas, depressions, and headwaters
- For creation projects: look for unforested areas



The site indicated as "worst" is an unlikely candidate for creation due to the steep topography. The sites labeled "Best" and "still possible" are both located adjacent to a stream with nearly level to flat topography, indicated by the lack of contours. The site labeled as "best" is a more likely candidate for creation projects because it is unforested while the "still possible" site is indicated as forested (color version of map is shaded green). For protection, restoration and enhancement projects this is not critical, unless you are specifically looking for unforested areas such as emergent wetlands.

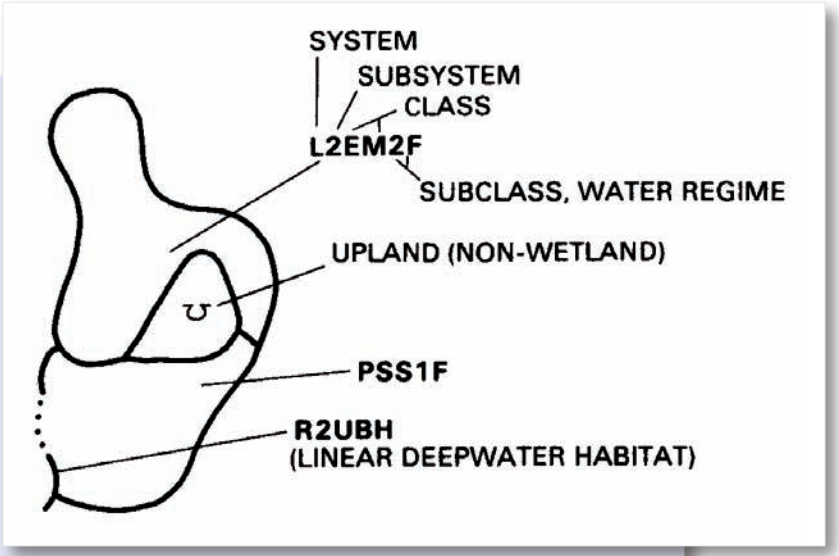
- **Understanding Digital Cartographic Data**: Several types of digital data is available from the USGS, including from Business Partners. For more information go to http://geography.usgs.gov/esic/to_order.html
- **Explanation of digital data types:**
  - Digital Line Graphs (DLG) – small files of data derived from USGS topographic quadrangle maps, arranged in layers, generally for use in geographic information systems (GIS)
  - Digital Elevation Models (DEM) – elevation data (similar data also available in seamless set known as National Elevation Data, or NED)
  - Digital Raster Graphics (DRG) – scanned topographic maps
  - Digital Orthophoto Quadrangles (DOQ) – digitized and ortho-rectified renderings of National Aerial Photography Program products

Obtaining Topographic Maps

- **Topographic maps with a smaller scales (zoomed in or close up) than 7.5 minute quadrangle:**
  - Local government planning/zoning offices
  - Also check to see if a site survey has been performed
- **USGS Topographic Maps (online, hardcopy, and/or digital):**
  - **USGS:**
    http://geography.usgs.gov/esic/to_order.html
    1-888-ASK-USGS (1-888-275-8747):
    P.O. Box 25286
    Denver, CO 80225
    USGS Business Partners:
    http://rockyweb.cr.usgs.gov/acis-bin/querypartner.cgi
  - **Virginia Department of Mines, Minerals and Energy (DMME), Division of Mineral Resources (DMR):**
    http://www.mme.state.va.us/DMR/PUB/maplist2.html#topo
    434-951-6341
    P.O. Box 3667
    Charlottesville, VA 22903
  - **TerraSever** – on online service that contains high-resolution USGS aerial imagery and USGS topographic maps that can be viewed and downloaded *for free*. http://terraserver-usa.com/
  - **Topozone** – on online service that contains USGS topographic maps that can be viewed *for free*. http://www.topozone.com. Purchasing requires subscription to Topozone Pro.
  - **National Geographic** – CD-ROM contains all topographic maps set for the Mid-Atlantic region: http://www.trailsillustrated.com/acb/showdetl.cfm?&DID=15&Product_ID=943&CATID=35
    - Digital format for ArcGIS also available: http://maps.nationalgeographic.com/topo/extension.cfm

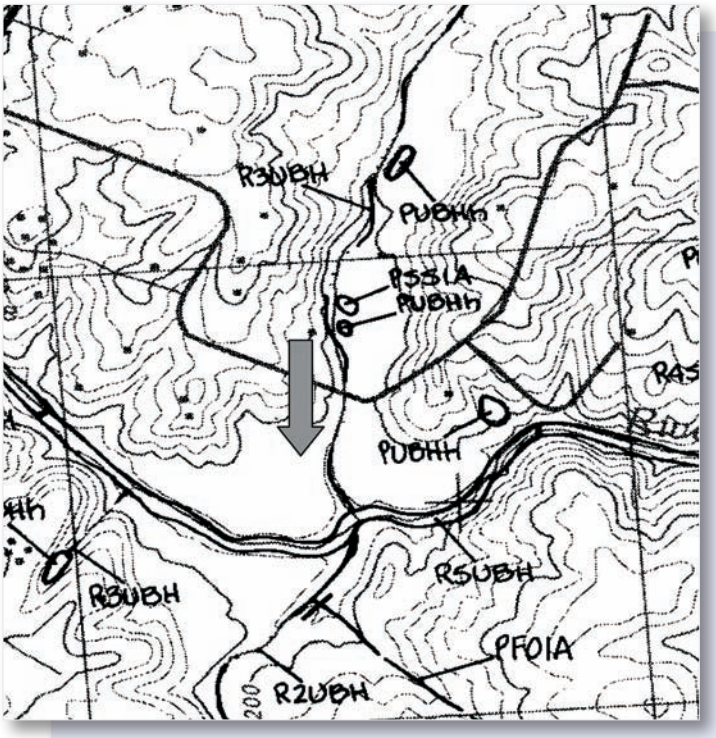
National Wetland Inventory (NWI) maps

The National Wetland Inventory (NWI) maps are based on the NWI classification system developed by the FWS and provide information on the status and extent of wetlands and deepwater habitats. Hardcopy NWI maps are printed on a blueprint and are overlain on top of USGS 7.5 minute quadrangles. The FWS recently completed or revised the over 800 NWI maps necessary to cover all of Virginia (Hershner et al., 2003). Efforts are currently underway by the FWS to produce a seamless digital data set for the entire Nation. Digital data sets contain additional information as part of The National Map effort.



How to Read and Use NWI Maps:

Wetland and deepwater habitats are displayed as polygons using the alphanumeric codes corresponding to the classification nomenclature that best describes the habitat. A wetland key to the alphanumeric system is located at the bottom of each hardcopy map. The diagram above shows two different polygon shaped wetland features: L2EM2F (Lacustrine [L], littoral [2, meaning along the shoreline], emergent [EM], nonpersistent vegetation [2], semi permanent water regime [F]); and PSS1F (Palustrine [P], scrub-shrub vegetation [SS], broad leaved deciduous vegetation [1], semi permanent water regime [F]) surrounding an upland feature (polygon labeled with "u", indicating an upland area. A solid and dashed line indicates a linear Riverine feature. For online maps, an online codes link is available from the NWI website.



Tips for using NWI Maps for identifying potential sites for voluntary wetland activities:

- For protection, enhancement and restoration projects- look for areas indicated as wetlands.
- For creation projects, look for areas adjacent to wetlands
- Fore restoration projects, compare historic NWI maps to recent NWI maps to identify sites that previously wetlands but that are no longer.

Precautions with using NWI maps:

As the NWI maps are created from aerial photos, some types of wetlands, particularly smaller forested wetlands, may not appear on the NWI maps.

The site indicated by the arrow is the same as that labeled as " Best" in the topographic map section for a creation project. The general area is potentially a candidate for a creation project, because although it is not indicated as being a wetland, it located close to several riverine (R) and palustrine (P) wetlands. Any of the areas indicated as wetlands may be potential sites for protection, enhancement or restoration.

Obtaining NWI maps (online, hardcopy and digital):

NWI wetland information has been collected and disseminated over the past several decades. Therefore, the data exist in different formats:

- **Hardcopy** – (Standard-sized 7.5' paper composites) for purchase from USGS Cooperator-run Distribution Centers. For Virginia NWI maps
  http://www.umass.edu/tei/esio/wtlnd.html
  Earth Science Information Center
  at University of Massachusetts
  Blaisdell House
  Amherst, MA 01003
  (413) 545-0359

- **Online (Viewing and customized downloads)**: NWI Wetlands Mapper – Digital NWI data:
  http://wetlandsfws.er.usgs.gov/intro.html

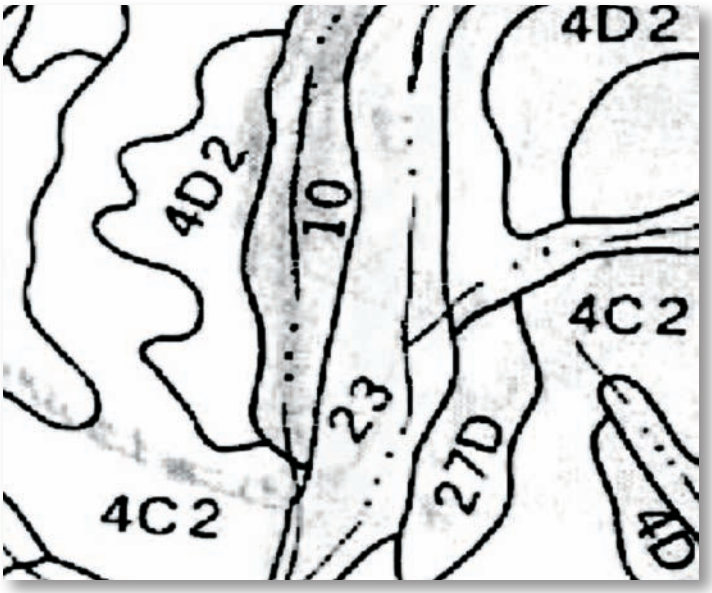
- **Custom digital NWI maps *for purchase* (to download)**:
  http://www.charttiff.com/WetLandMaps/index.html

- **VIMS Wetlands Data Viewer tool** – allows users to obtain NWI statistics for any hydrologic unit in Virginia. Localities are divided by county or municipality. http://ccrm.vims.edu//disclaimer_wetlandsdataviewer.html

For more information about obtaining NWI maps, go to http://wetlandsfws.er.usgs.gov/intro.html

Soil Surveys

The Natural Resources Conservation Service (NRCS) produces soil surveys. Soil surveys are produced for most counties and some cities and contain maps showing the locations and extent of soils as well as data about the physical and chemical properties of those soils. The maps are underlain by aerial photographs and show soil boundaries as well as linear features such as roads and drainage features and point features such as buildings.



How to Read and Use Soil Surveys

1. The lines on the map separate different soil types, referred to as map units. The alphanumeric labels, such as 10, 23, or 27D, designate the types of soil mapping units, which are described within the narrative portion of the soil survey.
2. Note the perennial streams indicated by the —— _ _ _ —— symbol.

(For more detailed instructions on reading soil surveys, go to http://soils.usda.gov/survey/how_to/)

Tips to using soil surveys for identifying potential sites for voluntary wetland activities:

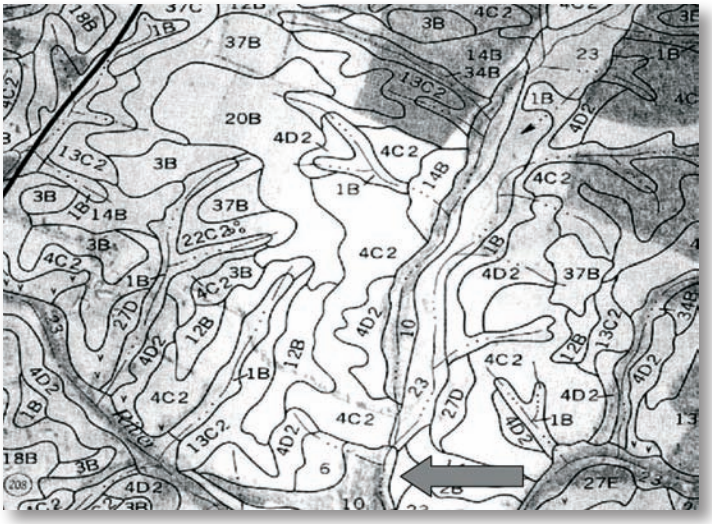
- **Obtain a Hydric soils list for your area of interest from the Local NRCS office** – This list contains hydric soils and oftentimes **fluvaquents** (soils formed from frequent flooding, often found in floodplains) and hydric **inclusions** (hydric soils located within larger non hydric soil complexes). These soils are on this list because they have been found to share characteristics due to their formation under conditions of saturation, ponding or flooding for a long enough time period to have developed anaerobic conditions. They generally share characteristics such as poor drainage, a high water table, are found on flat or nearly level slope, or are located in a floodplain.

- **Identify Hydric soils and fluvaquents on your soil survey map** – these indicate areas that have a high likelihood of either being a wetland at the time the soil survey was made or at some prior time.

- **Once you have narrowed down your search, look for soils with hydric inclusions**, which might indicate the presence of smaller wetlands at the time of the survey or at some prior time.

Precautions with using Soil Surveys

Precautions must be taken in using soil surveys for gathering hydric soil information because due to the scale of the surveys, map units will contain soils that are not all of the same type. Therefore a map unit that contains a soil type listed on the hydric soil list may contain inclusions of soils that are non hydric. Likewise, map units that are not on the hydric soils list may include inclusions of hydric soil. Once you have narrowed down your search to one or a handful of sites, you should confirm your findings by having someone such as a soils scientist visit the site(s).



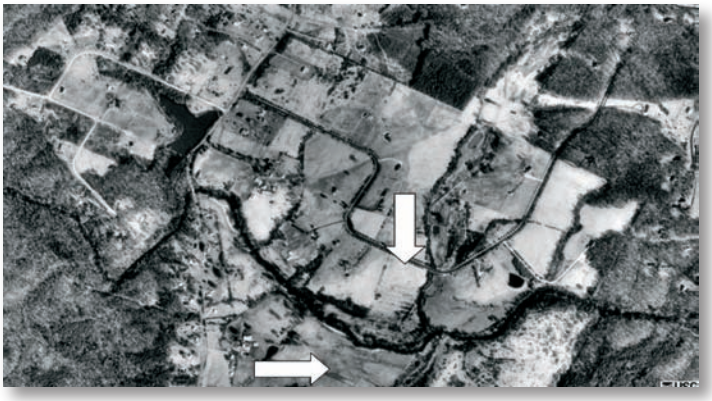
The site to the left of the arrow is the same as that labeled as " Best" on the Topographic Map for a creation project. The general area is potentially a candidate for a creation project, because it is labeled as map unit "10." Based on the codes description included in the soil survey, this refers to a soil unit included on the hydric soils list for that particular county. Soil units 23 and 34B are also listed on the county's hydric soils list and therefore have a high likelihood of either being a wetland at the time the soil survey was made or at some prior time.

Aerial photographs

Aerial photographs are a useful tool for understanding more about recent site conditions as well as providing clues to the past.

Tips for using aerial photographs for identifying potential sites for voluntary wetland activities:

- Look for darkened areas, which may indicate the presence of water.
- Look for sites adjacent to streams or water bodies
- For creation projects: look for unforested areas



The site framed by the two arrows is the same as that labeled as " Best" on the Topographic Map for a creation project. The general area is potentially a candidate for a creation project, because it is unforested and is located close to several stream systems that appear to be forested or shrub-scrub. The area below the top arrow is lighter in color and is most likely a crop field.

Obtaining aerial photographs

- **Farm Service Agency (FSA)** – The Aerial Photography Field Office (APFO) of the FSA is the primary source of aerial imagery for the U.S. Department of Agriculture (USDA). Hard copies of aerial photographs are available for purchase for much of the country for years 1955 to present. Orders are all custom-made, as no stock of completed photography is on hand. Digital imagery is currently being archived and developed at the APFO to meet USDA Service Center requirements. More information on obtaining aerial photographs may be obtained by contacting the state FSA office or:http://www.apfo.usda.gov/
  Virginia State FSA Office
  1606 Santa Rosa Rd.
  Culpeper Building, Suite 138
  Richmond, VA 23229
  Phone: 804-287-1503
  Fax: 804-287-1723
- **USGS** – Aerial photographs may also be ordered from the USGS through their *Business Partner Program:* http://rockyweb.cr.usgs.gov/acis-bin/querypartner.cgi?results&sort=location.
- **TerraSever** – Online service that contains high-resolution USGS aerial imagery and USGS topographic maps that can be viewed and downloaded *for free*: http://terraserver-usa.com/
- **TopozonePro** – Full-resolution 1-meter USGS aerial photographs available *for purchase:* http://www.topozone.com/topozonepro.aspy
- **Virginia Department of Transportation (VDOT)** Current as well as historic aerial photographs, dating back to the 1930s for some areas, available *for purchase*: (804) 786-2575 for more details

Geographical Information Systems (GIS)

Geographical Information Systems (GIS) is a type of computer system that can capture, store, analyze and display information geographically, or according to location. GIS allows users to view multiple layers of geographical-based data such as roads, topography, and wetlands at one time. "The power of a GIS comes from the ability to relate different information in a spatial context and to reach a conclusion about this relationship" (U.S. Geological Survey [USGS], December 2005). GIS also allows the user to "point" at an area, location or object on the computer screen and retrieve recorded information about it from off screen files.

The way maps and other data have been stored or filed as layers of information in a GIS makes it possible to perform complex analyses. For example, GIS can be used to analyze NWI maps, USGS topographic maps, and soil maps to produce a new map layer or overlay that ranks the wetlands according to certain criteria. GIS can therefore be a valuable tool to research large amounts of geographical data for large areas.

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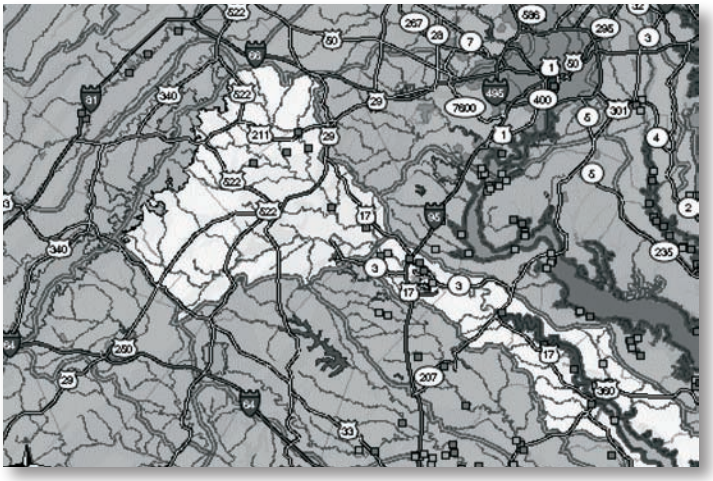
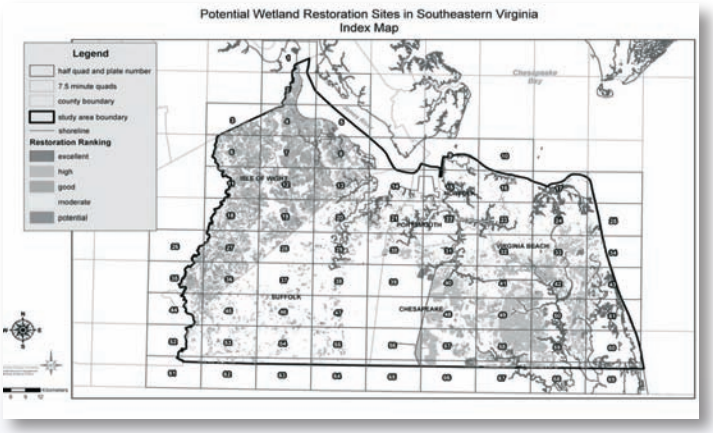
GIS requires viewing capabilities as well as digital data in GIS-based format. Until recently, this required expensive computer software and related computer skills. Recently however, online viewing of GIS-based data has become more available through web-based interactive programs on Federal, state, and private websites. To create your own GIS data, however, you will most likely need GIS-based still software and computer skills.

An active GIS market has resulted in lower costs and continual improvements in GIS hardware, software, and data. These developments will lead to a much wider application of the technology throughout government, business, and industry.

For more information on GIS, visit the USGS website at: http://erg.usgs.gov/isb/pubs/gis_poster/#what



Example of Towson CGIS' Watershed Mapper for the Rappahannock Watershed showing roads, water features and citizen-based water quality monitoring stations.



Wetlands mitigation/restoration targeting tool for Hampton Roads area.

Sources for Geographical Information Systems Assistance, Data and Online Viewers:

- **Local planning/zoning offices** – Geographical data layers with local information is often available for purchase or download
- **The Virginia Economic Development Partnership** – Digital data coverage of the 7 1/2 Minute Quadrangles for Virginia as well as many other GIS data layers, *for free:* http://gis.vedp.org/VEDPdatasets.html
- **Chesapeake Bay Program** – Variety of Chesapeake Bay watershed geographical resources are available for downloading: http://www.chesapeakebay.net/maps.htm. Interactive Mapping is also available as well as links to other sites with GIS data
- **Academic Institutions** –May be able to offer technical assistance for your project. Additionally, several have websites with online viewers containing many useful data layers and data layers that can be downloaded for free or for purchase
  - **Virginia Institutive of Marine Science (VIMS) Comprehensive Coastal Inventory Program** Online GIS Databases:
    - **GIS data links** available to support programs and activities which research, enhance, or implement policy related to shoreline management in Virginia: http://ccrm.vims.edu/gis/gisdata.html
    - **Wetlands mitigation/restoration targeting tool:** GIS and landscape practices to determine sites suitable for wetlands creation and restoration. Tool contains two components: *static maps* and an *interactive query system*. Currently, the model has been run for the Hampton Roads Area. VIMS plans to run the model statewide in the future. http://ccrm.vims.edu/cci/wet_target/
  - **Towson University (TU) Center for Geographical Informational Sciences (CGIS)** – GIS technical services, free easy to use viewing software, and interactive mapping for analysis and display of geographic information: http://chesapeake.towson.edu/.
    - Basic Interactive-mapping Viewer: http://chesapeake.towson.edu/mapping/simpleims.asp
    - Watershed Mapper – Provides watershed associations the ability to disseminate geographic information about their watershed over the Internet. This is accomplished through features such as a list of available data to view, a map window, and a number of basic GIS tools: http://chesapeake.towson.edu/mapping/watershedmapper.asp
- **The GIS Center at Radford University** – Several spatial data sources covering Virginia and surrounding states: http://www.radford.edu/~geoserve/main_page.html

Other Tools:

Several other tools may be useful when identifying potential sites for voluntary wetland activities, especially once you have narrowed down your search and are considering site characteristics such as the presence or absence of threatened and endangered species, cultural resources, or the likelihood of environmental contamination.

- **DGIF's Virginia Fish and Wildlife Information Service (VAFWIS)** – Online database containing current and comprehensive information about Virginia's Wildlife resources, including wildlife species observations, threatened or endangered species locations, and cold water (trout) stream surveys. Also available as GIS data layers: http://vafwis.org/WIS/ASP/default.asp
- **Virginia Natural Heritage Program's (NHP's) Online information of Virginia's Natural Communities, Rare, Threatened and Endangered Animals and Plants** – On-line database allows for queries to find information on Virginia's 1600+ natural heritage resources. Queries can be run for categories such as species/natural areas, counties, physiographic regions, and others: http://www.dcr.virginia.gov/dnh/nhrinfo.htm
- **Virginia Department of Historic Resources (DHR)** – To determine historic, architectural, archaeological, and cultural resources that may exist on your site or on sites within the project vicinity. Organized by city and county, this collection of data is contained in files, reports and maps. For more information, contact DHR's Archivist at (804) 367-2323 ext. 124 or: http://www.dhr.virginia.gov/archives/archiv_info.htm
- **Environmental databases** –A number of environmental databases are available for identifying the potential risk of contamination at or in the vicinity of your site. Examples include:
  - **Toxic Release Inventory (TRI)** – database containing information of releases and transfers of toxic chemicals from facilities in certain industrial sectors, including manufacturing, waste handling, mining, and electricity generation.
  - **Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)** – database containing information on hazardous waste sites, site inspections, preliminary assessments and remedial status.
  - **Obtaining Environmental Databases** – many are available online *for free*. Custom database searches can also be provided by a number of commercial businesses *for purchase*:
    - **EPA Envirofacts:** online access to select EPA environmental data *for free*: http://www.epa.gov/enviro/
    - **The Right-to-Know Network** – provides *free access* to numerous environmental databases: http://www.rtknet.org/
- **Tax Maps** – Available at County/City Tax Assessor's office

Getting Help – Resources for Financial and Technical Assistance

"Asking is the beginning of receiving." ~ Jim Robins

You are not alone when it comes to voluntary wetland activities. Help is out there!

In fact, unless you are a wetland professional, it is highly recommended to recruit technical assistance for your project in order for it to most likely be successful. This ToolKit chapter is intended to provide basic information in table format at-a-glance as well as contacts for further more detailed information. Four tables are included: Grants and Foundations; Cost Share Programs; Preservation Assistance; and Technical Assistance for Wetland Enhancement, Restoration or Creation.

Grants and Foundations

The Grants and Foundations table lists environmental **grant** and **foundation** funding programs. Many of these listings are not specific to Virginia or to voluntary wetland activities; however, all of these listings have funded such projects in the past. Eligible recipients vary but generally include nonprofit organizations and often local or state agencies. More information can be obtained by visiting the agency's website or by contacting them by phone or in person.

A special note about matching funds

Please be aware that some grants require **matching funds**, often referred to as *match* or **cost share**. Match is the amount of money that the applicant organization or partners are prepared to spend on the project. These contributions can be in the form of cash (cash outlay), **in-kind contributions**, or donated goods and services. Each **grantor** has different match requirements and different restrictions on allowable match.

Other helpful information about grants:

- **Catalog of Federal Funding Sources for Watershed Protection** – online database allows you to perform tailored queries for financial assistance sources (grants, loans, cost-sharing) based on entered information about type of assistance, eligible organization type, match requirements and keywords: http://cfpub.epa.gov/fedfund/
- **Environmental Foundation Funding** – Centralized, web-based clearinghouse of foundation funding and resources. For environmental foundation funding: http://fdncenter.org/pnd/rfp/cat_environment.jhtml;jsessionid=FSF5E2TG0RSOYP5QALRSGXD5AAAACI2F
  - **Online tools for grant writing:**
    - **Grant Terminology, Grant Research and Writing Tips:** http://www.howard.k12.md.us/grants/Terminology.html
    - **Grant-writing tools for non-profit organizations:** http://www.npguides.org/
    - **EPA Grant-Writing Tutorial:** http://www.epa.gov/seahome/grants/src/grant.htm

Cost Share and Payment Programs

The Cost Share Table lists incentive-based programs geared to landowners, particularly agricultural, for voluntary wetland activities. Funding specifics vary with program and should be closely examined. Typically, the landowner's portion of the project cost is required upfront, with reimbursement after project completion.

Scenario of how cost share programs typically work:

Landowners contact technical or financial assistance organization. The organization determines if a suitable site exists on the property. Consultation with the landowner determines likely activities and a survey and project design are completed for the landowner to review and approve. The landowner signs the contract, and the necessary permits and clearances are obtained. The project is then constructed with partner oversight and the landowner is reimbursed for project expenses. (Virginia Wetlands Restoration Coordinating Committee, 2001).

Preservation Assistance

Land Trust Alliance lists just a few of the many agencies, organizations and programs in Virginia to assist private landowners with land preservation. To find a Land Trust organization in your area, visit the Land Trust Alliance's webpage for a listing of Virginia organizations at http://www.lta.org/findlandtrust/VA.htm.

Technical Assistance for Voluntary Wetland Enhancement, Restoration and Creation Projects

This table lists contact information for technical assistance for voluntary wetland activities within Virginia. Although most of these entities are also listed in the *Cost Share and Payment Programs* table for specific programs offered by these entities. These organizations are additionally listed within this section to emphasize the fact that even if they cannot offer financial assistance under a particular program, they can still oftentimes provide technical assistance. Many of these entities and programs are closely networked, meaning that if one entity is unable to assist with your project, they can likely place you under the assistance of another.

GRANTS & FOUNDATIONS				
NAME	CONTACT ORGANIZATION	GOALS	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
Chesapeake Bay Restoration Fund (CBRF)	Virginia Division of Legislative Services	Environmental education, restoration and conservation of the Chesapeake Bay	State and local governments, nonprofit organization and academic institutions. Grants will not be awarded to individuals. Preferences will be given to environmental education and action-oriented conservation and restoration projects within Virginia's Chesapeake Bay watershed	http://dls.state.va.us/cbrfac.htm
Chesapeake Bay Small Watershed Grants Program	National Fish and Wildlife Foundation (NFWF)	To protect and improve watersheds in the Chesapeake Bay while building citizen-based resource stewardship	Non-profit organizations or local governments within Chesapeake Bay watershed. Individuals, state and Federal government agencies, and private for-profit firms are not eligible	http://www.nfwf.org/programs/chesapeake
Community-Based Restoration Program (CRP)	National Oceanographic and Atmospheric Administration (NOAA)	Grass-roots habitat restoration benefiting living marine resources	Institutes of higher education, hospitals, nonprofit organizations, commercial and international organizations, state/local/tribal governments	http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/index.html
Fish America Foundation	Fish America Foundation	On-the-ground habitat restoration benefiting fishery resources	Public and private organizations, local/state/tribal governments	http://www.fishamerica.org/faf/

GRANTS & FOUNDATIONS				
NAME	CONTACT ORGANIZATION	GOALS	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
Five-Star Restoration Challenge Grants	EPA and NFWF	Community-based wetland, riparian, and coastal habitat restoration that builds diverse partnerships and fosters local natural resource stewardship	Any public or private entity	http://www.nfwf.org/programs/5star-rfp.cfm
Migratory Bird Conservancy (MBC) Grant Program	NFWF	Conservation of bird habitats including acquisition, restoration, and management	Private individuals, organizations, government entities	http://www.conservebirds.org/
National Fish and Wildlife Foundation – General Matching Grant Program	NFWF	Actions promoting fish and wildlife conservation and habitat conservation while involving and working with other conservation and community interests	Federal, state, and local governments, educational institutions, and nonprofit organizations	http://www.nfwf.org/guidelines.cfm
North American Fund for Environmental Cooperation Grants	North American Commission for Environmental Cooperation (NAFEC)	Projects must strengthen the capacity of citizens and communities to monitor aspects of their Environments that affect their own health.	Non-profit, non-governmental organizations in North America	http://www.cec.org/
North American Wetlands Conservation Act (NAWCA) Grants	US Fish and Wildlife Service (FWS)	Wetlands conservation projects that promote long-term conservation of North American wetland ecosystems that provide habitat for waterfowl and other migratory birds, fish and wildlife	Public or private, profit or nonprofit entities or individuals establishing public-private sector partnerships, in US, Canada, Mexico	http://www.fws.gov/birdhabitat/NAWCA/act.htm
Private Stewardship Grants Program	FWS	To benefit federally listed, proposed, or candidate species, or other at-risk species by providing grants and assistance to individuals and groups.	Private (non government) landowners and their partners – includes private landowners, individually or as a group as well as individuals or groups (for example land conservancies, community organizations, or conservation organizations) working with private landowners on conservation efforts are eligible to apply. State agencies are not eligible to apply	http://www.fws.gov/endangered/GRANTS/PRIVATE_STEWARDSHIP/

GRANTS & FOUNDATIONS				
NAME	CONTACT ORGANIZATION	GOALS	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
Project AWARE Grants	Project AWARE Foundation	To support worthwhile aquatic conservation projects such as: public education; grass roots conservation and enhancement projects; research leading to conservation; public awareness initiatives; environmental assessment and monitoring projects; and volunteer-supported community activism	Individuals, organizations, government entities	http://www.projectaware.org/americas/english/grants.asp
Urban and Community Forestry Assistance Grants	USDA-FS / VDOF	To encourage projects that promote tree planting, the care of trees, the protection and enhancement of urban and community forest ecosystems, and education on tree issues in cities, towns and communities across the nation	State, local and regional governments, nonprofit organizations, neighborhood associations and civic groups, public educational institutions (college level) or Community Tree Volunteers	http://www.dof.virginia.gov/info/grants.shtm
Virginia Environmental Endowment (VEE) – Virginia Program and Mini-Grant Program	VEE	To improve the quality of the environment by using its capital to encourage all sectors to work together to prevent pollution, conserve natural resources, and promote environmental literacy	Virginia Program: nonprofit, tax-exempt, charitable organizations and institutions and governmental agencies Mini-Grant Program: Public and private schools (K-12) and nongovernmental, nonprofit community organizations local, state, and Federal government agencies and programs are not eligible	http://www.vee.org
Wetland Program Development Grant	EPA	Main funding priorities: (1) Developing a comprehensive wetland monitoring and assessment program; (2) improving the effectiveness of compensatory wetland mitigation; and (3) refining the protection of vulnerable wetlands and aquatic resources	States, Tribes, local governments, interstate associations, intertribal consortia, and national nonprofit, non-governmental organizations	http://www.epa.gov/owow/wetlands/grantguidelines/

COST SHARE PROGRAMS				
NAME	CONTACT ORGANIZATION	GOALS	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
Conservation Enhancement Program (CREP) – Virginia	US Department of Agriculture – Farm Service Agency/ Natural Resources Conservation Service (USDA-FSA/ NRCS)	To encourage farmers and ranchers to remove lands from agricultural production in order to improve water quality and to treat environmentally sensitive areas through the establishment of forested streamside buffers, filter strips and the restoration of wetlands	Private agricultural landowners in Virginia's Chesapeake Bay watershed and eligible portions of Southern Rivers watersheds	http://www.dcr.virginia.gov/sw/crep.htm
Conservation Reserve Program (CRP) – Virginia	USDA-FSA/ NRCS	Water quality and habitat enhancement and Conversion of highly erodible land (HEL)	Private agricultural landowners; Privately owned, highly erodible cropland or environmentally sensitive acreage	http://www.fsa.usda.gov/pas/publications/facts/html/nonfloodwet04.htm
Cost-Share and Tax Credit for Virginia Agricultural Best Management Practices (BMPs)	Virginia Department of Conservation and Recreation (DCR) and Virginia Soil and Water Conservation Districts (SWCD)	To assist with the installation of conservation practices that protect water and make farms more productive	Farmers in designated priority watersheds within Virginia	www.dcr.virginia.gov/sw/costshar.htm
Ducks Unlimited (DU) Chesapeake Bay Wetland Restoration Program	DU	To provide funding and technical assistance for wetland restoration projects within the Chesapeake Bay watershed	Private landowners within Virginia's James, Rappahannock and Potomac (including Shenandoah) watersheds	http://www.ducks.org/
Forest Land Enhancement Program (FLEP)	USDA-Forestry Service (FS)	To keep private forestlands and natural resources productive and healthy	Non-industrial private forest owners, group associations, corporations, Indian tribes, or other legal, private entities	http://www.dof.virginia.gov/

COST SHARE PROGRAMS				
NAME	CONTACT ORGANIZATION	GOALS	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
Partners for Fish and Wildlife – Virginia	FWS	To promote voluntary restoration of wetlands and streamside habitats through offering of technical and financial assistance	Private (non-Federal) and corporate landowners. Cost Share is currently available for only specific areas of VA and changes with internal funding levels. Contact FWS for more information.	http://www.fws.gov/partners/index.htm
Virginia Department of Game and Inland Fisheries Technical Landowner Assistance Program	Virginia Department of Game and Inland Fisheries (DGIF)	To provide assistance to undertake wetland restoration or habitat improvement and management projects	Private and public landowners	http://www.dgif.virginia.gov/index.asp
Wetland Reserve Program (WRP)	USDA - NRCS	Provides technical and financial assistance to eligible landowners to restore, enhance and protect wetlands. The goal is to restore degraded wetlands to "natural" conditions. In eastern VA, focus is on groundwater dependent hardwood forested wetlands. In mountain region, focus is on spring seep and herbaceous/shrub wetlands	Private agricultural land (including Tribal)	http://www.nrcs.usda.gov/programs/wrp
Wildlife Habitat Incentive Program (WHIP)	USDA-NRCS	To encourage the creation or restoration of high quality fish and wildlife habitats primarily on private land. Allows for the development and protection of upland, wetland, riparian, and aquatic habitat areas. Offering of technical and financial assistance	Private landowners (including Tribal); State and local government on a limited basis	http://www.nrcs.usda.gov/programs/whip/

LAND CONSERVATION PROGRAMS				
NAME	CONTACT ORGANIZATION	GOALS	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
Land Conservation Program	Piedmont Environmental Council (PEC)	Provides assistance to landowners to undertake land conservation measures and to encourage the placement of conservation easements	Private landowners in certain counties of the Piedmont Region in Virginia	www.pecva.org
Land Trust Alliance	Land Trust Alliance (LTA)	Provides resources to promote voluntary land conservation and strengthen the land trust movement by providing the leadership, information, skills and resources land trusts need to conserve land for the benefit of communities and natural systems	National organization-provides technical assistance through resources	www.lta.org
Land Trust of Virginia	Land Trust of Virginia	Provides assistance to landowners with conservation easements	Statewide	http://www.landtrustva.org/
Office of Land Conservation	Virginia Department of Conservation and Recreation		State agency	http://www.dcr.virginia.gov/olc/
Open Space Lands Preservation Trust Fund	Virginia Outdoors Foundation (VOF)	Preserve farmland, forestland, and natural and recreational areas by restricting intensive uses	Individual landowners in VA	http://www.virginiaoutdoorsfoundation.org/
Orange County Conservation Fund	Piedmont Environmental Council (PEC)	Protect lands threatened by sprawl development	Private landowners in certain parts of Orange County	www.pecva.org

TECHNICAL ASSISTANCE FOR WETLAND ENHANCEMENT, RESTORATION OR CREATION				
NAME	CONTACT ORGANIZATION	CONTACT ORGANIZATION	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
	Chesapeake Bay Foundation (CBF)	Libby Norris Virginia Watershed Restoration Specialist Virginia State Office 1108 East Main Street, Suite 1600 Richmond, VA 23219 (804) 780-1392 lnorris@cbf.org	Private or public landowners within Virginia's Chesapeake Bay watershed	http://www.cbf.org
	Chesapeake Wildlife Heritage (CWH)	Austin Jamison Old Three Notch Road Charlottesville, VA 22901 (804) 825-7587 ajamison@cheswildlife.org	Private or public landowners within Virginia's Chesapeake Bay watershed	http://www.cheswildlife.org
Chesapeake Care Program	Ducks Unlimited, Inc.	Grace Bottitta Great Lakes Atlantic Region Mid Atlantic Field Office 34 Defense Street, Suite 200 Annapolis, MD 21401 (410) 224-6620 gbottitta@ducks.org	Private landowners within Virginia's James, Rappahannock and Potomac (including Shenandoah) watersheds	www.ducks.org
Partners for Wildlife	U.S. Fish and Wildlife Service (FWS) Partners for Fish and Wildlife	6669 Short Lane Gloucester, VA 23061 (804) 693-6694 David Byrd – ext 133, or Willard Smith – ext 124	Private (non-Federal) landowners. Technical assistance is currently available for wetlands in Rappahannock, Roanoke, and Back Bay Watersheds, and on the Eastern Shore of Virginia. Technical assistance is currently available for streams in the Rappahannock, Shenandoah Valley, and Upper Tennessee Watersheds, and on the Eastern Shore of Virginia	http://www.fws.gov/partners/index.htm
Private Landowner Technical Assistance	Virginia Department of Game and Inland Fisheries (DGIF)	David Norris Williamsburg Regional Office 5806 Moore Town Road Williamsburg, VA 23188 (757) 253-7072 dnorris@dgif.state.va.us	Private and public landowners. Will provide technical assistance, including project design, even if landowner does not enroll in program with DGIF	http://www.dgif.virginia.gov/index.asp

TECHNICAL ASSISTANCE FOR WETLAND ENHANCEMENT, RESTORATION OR CREATION				
NAME	CONTACT ORGANIZATION	CONTACT ORGANIZATION	ELIGIBILITY REQUIREMENTS	WEB ADDRESS
Rivers, Trails and Conservation Assistance Program	National Park System (NPS)	Wink Hastings Chesapeake Bay Program Field Office (410) 267-5747 Hastings.Wink@epamail.epa.gov, or Ursula Lemanski Potomac Field Office (304) 535-4018 Ursula_lemanski@nps.gov	Community groups, State and local governments working to conserve rivers, preserve open space, and develop trails and greenways	http://www.nps.gov/rtca/
Wetland Reserve Program and cost share programs	Natural Resources Conservation Service	John Meyers WRP Program Manager 1606 Santa Rosa Road, Suite 209 Richmond, VA 23229-5014 John.myers@va.usda.gov 804-287-1668	Provides technical assistance for private and public landowners who want to undertake riparian, wetland or grassland activities	http://www.nrcs.usda.gov/programs/wrp

Wetland Permitting and Delineations – Information for Voluntary Wetland Activities

"Better to ask for permission first than to ask for forgiveness later" ~unknown

Introduction to Permitting

Why do I need a permit? Even though your voluntary wetland activity – be it preservation, enhancement restoration, or creation – is for the purpose of benefiting the environment, it is quite possible that your activity may have some impacts that will require a permit from government agencies. Many projects may require permits for activities associated with the project, such as disturbance of the land surface, crossing existing waterways, and melding with the existing habitat and land uses in the project area.

Examples of activities requiring permits include:

- Dredging (removing or relocating sediment from surface waters)
- Filling (adding material to the bottom of surface waters)
- Discharging any pollutant into or adjacent to surface waters
- Altering physical, chemical or biological properties of surface waters
- Activities causing significant damage to existing wetland acreage
- Land disturbance
- Vegetation disturbance in the Chesapeake Bay Preservation Area

Priest

Land Disturbance as part of excavation for tidal wetland restoration project

Begin Researching Permit Requirements Early!

As you plan a wetland project, an important step is to research and evaluate the types of permits you might need from local, state, and Federal agencies. This step should be conducted early in the planning process, as each agency has different requirements and time frames for issuing permits.

Two of the main resources to consider when planning a restoration project are the project's impacts to water and soil.

Impacts to water bodies, such as streams, wetlands, ponds, and lakes, may require permits from more than one local, state, or Federal agency. Impacts to the ground surface and soils, also referred to as **land disturbance**, may require permits from local and state agencies. The below sections discuss permits for these two types of impacts.

Partners may Provide Technical Assistance for Permitting Process

If a partnering organization, such as the CBF, DU, NRCS, DGIF or FWS, is taking the lead with your project, they most likely will take care of obtaining any necessary permits. It's always a good idea to confirm this is being taken care of by them and to find out the expiration dates of any permits that are required as well as steps to renew permits for the future.

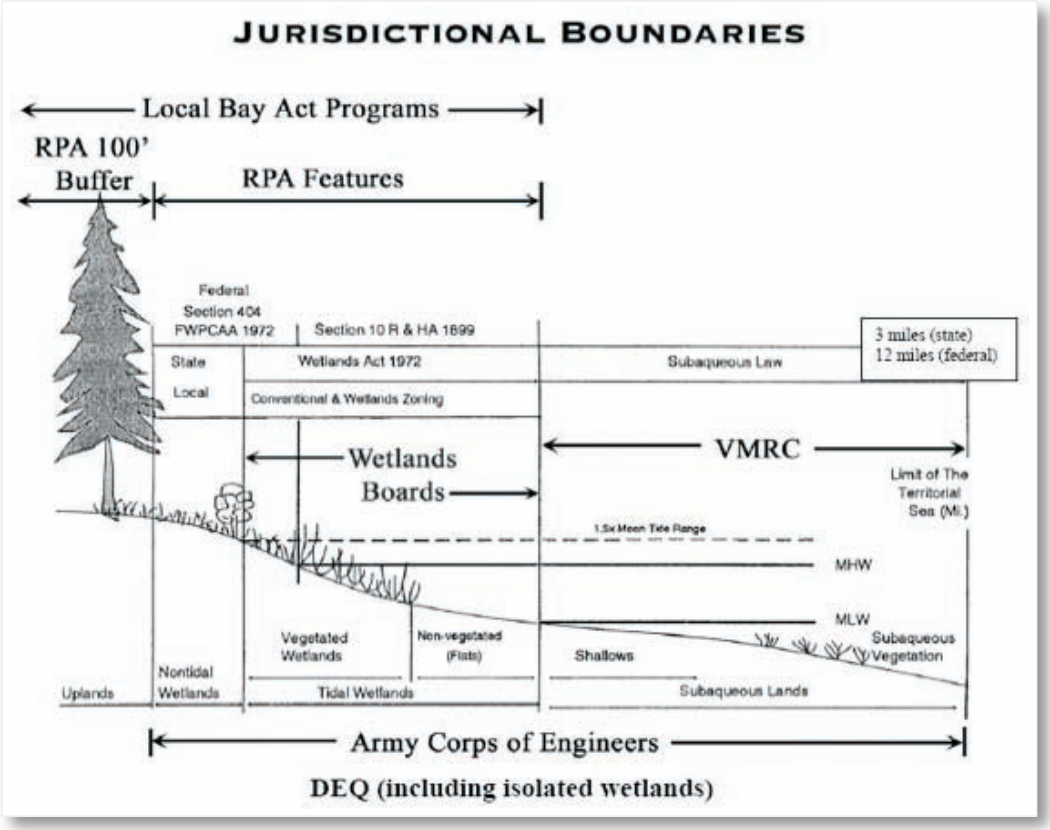


Diagram showing jurisdictional boundaries within Virginia for uplands, nontidal and tidal wetlands, and subaqueous lands. Source: Tidewater Joint Permit Application (JPA), available online at: http://www.nao.usace.army.mil/regulatory/webTidewaterJPA2004.pdf

Water Impacts – Typical Permits needed:

Joint Permit Process

The permit process for impacting tidal wetlands, nontidal wetlands and other water bodies including subaqueous lands begins with a Joint Permit Application (JPA). The JPA process was established to minimize duplication of permitting and to improve coordination and tracking of permits among the various state and Federal agencies. A JPA is submitted to the VMRC.

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VMRC assigns a permit number and distributes the JPA to local wetlands boards, DEQ, and the Corps, which decide separately whether they need to issue a permit for the project. Each agency responds separately to the applicant (Association of State Wetland Mangers, 2005).

Several state resource agencies additionally provide specific information to the regulatory agencies on natural resources that may be impacted by the proposed project. Among these agencies are DGIF, DCR, CBLAD, Department of Health (VDH), and the Department of Agriculture and Consumer Services (DACS). Input is sought from these agencies through the each agency's internal permitting process. Permitting activities are also coordinated with these agencies during preliminary site visits (DEQ, August 2005).

Nation Wide Permit (NWP) 27

NWP 27 is the most likely permit required for voluntary wetland projects Typically issued by the Corps for enhancement, restoration and creation activities associated with streams and wetlands. NWP 27 is conditionally certified by the DEQ, meaning that if certain conditions are met by the applicant/permittee, then a separate permit is not required from DEQ. However, local permit requirements may still apply. A JPA is required to apply for coverage under the Corps' NWP 27. More information concerning NWPs, DEQ permits, and the permit process in general for wetlands and other waters is included in the following information.

Tidal Surface Waters and Wetlands, Subaqueous Lands and Coastal Primary Sand Dunes

- **VMRC, Division of Habitat Management** – has main regulatory authority. VMRC is the regulatory agency for impacts to subaqueous or bottom lands, tidal wetlands, and coastal primary sand dunes. More information about VMRC permit requirements can be found at http://www.mrc.state.va.us/regulations/hm-permits.shtm
    - **Local Wetlands Boards (LWB)** – LWBs are the main entity in the Tidewater region responsible for reviewing impacts to tidal wetlands, both vegetated and unvegetated. VMRC reviews decisions made by LWBs. In area within Tidewater where no LWB exists, VMRC is the main regulatory authority. Contact the planning and zoning office in the area of your project to find out if such a board has jurisdiction, or visit http://www.nao.usace.army.mil/Regulatory/wetlandsboard.htm for more information
- **Corps Nationwide or Regional Permits** – may also be required for impacts to subaqueous or bottom lands, tidal wetlands, and coastal primary sand dunes. More information about permits issued by the Corps – Norfolk District Office can be found at http://www.nao.usace.army.mil/
- **DEQ's Virginia Water Protection Permit (VWP) Program** – VWP permits required for tidal wetland projects only if 401 Certification is required. When a Corps nationwide or regional permit is issued in addition to a permit issued by VMRC, it is automatically conditionally certified by DEQ, meaning that if certain conditions are met by the applicant/permittee, a separate permit is not required from DEQ. If the conditions cannot be met, a separate permit may be required from DEQ.

TIDEWATER JPA – Tidewater JPA is an abbreviated version of the JPA for certain activities within the tidewater region. Activities eligible for a Tidewater JPA include:

- **Access-related activities**: piers, boathouses, boat ramps (without associated dredging or excavation), moorings, marinas, aquaculture facilities, etc.
- **Shoreline stabilization projects**: riprap revetments, marsh toe stabilization, bulkheads, breakwaters, beach nourishment, groins, jetties, etc.
- **Crossings over/ under tidal waters and wetlands**: bridges and utility lines (water, sewer, electric, etc.)

Nontidal surface waters and wetlands

If your project is nontidal, depending on the nature and size of the impacts, DEQ, the Corps, or both agencies will issue a permit. Impacts to nontidal subaqueous lands (i.e., impacts to stream bottoms) are still regulated by the VMRC. Depending on the details of the projects, most projects will qualify for either a Nationwide or Regional Permit from the Corps, and/or a General Permit from DEQ. When a proposed activity does not qualify for any of these more general permits, an individual permit from one or both agencies may be required.

- **DEQ VWP – General Permits** – Projects with less than 2 acres of surface water impacts will likely qualify for one or more of the four existing VWP General Permits. For more information on the types of VWP general permits, please visit http://www.deq.virginia.gov/wetlands/permitfees.html
- **Corps Nationwide or Regional Permit** – May be required for projects having minimal surface water impacts. DEQ has conditionally certified most NWPs and regional permits, meaning that if certain conditions are met by the applicant/permittee, a separate permit is not required from DEQ. If the conditions cannot be met, a separate permit may be required from DEQ. For more information on the types of Corps' Nationwide and Regional permits: http://www.nao.usace.army.mil/Regulatory/Regulatory.html

Compensatory Mitigation

If impacts to wetlands are unavoidable as a result of your voluntary creation, enhancement or restoration project, keep in mind that compensatory mitigation may be required for impacts to wetlands and surface waters. Compensatory mitigation may be as simple as restoring a stream crossing that was temporarily disturbed during the construction process area, or as complicated and costly as replacing a wetland impacted by your project.

Soil Impacts – Typical Permits needed:

In addition to water impacts, voluntary wetland projects may result in land disturbance and may require the following permits from local and state agencies.

- V**irginia Stormwater Management Program –DCR** is responsible for the issuance of Virginia Pollutant Discharge Elimination System (VPDES) permits, which apply to the control of stormwater discharges from land disturbing activities under the Virginia Stormwater Management Program. Projects requiring permits include land disturbance activities impacting an area of 1 acre or more in nontidal locations, or between 2,500 square feet and 1 acre in locations designated as Chesapeake Bay Preservation Areas. More information can be found at http://www.dcr.virginia.gov/sw/stormwat.htm
- **Erosion and Sediment Control Programs** – Any time land is disturbed above a certain area (square footage or acreage), permits are generally required from the local government to ensure that controls are in place to minimize sedimentation and erosion. Voluntary Wetland projects are not *typically exempt* from these programs. For more information about local requirements, contact the planning and zoning office for the area in which the project will occur.

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Don't forget about the Bay Act in Tidewater Region

Projects involving land disturbance or removal of vegetation that are located in Chesapeake Bay Preservation Areas (Tidewater, VA) will require approval from local governments. For some localities, the LWB is the same entity that regulates the Bay Act, but don't assume this without checking with your local government.

A Note about Wetland Delineations

Step 1 – Confirming your site is a wetland

Section One (*What Makes it a Wetland?*) discusses simple ways to tell if your site is most likely a wetland. If you are pretty sure you have a wetland, it is still a good idea to have it confirmed by someone experienced in wetland identification. Section four (Getting More Help) lists several places to go for technical assistance, including the Corps, NRCS, and the DGIF, to name a few. If someone from one of these agencies is unable to visit your site (especially if you are under a tight timeline), they can point you in the right direction for further assistance.

Step 2 – Have wetland delineation performed

The process of determining the boundaries of a wetland area is termed a **wetland delineation** (Kellselheim & Slattery, 1995). Wetland delineations are used to determine "jurisdictional" wetlands based on the regulatory definition of a wetland used by the Corps, EPA and the DEQ (discussed in *Section One, What is a wetland?*).

Why is wetland delineation useful?

- Knowing the boundaries of your wetland area is useful, for simply the ease in studying and observing it
- If you want to put your wetland into some type of conservation easement or other protection, identifying your wetland boundary will be critical for legal purposes
- For any type of on-the-ground project, permits required for water impacts additionally require a Corps-approved wetland delineation

Who can perform wetland delineation and how does the Corps approve it?

The Norfolk District Corps office maintains a list of individuals and companies that offer professional delineation services. This list may be accessed by going to: http://www.nao.usace.army.mil/Regulatory/Agents/Wetland-Consultants.pdf

- As a word of caution, the consultant you select should be familiar with and utilize the current 1987 Corps Wetlands Delineation Manual and subsequent guidance, to perform wetlands delineations
- You may also want to ask the consultant if he or she is certified through the Virginia Board for Professional Soil Scientists and Wetland Professionals. This is a voluntary certification program and is not presently required to perform wetland delineations in Virginia

The consultant's findings should then be provided to the Corps in the form of a report. Once delineation has been performed, Corps staff will review the validity of the report and make a determination on the presence and extent of wetlands and other waters of the United States on the property.

Resources and Assistance to Learn More about Permitting:

DEQ regional offices – A map including the counties included in region: http://www.deq.virginia.gov/regions/homepage.html

Corps – The Norfolk District may be contacted at (757) 201-7652. To contact a local office: http://www.nao.usace.army.mil/map.htm

VMRC – A Map showing Habitat Division Territory Assignments: http://www.mrc.state.va.us/territory_assignments.shtm

A Guide to the Virginia Water Protection Permit Process, DEQ, June 2003: http://www.deq.virginia.gov/wetlands/pdf/guidevwpprocess.pdf. Note: this document should be used only as a general guideline, as the DEQ wetland/streams regulatory program has changed since the document's publication date.

Information pertaining to the VWP Program can be found at: http://www.deq.virginia.gov/wetlands/

A copy of the JPA can be found at: http://www.nao.usace.army.mil/Regulatory/JPA.html

In summary, remember to plan ahead! Include time in your project schedule to research permit needs, and include space in your budget for permit fees and compensatory mitigation, if required. Contact local, state, and Federal government agencies for direction on permit and compensation requirements for your project. Research agency web pages for further information. And, if your project design changes over the course of planning or construction, take time to re-evaluate the need for permits, additional permits, or modifications to the permits you already have.

Case Studies

Every day is Earth Day." ~Author Unknown

This chapter highlights voluntary wetland projects that have been funded through some of the financial resources or that have received technical assistance highlighted in the *Getting Help* chapter of this section. These projects vary in their size, scope and partnerships to provide some varied "blueprints" of how other efforts to preserve, enhance and restore wetlands in Virginia have evolved.

Environmental Law Institute: National Wetland Awards

The Environmental Law Institute (ELI) located in Washington D.C. has advanced dialogue on wetland law, science and policy since 1978. Annually, in partnership with the EPA, National Marine Fisheries Service, NRCS, FWS and the USDA Forest Service, they recognize individuals who have demonstrated innovation, effort, and excellence in wetland conservation, research and education through the National Wetlands Awards. Each year, ELI produces a summary of the National Wetlands Award winners including a brief bio and a description of the work they were nominated for. This is a great resource to glean inspiring ideas and to locate innovative people and projects in your area. To find out more about the National Wetlands Awards, visit the ELI web site at www.eli.org.

Bandy Field: The Little Engine That Could

Bandy Field Nature Park – This once threatened 18-acre green space, nestled within a suburban neighborhood in Richmond, is a grass roots success story. This is a story of citizens coming together and marching forward towards a common vision to saving an urban oasis from encroaching development and transforming it into a nature park for the pleasure and environmental education of all.

A group of local residents long recognized the conservation value of this open field and wanted to protect the area from ensuing development. In 1998, area residents began lobbying Richmond City Council to prevent the City from selling the area or developing the site. The slogan "Save Bandy Field" was spread throughout the neighborhood and Friends of Bandy Field (FOBF) was born. FOBF, led by Dr. Charles Price, a 9-member board, and many additional members and volunteers began their preservation efforts. Dedicated to the preservation and maintenance of Bandy Field, FOBF petitioned city officials and eventually succeeded in having the property designated as a public park. FOBF, working with an advisory board, started a trust to fund continue park maintenance.

In 2003, a project was undertaken in the park to enhance a mowed drainage swale in order to create a wetland. The objective was three fold: 1): improve water quality of Little Westham Creek, a tributary of the James River, 2): create wildlife habitat for amphibians, birds and other invertebrates, and 3): create an educational tool for the community. Under the guidance of environmental planner and FOBF volunteer Robert Wright, a project was developed to regrade the swale area, excavated a small vegetated catchment basin, and plant both areas with native plants to naturally filter surface runoff from a

Bandy Field before restoration

Bandy Field 5 months after restoration

portion of the field, woods, and adjacent parking area. The 800 sq feet habitat was designed to featuring four primary components: 1): an interior marsh like habitat established with emergent herbaceous plants, 2): a perimeter of shrub plants, 3): a reserved un-manicured planting area for future use as a wildflower meadow, and 4): a denser planting of shrubs toward the interior marsh.

FOBF partnered with the Alliance to coordinate a hands-on, volunteer day to plant the wetland habitat and to educate, empower, train and engage volunteers. City of Richmond staff performed the site excavation a few days prior to the volunteer day. Volunteers included FOBF members, area residents, Tuckahoe Garden Club, Boxwood Garden Club, Virginia Native Plant Society, local Boy Scouts, Sierra Club volunteers, and high school science club members. The project was funded through funds raised by FOCB and through the Alliance's RestoreCorps program, through a grant from the Chesapeake Bay Restoration Fund.

Other projects include the continued removal of invasive plants within other areas of the park and the replacement with native plants. Other planned projects include developing a butterfly habitat and creating woodland paths complete with native plant interpretive signage

Future environmental education plans for Bandy Field Nature Park include continuing to provide environmental education opportunities to local students and the larger community regarding wetlands and natural habitats. Plans include the installation of interpretive signage and maps to allow self guided tours, the development of educational printed materials, and offering the site for field trips for teachers and students. Volunteers will be trained to develop and conduct environmental programs for all ages. FOBF will partner with the City of Richmond's After School Program and the Henricopolis Soil and Water Conservation District.

In the words of Margaret Mead, "Never doubt that a small group of dedicated people can change the world, indeed, it's the only thing that ever has." Undoubtedly, FOBF has heard her cry for grass roots action and dedicated citizenship to enact environmental preservation and Bandy Field Nature Park is their living tapestry for all to enjoy.

For more information about Bandy Field Nature Park: www.bandyfield.com (available in Fall 2006) or call Dr. Charles Price at (804) 358-0256

Bandy Field Action Day

Bandy Field volunteers

Wetlands Estonoa Learning Center Project: Lasting Education for A Community

Team Estonoa – The town of St. Paul is located within the sparsely populated (population 1,000) County of Wise, in the southwest corner of the state. The community is nestled within the Clinch River valley, relying on the Clinch as its primary drinking water source. The karst geology of the valley means that it is particularly susceptible to ground-water contamination from overlying surface water area, making area wetlands critical for filtering and ground-water recharge functions.

In the spring of 1999, students enrolled in an ecology class from Saint Paul High School were assigned various projects. One student, Stevie Sabo, chose to do his project on a local, neglected waterbody known as Lake Estonoa. His project covered the lake's history, present condition, and his desire to see the lake restored. Another student, Nikki Buffalow, became interested in the project the following school year, and through her research, discovered the "lake" should actually be classified instead as a wetland. With the hope of better preserving "Lake" Estonoa, she began a quest to have it officially classified as a wetland. After successfully achieving this endeavor, interest began to grow within the school and surrounding community to restore the wetland.

Students from St. Paul's Appalachian Ecology and Physics classes led the restoration effort.. The students became known as "Team Estonoa" with a mission to protect and conserve the "Wetland Estonoa" in order to create a lasting educational venue for the community. Semester after semester with excitement and curiosity, the team continues to work on the Wetlands Estonoa Learning Center Project. Seeing the students' enthusiasm and dedication over the years, the Town of St. Paul has become an active partner in continuing to preserve and protect the wetlands.

During the past five years, Team Estonoa has developed various partnerships, pursued grant opportunities, and performed many hours of public outreach and maintenance. To date, the team has removed multiple truckloads of trash from the wetland, constructed an environmentally friendly walking path, footbridges, picnic tables, benches and a floating dock. The team has conducted wetlands workshops for area teachers, students and college groups. Over 100 groups have received presentations or have been hosted in some way by Team Estonoa.

Through the efforts of Team Estonoa, a beautiful learning center has recently been constructed adjacent to the wetland. Team Estonoa has already hosted over twenty groups in the newly completed center for environmental workshops and watershed meetings. The grounds around the center have been landscaped with native Appalachian flora, interpretive signs, and an observation area with seating. A rain garden has been installed to control stormwater runoff and to serve as a teaching tool, illustrating its value as a low impact method of storm water management.

The Team Estonoa project demonstrates how students and community members can be actively engaged to conserve and protect important resources like the Estonoa Wetlands. All it takes is that initial spark of enthusiasm and dedication to conserve our natural resources for generations to come — the stewardship and community involvement that results is infectious!

To learn more about Wetlands Estonoa : www.estonoa.org. To schedule a visit to Wetlands Estonoa contact Terry Vencil at (276) 762 0221.

Planning meeting

The dock at Wetlands Estonoa

Arial photo of Wetlands Estonoa

Wetlands Estonoa up close

The Oscar's Landing Wetland Project: An Urban Oasis

Oscar's Landing – Through the efforts of many partners, a neglected and degraded piece of land has been resorted into a functioning tidal wetland within the heart of an urban area. The Oscar's Landing Wetland was restored to enhance Jones Creek, a tributary of the Elizabeth River and the Southgate area of Chesapeake.

Since World War II, the Elizabeth River watershed has lost 50% of its crucial tidal wetlands. Oscar's Landing is part of "reversing the loss" and will naturally treat stormwater runoff from 250 acres of neighboring property. Additionally, the wetland improves the aesthetics of the neighborhood by providing a more natural habitat for native plants and animals, attracting migrating shorebirds, butterflies, and other aquatic species.

The Oscar's Landing Wetland project is a combined effort of the Elizabeth River Project (ERP) and the City of Chesapeake. The four-acre site has two sections: a conservation easement donated by Mr. Si-Jun Lee of Southgate Plaza Corporation to the ERP, and a wetland creation site owned by the City of Chesapeake. Placing this land under a "conservation easement" legally protects Oscar's Landing from future development and preserves this important natural resource. The property, once a borrow pit and landfill, was most recently the site of a go-kart track. Since the closure of the track, the site was littered with trash and other debris and had become infested with the invasive plant, Phragmites (Reed grass).

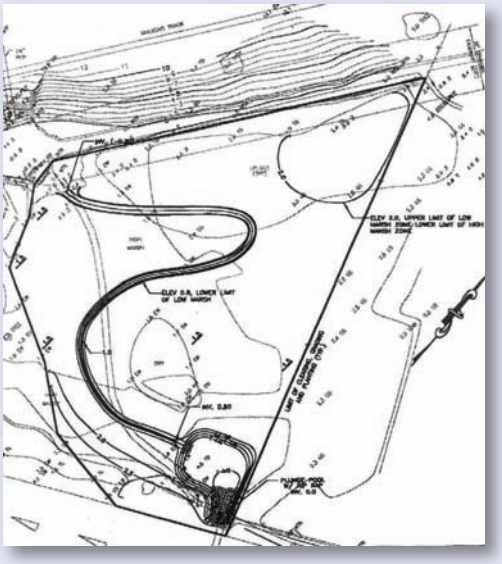
Many partners, including the ERP, the City of Chesapeake, Southgate Plaza Corporation, Oscar Smith Middle School, and the community of South Norfolk worked together to restore the "donated" portion of the site into a functioning tidal wetland. Restoration of the site required excavation of sediment in order to restore the tidal connection as well as to eradicate the Phragmites. VIMS was brought in to lead the project design. Excavation and grading of Oscar's Landing, performed by Whit Williams Inc., began in April 2002 and was completed in July 2002.

Following the excavation, ERP coordinated a volunteer event to plant native tidal wetland vegetation. Volunteers included the Women's Club of South Norfolk, local scouts, and many neighborhood citizens. The students of Oscar Smith Middle School have been ongoing stewards of this wetland restoration project. The children participated in a contest to name the wetland. In addition, students researched information on native plants and animals found in the wetland habitats displayed on educational markers places on the observation platform overlooking the site.

Funding for the donated portion of the wetland project was provided through a grant from the Virginia Department of Conservation and Recreation. The FWS and American Management Systems provided additional funding. Whit Williams Inc. provided assistance with construction costs. VIMS, Landmark Design Group, Old Dominion University, East Coast Hydrographic, Emerald Forest Consulting, Naturescapes Inc., as well as the Chesapeake Department of Public Works provided additional surveying and design support.

The Oscar's Landing Wetland Project will continue to serve as a lasting educational and environmental benefit to the community of South Norfolk and provides a beautiful oasis in the midst of the urban fabric.

For more information about Oscar's Landing Wetland Project contact the Elizabeth River Project at (757) 399- 7487 or www.elizabethriver.org



Restoration plan for Oscars Landing

Oscars Landing after planting

Walter Priest ERP and donor

Oscars Landing after Spring 2003

Chesapeake Bay Foundation and the U.S. Fish and Wildlife Service: Restoring Agricultural Wetlands

The Laurel Grove Tract Project – The Laurel Grove Tract is a 465-acre parcel located in Richmond County, in the Northern Neck region of Virginia. The project site is located along the banks of Farnham Creek and within one-half mile of the Rappahannock River and is part of the FWS's Eastern Virginia Rivers National Wildlife Refuge. The site consisted of 250-acres of mature, hardwood forest, 205-acres of open cropland, and an 11-acre, freshwater lake. The tract was purchased, restored and protected through the "Chesapeake Conservation Challenge," a unique partnership comprised of private business, Federal government, and nonprofit organizations. The partners included CBF, the Conservation Fund (TCF), a non-profit conservation organization based in DC, Bass Pro Shops, National Fish and Wildlife Foundation (NFWF), and the FWS. TCF negotiated with the landowner and purchased the property. When the farm became available, each of the five conservation partners, each assumed a role in the project that spanned from 2001 until 2004.

CBF, with major funding from The Bass Pro Shops and NFWF led the wetland restoration efforts. CBF worked closely with the FWS to provide the habitat and water quality benefits the refuge desired. After several options were discussed and evaluated, it was decided that restoring both the wetlands and reforesting the open fields would provide important habitat for interior forest birds.

Prior to any restoration work, the existing agricultural fields were planted in clover, to serve as a cover crop throughout the year. CBF worked with the current farmer to plant the clover and serve as a consultant on the project. His knowledge of the property and its history served a critical role in the project. To restore wetland hydrology, over 1500-feet of agricultural drainage tile was broken and ditches were plugged to restore approximately 50-acres of wetlands. The open fields were reforested using a mix of sixteen different native hardwood tree species. Volunteers planted the final acre of trees during a Public Field Day event in 2004, celebrating the project and its partnerships.

Since the completion of the Chesapeake Conservation Challenge project at Laurel Grove, the FWS and CBF have partnered on another innovative habitat tool. The "Acorns to Acres" project retrofitted a no-till planter to plant acorns, instead of corn. In 2005, with funding from NFWF, the pilot project planted four species of acorns across a 10-acre field located in the center of the Laurel Grove Tract. The resulting seedlings will be monitored for the next several years, and their growth and survivability will be compared with the tree seedlings planted as part of the Chesapeake Conservation Challenge project. This new conservation tool may offer landowners and agencies new options for planting hardwood trees in riparian buffers or reforestation projects.

For more information about the Laurel Grove Tract Project, contact Libby Norris with the Chesapeake Bay Foundation at Lnorris@cbf.org or 804.780.1392

Kids planting trees as part of CBF's Public Field Day

Standing water and emergent wetland at Laurel Grove

5 Volunteer-Based Wetland Monitoring

Top to Bottom: Alliance volunteer measuring pH from stream sample; Volunteer measuring salinity within estuary; Bottom photos: Virginia Save Our Streams Volunteers at Macroinvertebrate Training (top photo by Dovis; others courtesy Alliance)

Introduction to Monitoring Wetlands

Importance of Wetland Monitoring

The purpose of this chapter *is not to recommend a particular purpose or type of monitoring, but rather to discuss reasons for monitoring, things to consider, and to introduce various types of monitoring and related resources in which to obtain further information. Think of this chapter as serving as a "launching pad" to help get you started with wetlands monitoring, saving you valuable time and energy!*

> "People who monitor wetlands become more intimately knowledgeable about the place in which they live and the ecological processes that influence it" (EPA, 2001, December). Wetland monitoring builds and fosters stewardship among those that participate, by creating more informed and knowledgeable citizens, who can then become stewards and advocates for not only wetlands, but for more sustainable approaches to land and water management overall (EPA, 2001, December).

Government funds alone cannot support all the monitoring needed to assess the quality and quantity of our natural resources. Volunteer monitors across the nation have helped fill this void in part by generating extremely useful data that has been used by state, Federal and local agencies to meet reporting requirements, make management decisions and assess various impacts. For example, chemical and biological water quality data collected by volunteers is used by the DEQ for their biannual water quality assessment report, contributing to the assessment of the status and trends of surface waters within the Commonwealth. (For more information about the Water Quality Assessment Reports, visit the DEQ's Water Quality Assessment web page at http://www.deq.virginia.gov/wqa/).

In addition to assessing existing natural resources, monitoring is essential towards measuring progress towards the intended ecological goals of wetland enhancement, restoration or creation. The Interagency Workgroup on Wetland Restoration commented on the great need for post activity monitoring: "A common misconception about wetland restoration, creation, and enhancement is that once a project is implemented, nature will just do the rest. In reality, many wetland projects need mid-course corrective actions such as re-planting seedlings that were washed away by a storm, digging more channels to get water to remote parts of the site, or plugging ditches missed during the initial site survey. Monitoring provides the information for this adaptive management. Monitoring can also give information on routine maintenance that may be necessary to keep the site functioning well. Broken sprinkler heads, non-native weed growth, and holes in fences are just a few of the routine maintenance items that are easily observed during monitoring" (EPA, n.d.).

Why Monitor Wetlands?

There can be many reasons for monitoring wetlands. Some of the most common include:

- Basic wetlands education
- Wetland type identification
- To study wetland plants
- To study wetland animals
- To determine the health of a wetland, or trends in wetland health (improvement or decline)
- To determine the need for wetland protection, such as the presence or absence of rare, threatened or endangered plant or animal species or natural communities
- To determine if a restored, enhanced or created wetland is *successful* in terms of meeting the three basic criteria for a wetland (keeping in mind that for created wetlands, it could be years before hydric soil has developed)
- To determine if the voluntary wetland activity has been *successful* in terms of meeting the intended functions and values

Two Main Categories of Voluntary Wetland Monitoring

For the purposes of this ToolKit, the monitoring methods discussed below are referring to monitoring associated with voluntary wetland activities; monitoring methods associated with compensatory mitigation as a result of a permit must be approved by the regulatory agency issuing the permit.

We have divided wetlands monitoring into two main categories, *Visual-based monitoring* and *Hands-On Monitoring* for ease of discussion and to benefit the many interests and goals of those who want to pursue wetland monitoring. *Visual-based monitoring* refers to observational type monitoring in which samples are not collected whereas *Hands-On Monitoring* refers to more in-depth monitoring in which samples are often collected or measurements are made. *Visual-based monitoring* includes the gathering of the same tools necessary for identifying potential sites for voluntary wetland activities and is the necessary prior to any hands-on type of monitoring. It is recommended that individuals and organizations phase their monitoring project, first performing visual observations prior to any hands-on types monitoring.

Planning Your Monitoring Program

Much like planning your voluntary wetland activity, taking time to plan for wetlands monitoring is important and will depend on your goals, interests, and resources. Before jumping right into monitoring a wetland, you first need to think about what questions you hope to answer and what you want to gain from the monitoring program. The *Virginia Citizen Water Quality Monitoring Program Methods Manual*, although specific to chemical and biological water quality monitoring for streams and rivers, contains basic helpful information for planning a volunteer monitoring program that can easily be applied to a wetlands monitoring program. Appendix 10 of the manual contains worksheets intended to help you focus your planning efforts. (See the last part of this chapter for more information about the manual). Questions to ask while planning your monitoring program include:

- **What are your main monitoring goals?** Do you want to educate yourself, your organization, or others? Do you want to protect an existing threatened wetland? Do you want to develop baseline data for a site where no prior information exists in case of potential future development? Do you want to monitor wildlife or plants?
- **What resources, such as time, money, and volunteers are available?**
- H**ow can your monitoring project be most beneficial to others interested in preserving wetlands?** What data is most needed by local governments or nongovernmental organizations? Are there particular sites that need to be monitored? If so, what type of monitoring do these agencies need?
- **What about access and permission to the wetland site?** Do you also have permission to collect samples, install wells, etc.?

(Firehock et al., 1998)

Your goals will guide your monitoring project plan and monitoring objectives should follow accordingly (Firehock et al., 1998). For example, if your goal is to protect a wetland site that is threatened, one objective may be to perform water quality monitoring upstream and downstream of a wetland in order to establish that the wetland improves water quality and therefore should be protected (Firehock et al., 1998).

Other monitoring considerations

The below questions are examples of considerations when narrowing down the focus of your monitoring plan:

- What seem to be the most important functions and values of the particular wetland to the community?
- What parameters should you monitor in order to learn about these functions and values?
- Will you measure water chemistry, hydrology, wildlife, plants, or a combination of these?
- What are your technical needs? Do you have technical expertise within your organization or can you partner with someone or recruit the volunteers with necessary skills?
- Who will collect data? Volunteers? Students? Volunteers with special skills, such as volunteer birders?
- How will monitoring participants be trained to collect consistent data?
- Who will use your data and how will you report data findings?

(Firehock et al., 1998)

Developing a Quality Assurance Project Plans to ensure Use and Validity of Data

Once you have developed your project plan and have determined the types of monitoring to perform, parameters to monitor, and the like, you should also prepare a Quality Assurance Project Plan (QAPP) in order to add credibility of your project. A QAPP is a written document that explains how your project ensures that the data collected and analyzed meets project requirements (Firehock et al., 1998). **Quality Assurance** refers to an overall quality management system including organization, planning, data collection, documentation, and reporting. **Quality Control** refers to steps that you will take to assure the quality of the data for error control (Firehock et al., 1998). A QAPP documents the quality of your data and lends itself to increased use by others due to this documentation.

Getting to Know Your Wetland: Visual-Based Wetland Monitoring

"To see a wren in a bush, call it "wren," and go on walking is to have (self-importantly) seen nothing. To see a bird and stop, watch, feel, forget yourself for a moment, be in the bushy shadows, maybe then feel "wren"—that is to have joined in a larger moment with the word."~ Gary Snyder, Language Goes Two Ways, 1995.

Getting acquainted with your wetland is a critical first step prior to any voluntary wetland activity such as enhancement or restoration as well as prior to any type of hands-on monitoring. After all, how can you determine what parameters you might want to measure if you don't first know some basic information about your site? Visual-based monitoring is oftentimes all that many individuals and groups perform, due to time and other constraints. This type of monitoring can still be extremely valuable, leading to activities such as wetlands preservation.

Gathering Background Site Information

As many informational tools (introduced and discussed in Section Four, *Informational Tools*) as possible should be gathered and reviewed as background information for your site prior to ever stepping foot on the property. These tools include topographic maps, NWI maps, soil surveys, aerial photographs, additional information obtained through GIS, if possible as well as tools such as tax maps, and information concerning the presence of cultural resources and rare, threatened or endangered species. This information should be well organized so it can be easily accessed and understood by other members of your organization and the interested community (Firehock et al., 1998).

Once you have gathered and reviewed these tools, you can already begin to learn a lot of useful information about your site that can then be confirmed in the field through site visits. This information includes:

- **Studying the wetland location relative to its watershed** – By using your topographic map, you can determine the drainage area that drains into your wetland site as well as what larger watershed your wetland is a part of. Confirm your mapped observations by walking the area and comparing it to the actual landscape.

Where to go for more help with developing a Monitoring Plan and a QAPP

- The *Virginia Citizen Water Quality Monitoring Program Methods Manual* contains information on developing a quality assurance project plan and contains QAPP template: http://www.deq.virginia.gov/cmonitor/guidance.html
- The *Volunteer Monitor's Guide to Quality Assurance Project Plans*, developed by EPA, is available at http://www.epa.gov/owow/monitoring/volunteer/qappcovr.htm.

Safety Tips To Protect You and The Wetland

Safety First! – Safety is an important element of any volunteer monitoring program. Monitors should never put themselves at risk to perform wetlands monitoring. No data is more important that safety!

- Always obtain permission from the landowner (whether private or public) to enter and monitor a wetland site.
- Dress properly for the weather. Don't forget to wear blaze orange during hunting season!
- Sample in teams or with partners.
- Inform someone where you are going and when you plan to return.
- If you drive to the monitoring site, park in a safe location
- Watch out for poisonous plants and wildlife. Dress appropriately for protection against ticks.
- Minimize impact to the wetland you are monitoring – This can mean limiting the number of people, choosing a single entrance path, or sometimes not even entering a wetland at all. Some wetlands may be so ecologically fragile that they should only be monitored by knowledgeable scientists.
- Clean equipment, including boots after each monitoring visit to avoid transporting plant seeds and introducing them to other places.
- Collection of plant and animal samples – Make sure to follow regulations concerning the collection of plants and animals. Many parks and wildlife refuges have additional rules and regulations regarding the collection of plants or animals. Always make sure that the plant or animal you are collecting is not a rare, threatened or endangered species. For more information about wildlife procession (including nests, feathers, etc.): http://www.dgif.virginia.gov/wildlife/scp.html.

Adapted from *Volunteer Wetland Monitoring, An Introduction and Resource Guide* (EPA, 2001), the *Chesapeake Bay Citizen Monitoring Manual* (Alliance for the Chesapeake Bay [Alliance], 2002) and the *Virginia Citizen Water Quality Monitoring Program Methods Manual* (DEQ, 2003).

- **Determining the size and type of wetland** – By using the NWI map as well as other tools, you can determine the size and type of your wetland and then confirm it in the field.
- **Studying Hydrology** – Several of your tools, including your topographic map and your NWI map, provide information about sources and types of water inputs or outputs related to your wetland, such as streams or springs. You can then visit the site to look for field observations of hydrology. Signs of wetland hydrology include drainage patterns and watermarks on trees (See Section One, *What Makes it a Wetland?* for more information about field indicators of wetland hydrology.)
- **Studying Types of Vegetation** – Your NWI map as well as aerial photographs should give you a clue prior to your site visit as the major dominant types of vegetation your site may contain. Site visits are necessary to confirm and to study vegetation in greater detail.
- **Wildlife Habitat Observations** – Background information gathered from resources including DGIF's Virginia Fish and Wildlife Information Service and Virginia Natural Heritage Program's Online information of Virginia's natural communities, rare, threatened and endangered species will provide information as to the likelihood of wildlife on and around your site. Site visits can help to confirm the potential presence of wildlife. Although you will not set up monitoring stations for wildlife or collect samples of signs of wildlife (such as feathers, nests or bones), as a part of visual-based monitoring you can still observe for potential habitat and also note any wildlife sightings at the time of your visits. Sightings include animals actually observed or heard as well as signs such as animal tracks, feathers, fur, scat and nests.
- **Studying Human Impacts to the Wetland Site** – Human land uses within a watershed affect the health and functionality of a wetland. Wildlife within a wetland can also be affected by disturbances such as roads or populated places. Therefore, it is important to study and document human impacts, including the presence of existing land uses as well as changes observed with future monitoring visits such as vegetation clearing, dumping, land disturbance and off-road vehicle damage. Topographic maps and aerial photographs provide some information about land use. Additionally, local state and Federal government agencies also have general land use data, much of which is becoming available in digital format. However, the most detailed and current land use information will be gathered by your on site monitoring. Be sure not to trespass on private property when studying land uses in the vicinity of your site. Much information can be gathered simply by driving around the area.

(Adapted from Firehock et al., 1998).

Other types of Visual-Based Monitoring

- **Establishing a Photographic Record** – Photographs are an easy way to record site conditions and to visually document change at the site. For photographs to be useful over time, it is important to take photographs at the same location and direction.
- **Journals for recording observations** – Journals are invaluable for recording observations and impressions of wetlands. After all, most of what we know about the natural world prior to the early 1800s is based on information obtained largely from journals. Think of the notebooks by Charles Darwin or the journals of Lewis and Clark and how much less we would know about our natural history without these documents. Journals can be strictly narrative, such as diaries, or can include sketches, photographs, or even sound recordings. Keeping a nature journal forces you to be more observant about your surroundings. It is a good idea to make journal entries with each visit to your wetland. "Day to day, season to season, year to year, you will begin to amass a collection of observations and important information about the area" (Thomson & Luthin, 2004). **Keeping a nature journal can be highly satisfying for volunteers**, many of which are drawn to volunteer monitoring due to their naturalist tendencies, whether or not they have been self-realized.

"What I have not drawn, I have never really seen"
~Fredereic Franck, The Zen of Seeing

Hands-On Wetland Monitoring

Once you or your organization has gathered background information and performed some visual-based monitoring, you may become more interested and prepared to begin *hands-on monitoring*, in which samples are often collected or measurements are made.

How to Measure and Sample Wetlands?

OK, so now you're ready to go out into your wetland and start taking some measurements, right? How and what exactly should you measure?

Well, there's not a straight answer because there is no one "correct way" to monitor wetlands. This can be a confusing and daunting realization for volunteers and professionals alike. As wetlands are the interface between land and water, compounded by their variability, deciding how and what to monitor can be daunting. Additionally, because wetlands often contain such a variety of biological conditions, typical water monitoring parameters such as pH, dissolved oxygen or temperature give a limited picture of the overall health of the wetlands. It is therefore often necessary to also study wetland plants and animals to order to obtain a better picture of how healthy the wetland is and how it is functioning (EPA, December 2001).

Types of Hands-On Wetland Monitoring

In general, wetland monitoring methods can be categorized into four broad types: (1) functional assessments, (2) habitat assessments, (3) wetland inventories and characterization, and (4) biological assessments (Danielson, 1998).

Functional assessments

For volunteers that measure water quality along streams and rivers, the idea of a "functional assessment" may seem new and unfamiliar. Instead of measuring water chemistry or macroinvertebrates, functional assessments attempt to estimate

the ability of a wetland to perform different "functions," such as surface water storage, water filtration, and serving as habitat for plants and animals (Danielson, 1998).

Habitat assessments

"Habitat assessment methods are based on the assumption that if the habitat is there, then the animals will be there"(Danielson, 1998). A well-known method is the *Habitat Evaluation Procedure* (HEP), developed by the FWS to answer questions such as "Is this site potentially good habitat for ducks?" (or any particular wildlife of interest). Using the HEP method, biologists visit a wetland and judge its ability to support the species in question (Danielson, 1998).

Wetland inventories and characterization

Wetland inventories and characterization are the most common types of wetland monitoring among volunteer monitoring groups. Some monitoring projects inventory just one or a few types of plants or animals. For example, volunteers with the Bird Studies Canada/Long Point Bird Observatory Marsh Monitoring Program monitor birds and amphibians (Danielson, 1998).

Biological assessments

> *"In a biological assessment, investigators evaluate the condition of one or more biological "assemblages" (examples of assemblages are macroinvertebrates, plants, or fish). Since plant and animal assemblages reflect the cumulative effects of chemical, physical, and biological disturbances to a habitat, scientists can use them much the same way as a doctor would use a thermometer, blood pressure gauge, and other instruments in a physical exam" (Danielson, 1998).*

This is different than simply inventorying types of plants or animals, as described in the previous section. Instead, by evaluating the composition, diversity, and condition of plant or animal assemblages, wetland scientists are then able to determine the overall "health" of a wetland (Danielson, 1998).

A **bioassessment** is a relatively new term used to describe a way of performing a more rapid biological assessment rather than a comprehensive assessment (Danielson, 1998). Wetland bioassessment methods are based on a combination of surveys of the different types of plants and animals within a wetland, often including the collection of some physical and chemical data. EPA, December 2001). For more information on wetland bioassessment, visit the EPA's Biological Assessment of Wetlands web page: http://www.epa.gov/owow/wetlands/bawwg/.

Wetland Parameters for Hands-On Monitoring

The below information introduces various wetland "parameters" that may be measured as part of one of the four main monitoring types discussed above. Remember to revisit your monitoring goals and objectives in order to focus your monitoring so that it will be most valuable to you and other intended users of your data. As a volunteer program, it is a good idea to start slowly with a narrowed down list of monitoring parameters.

- **Vegetation** – Plants are good indicators of wetland health and stability because they are restricted to one location for their entire lifetime. Some plants are more tolerant of human-induced stressors than others and can serve as indications of disturbance, whereas the presence of mainly less tolerant plants may indicate a healthier ecosystem (Firehock et al., 1998). Vegetation sampling is a common monitoring activity after an enhancement, restoration or creation activity has occurred in order to determine plant survival and vigor. Terrestrial vegetation sampling can include monitoring dominant vegetation types as well as the amount of invasive plants. In subaqueous wetlands, algae and submerged aquatic vegetation can be measured. There are many methods for sampling vegetation. Common methods include measuring plant species and percent cover using sample plots along either transects or within each vegetation community. Plot types and sampling methods vary based on the dominant vegetation type and specific goals and objectives.
- **Soil Investigation** – Soils often received the least attention by volunteer monitors. Soils can be measured for signs of wetland hydrology, for texture or color.
- **Hydrology** – the duration, timing and frequency of water inputs as well as outputs are critical to wetland health. Water fluctuations can be measured in wetlands, including groundwater and surface water levels as well as stream flow, precipitation and tides. Examples of ways hydrology can be measured include:
  - Surface water levels (inundation) – staff gauge installation and monitoring
  - Ground water levels (saturation) – **Piezometer** installation and monitoring
  - Stream flow – **Stream flow**, also referred to as discharge, is the volume of water that moves over a point for a period of time. Stream flow is directly related to the amount of water moving off a watershed into a stream channel. Stream flow may be measured using a flowmeter or by measuring crosssectional area and measuring stream velocity.
- **Water Chemistry** – can include collecting water samples and measuring water chemistry parameters such as dissolved oxygen, pH, water temperature and salinity.
- **Wildlife** – Volunteers who monitor wetlands often focus on living things, in part because they are so tangible and appealing. "If a citizen group wants to raise community awareness of wetlands, they'll do better to talk about songbirds and frogs than groundwater recharge and water storage capacity (as quoted by John Kusler in Danielson, 1998). Types and methods of wildlife monitoring include:
  - Birds – visual sightings, bird calls
  - Amphibians and Reptiles –visual surveys including terrestrial, trapping and egg masses as well as frog call surveys
  - Macroinvertebrate surveys – typically performed at least annually, possibly four times a year. Survey methods will

differ depending on the habitat type and variability.

- Fish – seining and shocking
- Mammals – more scientific surveys than simply incidental observations, best performed within seasonally, at different times of the day and within each habitat type.

Monitoring Resources for Visual and Hands-On Wetland Monitoring

The Monitoring Resources listed and described below contain information on methods that are appropriate for volunteers for many types of visual-based and hands-on wetlands monitoring. Each resource varies in terms of its focus, rigor, objectives and often the geographic setting (EPA, 2001, December). Remember, you will probably still need to write your own protocols and QAPP, using these resources as a reference. This is not a comprehensive list but rather a list of resources to help get you started in your monitoring journey.

Please note: Contact and pricing information were current as of October 2005. Websites and pricing may change after than time — we are providing these listings as a source of information only.

Dovis

Alliance volunteer measuring water clarity with a turbity tube

General Wetland Monitoring Resources

- *An Introduction and User's Guide to Wetland Restoration, Creation, and Enhancement*. Developed by the Interagency Workgroup on Wetland Restoration (EPA, Corps, FWS, NRCS, National Oceanic and Atmospheric Administration). This document is designed specifically for individuals, community groups, municipalities, or others who have little or no experience in the restoration field. Chapter 6 contains monitoring information. Available for download at: http://www.epa.gov/owow/wetlands/pdf/restdocfinal.pdf
- *Handbook for Wetlands Conservation and Sustainability.* 1998 (Second Edition). Firehock, K., Graff, L., Middleton, J.V., Starinchak, K.D. & Williams, C. The Izaak Walton League of America (IWLA). 288 pp. Softcover. The handbook is an excellent resource for wetland education, citizen action and monitoring. Contains protocols and resources for establishing monitoring transects and for the monitoring of vegetation, soil, and surface and groundwater hydrology (including chemical water quality). The manual also contains protocols and resources for wildlife monitoring including amphibians, birds, fish, macroinvertebrates, and mammals. Methods are very easy to understand and the manual contains many datasheets for reproduction. For a table of contents of this manual go to: http://www.iwla.org/SOS/handbook/index.htm. The manual is available for purchase from the McDonald and Woodward Publishing Company at www.mwpubco.com or 1-800-233-8787 $39.95 (0941675 05-X)
- *Maine Citizens Guide, to Evaluating, Restoring, and Managing Tidal Marshes*. 1997. Bryan, R., M. Dionne, R. Cook, J. Jones, and A. Goodspeed Maine Audubon Society, Falmouth, Maine. 87 pages plus appendices. This guide contains methods for assessing salt marshes for their overall ecological health as well as for functions and values. The document is geared toward collecting observational data that can be used to guide local planning efforts. Although the manual is quite technical and detailed, it is very methodical and includes clear definitions and explanations. Although the orientation of the manual is for tidal wetlands in Maine, much is applicable elsewhere. To obtain electronic copies (hardcopies are no longer available): contact the Maine Audubon Society, P.O. Box 6009, Falmouth, ME 04105-6009; Contact Becca Wilson 207-781-6180 ext. 222 or via email: bwilson@maineaudobon.org
- *A Manual for Salt Marsh Evaluation: Narragansett Bay Method.* 1996. Lipsky, A. Save the Bay, Providence, RI. 22 pages. This manual is based on the New Hampshire Coastal Method and outlines a visual-based evaluation of salt marshes and adjacent uplands. The manual is short and informal (photocopied), and was designed for use by Rhode Island volunteers to help gauge the restoration potential of altered and degraded salt marshes in Narragansett Bay. Although the orientation of the manual is for tidal wetlands in Rhode Island, much is applicable elsewhere. Contact Save the Bay, 434 Smith St., Providence, RI 02908-3770, Tel. (401) 272-3540. Available online: http://www.savebay.org/Habitat/SaltMarsh/NarragansettMethod.asp

- *A Volunteer's Handbook for Monitoring New England Salt Marshes* (2002, May). Carlisle, B.K., Donovan, A.M., Hicks, A.L., Kooken, V.S., Smith, J.P. & Wilbur, A.R.. Massachusetts Office of Coastal Zone Management. Contains discussion of developing a monitoring plan and includes methods for monitoring vegetation, tidal hydrology, salinity, birds, fish, crabs and other invertebrates. The Handbook contains easy to understand instructions, data forms and nice illustrations. Available online: http://www.mass.gov/czm/volunteermarshmonitoring.htm

- *The Volunteer Monitor Newsletter*, a forum for citizen volunteer monitors of all types, not limited to wetland monitors. The document is issued twice yearly and electronic copies may be downloaded at: http://www.epa.gov/owow/monitoring/volunteer/info.html

  - *Monitoring Wetlands* The Volunteer Monitor, Vol. 10, No. 1, spring 1998. This issue is devoted entirely to volunteer wetlands monitoring and discusses common types appropriate for volunteers. The issue also discusses biological wetland assessment. http://www.epa.gov/owow/monitoring/volunteer/newsletter/volmon10no1.pdf

- *Volunteer Wetland Monitoring, An Introduction and Resource Guide*. EPA. December 2001. EPA 843-B-00-001. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Wetlands Division, Washington DC. To order, call the EPA Wetlands Helpline at 1-800-832-7828 or email wetlands.helpline@epa.gov. Also available for download at: http://www.epa.gov/owow/wetlands/monitor/volmonitor.pdf

- *Wetland Bioassessment Fact Sheets*. Danielson, T.J. EPA. July 1998. EPA 843-F-98-001. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Wetlands Division, Washington DC. 11 fact sheets developed based on recent efforts to measure the biological condition of wetlands, Available for download at: http://www.epa.gov/owow/wetlands/wqual/bio_fact/

- *Wetland Restoration Handbook for Wisconsin Landowners 2nd Edition*. Thomson, A.L. & Luthin, C.S. (2004). Madison, WI: Bureau of Integrated Science Services, Wisconsin Department of Natural Resources. Available for download: http://www.dnr.state.wi.us/org/water/fhp/wetlands/resman.shtml (Publication #SS-989 2004). This manual is intended primarily for private landowners and encourages responsible and effective wetland restoration. The manual contains nice graphics, colorful quotes and interesting side-bars. Chapter 2 contains information on visual-based monitoring, including journaling. Chapter 11 contains information on monitoring after restoration

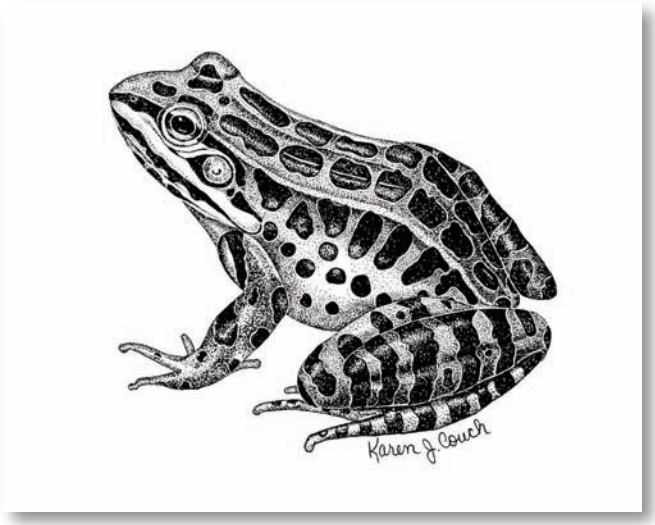
- "*Wetland Walk Manual: Guidebook for Citizen Participation*." 1996. EPA. Seattle: Office of Water. This 15 page manual with data forms provide instructions for citizens to easily determine the wetland type, observe human impacts to the wetland, observe signs of degradation in the wetland, and describe vegetative communities. Available for download at: http://www.epa.gov/owow/wetlands/pdf/wetwalk.pdf

- *WOW!: The Wonders of Wetlands, an Educator's Guide*. Environmental Concern. Kesselheim, A.S. & Slattery, B.E. (1995). An interdisciplinary curriculum guide for K-12 educators of grade levels focused on the three definitive wetland parameters: water, soil, and plants; there are wildlife-oriented exercises as well. Although geared for educators, much of the information is useful for volunteer wetland monitors. For more information, contact Environmental Concern Inc., http://www.wetland.org/ P.O. Box P, St. Michaels, MD 21663-0480, Tel. (410) 745-9620

Nature Journaling

- *Keeping a Nature Journal: Discover a Whole New Way of Seeing the World Around You* C. W. Leslie & C. E. Roth (2000) North Adams, Massachusetts, Storey Books

Amphibian Monitoring



FWS/Counch

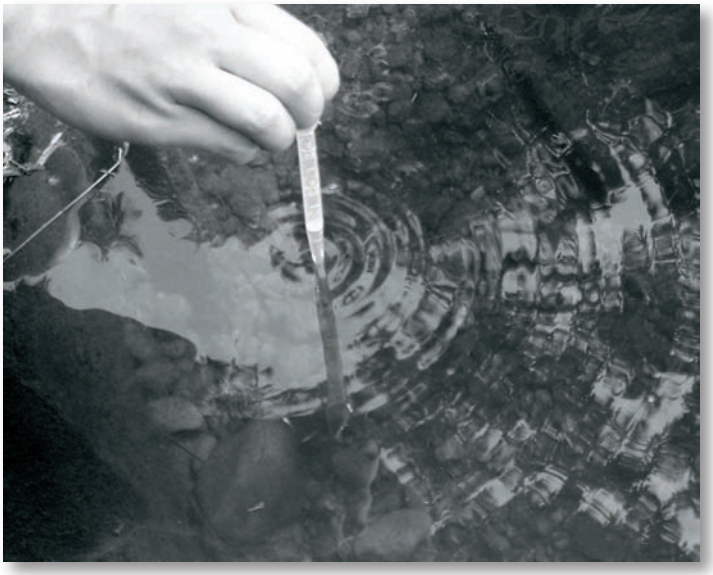
- *Frogwatch USA* is a volunteer frog and toad-monitoring program managed by the National Wildlife Federation (NWF) in partnership with the U.S. Geological Survey (USGS). Frogwatch USA volunteers monitor populations of vocal amphibians. The Frogwatch USA website contains all the basic information necessary to learn how and when to monitor, pick an appropriate monitoring site and enter results online. Although monitoring is recommended every two weeks throughout the breeding season, volunteers may participate on a less frequent basis. The Frogwatch USA program is set up mainly for individual participation but can easily be modified for organizations to participate. http://www.nwf.org/frogwatchUSA/

- *North American Amphibian Monitoring Program* (NAAMP) is a collaborative effort among regional partners, such as state natural resource agencies and nonprofit organizations, and the (USGS) to monitor populations of vocal amphibians. This is a "professional-grade" volunteer program with many data quality control procedures built into the monitoring protocols. After volunteers have collected sufficient data, it will be used to determine long-term amphibian population trends occurring across the nation. Recommended for volunteers

who can commit to a long-term program and adhere to a strict monitoring schedule within the established monitoring time periods. For more information on NAAMP: http://www.pwrc.usgs.gov/naamp/. The Wildlife Diversity Division of the DGIF coordinates the NAAMP program in Virginia. If you're interested in becoming a Virginia Frog and Toad Surveyor: http://www.dgif.state.va.us/wildlife/frog_call_survey.html

- *NAAMP frog call quiz* – Online Frog Quizzes and Frog Call information available for the general public, trained NAAMP volunteers, Frogwatch USA volunteers and Professionals: http://www.pwrc.usgs.gov/Frogquiz/.
- *Virginia Frogs and Toads* – The Virginia Herpetological Society website contains an up-to-date listing of all of the Virginia frog and toad species, distribution maps and sound clips of their mating calls: http://fwie.fw.vt.edu/VHS/frogs_and_toads_of_virginia.htm

General Water Monitoring



Alliance

- *Chesapeake Bay Citizen Monitoring Manual.* Alliance for the Chesapeake Bay. (October, 2002). Basic chemical water quality monitoring manual geared for volunteers Available for download from the World Wide Web: http://www.acb-online.org/pubs/projects/deliverables-206-1-2003.PDF The Alliance coordinates a citizen monitoring chemical water quality program for Virginia citizens within the Chesapeake Bay watershed. For more information, contact the Alliance's Virginia office: phone: 804-775-0951, P.O. Box 1981, Richmond, VA 23218 http://www.acb-online.org/project.cfm?vid=87
- *The Monitor's Handbook*. Campbell and Wildberger. LaMotte Co. Provides the background necessary for volunteers to understand water quality monitoring purposes and procedures. Describes the physical, chemical and biological factors in water quality, analytical procedures, and the elements of a successful monitoring program. Contains a glossary of terms, conversions, and additional resources. Available for purchase from the LaMotte Co., P.O. Box 329, Chestertown, Md. 21620; or call (800) 344-3100. Reference No.1507. ($12.95) http://www.lamotte.com/pages/edu/monitor.html
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- *Virginia Save Our Streams* (VASOS) is a nonprofit organization that trains and certifies volunteers to perform macroinvertebrate monitoring throughout Virginia. Although VASOS monitoring protocols have been developed for use in flowing streams, not wetlands, the website contains basic information on freshwater macroinvertebrates that may be found in wetlands. Website: http://www.sosva.com/index.htm. To contact VA SOS: phone: 804-615-5036 or toll free at 888-656-6664, P.O. Box 8297, Richmond, VA 23226

Acronyms and Abbreviations

Note- this list does not include abbreviations that are listed only in the Financial and Technical Assistance Tables (in *Getting Help*, Section Four), in *Monitoring Resources for Visual and Hands-On Wetland Monitorin*g (Section 5) or in *Literature Cited*.

APFO
Aerial Photography Field Office

Alliance
Alliance for the Chesapeake Bay

CBF
Chesapeake Bay Program

CBLAD
Chesapeake Bay Local Assistance Department

CBP
Chesapeake Bay Foundation

CERCLIS
Comprehensive Environmental Response, Compensation, and Liability Information System

Corps
U.S. Army Corps of Engineers

CZMA
Coastal Zone Management Act

DCR
Virginia Department of Conservation and Recreation

DACS
Virginia Department of Consumer Services

DEM
Digital Elevation Models

DEQ
Virginia Department of Environmental Quality

DGIF
Virginia Department of Game and Inland Fisheries

DHR
Virginia Department of Historic Resources

DLG
Digital Line Graphs

DMME
Virginia Department of Mines, Minerals and Energy

DMR
Division of Mineral Resources

DOC
Department of Commerce

DOQ
Digital Orthophoto Quadrangles

DRG
Digital Raster Graphics

DU
Ducks Unlimited

ELI
Environmental Law Institute

EPA
U.S. Environmental Protection Agency

ERP
Elizabeth River Project

FOBF
Friends of Bandy Field

FSA
Farm Service Agency

FWS
U.S. Fish and Wildlife Service

GIS
geographic information systems

HEP
Habitat Evaluation Procedure

JPA
Joint Permit Application

LWB
Local Wetland Board

NCV
Natural Communities of Virginia

NHP
Virginia Natural Heritage Program

ND
No Date

NED
National Elevation Data

NERR
National Estuarine Research Reserve

NOAA
National Oceanic and Atmospheric Administration

NRCS
Natural Resources Conservation Service

NRFS
Natural Resources Fact Sheet

NWI
National Wetlands Inventory

NWP
Nationwide Permit

PPT
Parts Per Thousand

QAPP
Quality Assurance Project Plan

RMA
Resource Management Area

RPA
Resource Protection Areas

SAV
Submerged Aquatic Vegetation

TCF
The Conservation Fund

TNC
The Nature Conservancy

TRI
Toxic Release Inventory

TU CGIS
Towson University Center for Geographical Informational Sciences

USDA
U.S. Department of Agriculture

USGS
Geological Survey

VAFWIS
Virginia Fish and Wildlife Information Service

VCP
Virginia Coastal Program

VDH
Virginia Department of Health

VDOT
Virginia Department of Transportation

VIMS
Virginia Institute of Marine Science

VMRC
Virginia Marine Resources Commission

VPDES
Virginia Pollutant Discharge Elimination System

VWP
Virginia Water Protection

Glossary

Note: The definitions in this Glossary are for the purposes of this ToolKit. Some glossary words may have varied or more technical definitions that those used here.

A

Anaerobic Condition
Condition resulting from little or no oxygen

B

Bioassessment
A relatively new term used to describe a way of performing a more rapid biological assessment rather than a comprehensive assessment

Brackish
Water that contains some salt, but less than seawater; a mixture of fresh and saltwater typically found in estuarine areas

Bottomland Forest
Low lying forested wetland between drier upland hardwood forests and a wetter river floodplain

Buffer Zone
The area of land next to a body of water or wetland, where activities such as construction are restricted or plants are established in order to protect water or water quality

C

Compensatory Mitigation
Required replacing or restoring of wetlands to compensate for wetland loss in another area

Conservation Easement
A legally binding and permanent deed to a property, tailored so that the land's unique characteristics are protected

Cost Share
Resources used to match other external funding resources

Creation
The establishment of a wetland in an area where one did not formerly exist. Examples include establishing a wetland on an upland site and the filling a pond to produce a wetland

D

Delineation
The process of defining boundaries, see wetland delineation

Discharge
The outflow of water or to release of something from one place to another

E

Emergent Vegetation
Plants with roots and part of the stem submerged below water level, but the rest of the plant is above water

Enhancement
Increasing one or more functions or values of an existing wetland or other aquatic resource

Evapotranspiration
A term that includes water discharged to the atmosphere as a result of evaporation from the soil and surface-water bodies and by plant transpiration

Estuarine
Found or formed in an estuary

Estuary
Semi-enclosed coastal waterbodies that are affected by both tides as well as freshwater

F

Fluvaquents
Soils formed from frequent flooding, often found in floodplains

Foundation
An organization or institution with internal funding often distributed in grants or monetary gifts

Freshwater
Water containing few salts (usually less than 0.5ppt)

G

Geographic Information Systems (GIS)
A type of computer system that can capture, store, analyze and display information geographically, or according to location

Gleying
The process by which mineral soils become black, gray or greenish-bluish gray in appearance or tint from the reduction of iron caused by the presence of water in the soil

Grant
Monetary gift given to an organization in exchange for a service

Grantee
Person or organization receiving the grant

Grantor
Person or organization supplying the grant

H

Hydric Soils
Soils that form from the lack of oxygen present due to the presence of water at or below the soil surface

Hydrology
Describes the movement and storage of water within an area

Hydroperiod
Fluctuations in water level over time often defined by the frequency and duration of wetness

Hydrophytes
A plant that is adapted to grow in water

Hydrophytic Vegetation
Vegetation that has adapted to survive in saturated or inundated conditions.

I

Inclusions
In this instance, pertaining to soils of one type located within larger soil complexes that is a different soil type

In-Kind Contribution
Donated goods and services used for match and cost-sharing

In-lieu Fee Fund
A type of compensatory mitigation where the developer pays a fee to a natural resource or nongovernmental organization for wetland creation or restoration

Inundation
The condition of having standing water or being flooded by water on the soil surface

Invasive Species
A species that does not naturally occur in a specific area and whose introduction does or is likely to cause economic or environmental harm or harm to human health.

K

Karst
An area of limestone that has cracks, joints and underground caverns

L

Lacustrine
Wetlands are located along the edges of lakes where the water depth is less than 2 meters (6.6 feet)

Land disturbance
Impacts to ground surface and soils

M

Matching funds
Cost sharing or supplying monies or services to match funds supplied by an external source

Mineral Soils
A type of hydric soil found in wetlands that is composed of sands, silts and clays

Mitigation
See compensatory mitigation

Mitigation Bank
Creating, enhancing or restoring wetlands and setting them aside to compensate for unavoidable wetland impacts and damages

Morphological Adaptations
Functional and structural adaptations in plants and animals

Mottling
A process occurring in mineral soils that results in concentrations of highly oxidized materials that result from fluctuating water levels in wetlands.

N

Navigable
Waters that are either tidal or have been used or are presently being used for the transport of interstate or foreign commerce.

O

Organic Soils
A type of hydric soil found in wetlands that is composed of decomposed plant materials

Oxidation
The process by which a substance is exposed to oxygen causing it to rust due to the loss of electrons

P

Palustrine
Nontidal freshwater wetlands that are neither riverine nor lacustrine

Persistent vegetation
Plants whose stems show above the water and do not deteriorate when the plant goes dormant

Physiographic Providences
Geographic regions

Physiological Adaptations
Adaptations of life processes

Piezometer
A type of well that is nonpumping, generally of small diameter, for measuring the elevation of a water table.

Pneumatophore
specialized roots formed on several species of plants occurring frequently in inundated habitats; root is erect and protrudes above the soil surface

Preservation
The protection of existing wetlands (or other aquatic resources) in perpetuity through the implementation of appropriate legal and physical mechanisms

Q

Quality Assurance
The overall mechanics of a monitoring organization or group to ensure accurate data collection by developing methods for data collection, documentation, reporting and evaluation

Quality Control
Activities that reduce, detect and correct errors in data

R

Resource Management Areas (RMAs)
Contiguous lands landward of the Resource Protection Areas that have the potential to damage water quality

Resource Protection Areas (RPAs)
Sensitive lands at or near the shoreline, which include buffer zones that include tidal and nontidal wetlands

Restoration
The re-establishment of a wetland in an area where it historically existed

Riverine
Wetlands located within freshwater river channels that are dominated by persistent emergent vegetation

S

Salinity
The measure of dissolved salts in water, usually expressed in parts per thousand (ppt)

Salinity Gradient
The gradual increase of salinity in a river as you travel towards its mouth where it is influenced by the ocean

Saltwater
Water that contains the approximate salinity to that of seawater (approximately 35 ppt)

Saturation
The condition where air spaces in soil are filled with water but no water is present on the soil surface

Sinkhole
A hole or depression in the ground that usually occurs in areas with limestone geology

Stakeholders
A person or group of people who have a stake or particular interest/attachment to an issue

Streamflow
the discharge of water in a natural channel

Subaqueous Land
Land and vegetation below the water surface. For regulatory purposes in Virginia, these lands are located channel ward of mean low water

Submerged Aquatic Vegetation (SAV)
Aquatic vegetation that grows entirely below the water surface and roots in the sediments

Substrate
The underlying material or ground cover

T

Tidal Freshwater
An area of freshwater that is influenced by the tides

Topographic Map
A map showing elevation and land use

Topography – The relative elevations of different features in a landscape

V

Vernal Pool
A small lake or pond that is filled with water for only a short time during the spring; many species of reptiles, amphibians, insects and invertebrates rely on vernal pools for breeding

W

Watershed
A watershed is an area of land that drains to a common waterway, including a wetland, stream, river, lake, or even an ocean.

Water Table
The upper level of the portion of the ground in which all spaces are saturated with water

Wetland Delineation
The process of defining the boundaries of a wetland

Wet Woods
Refers to both bog woodlands and floodplain woodlands

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