

Pompeston Creek Environmental Inventory



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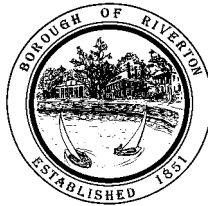


Prepared by the Environmental Commission
of the Borough of Riverton

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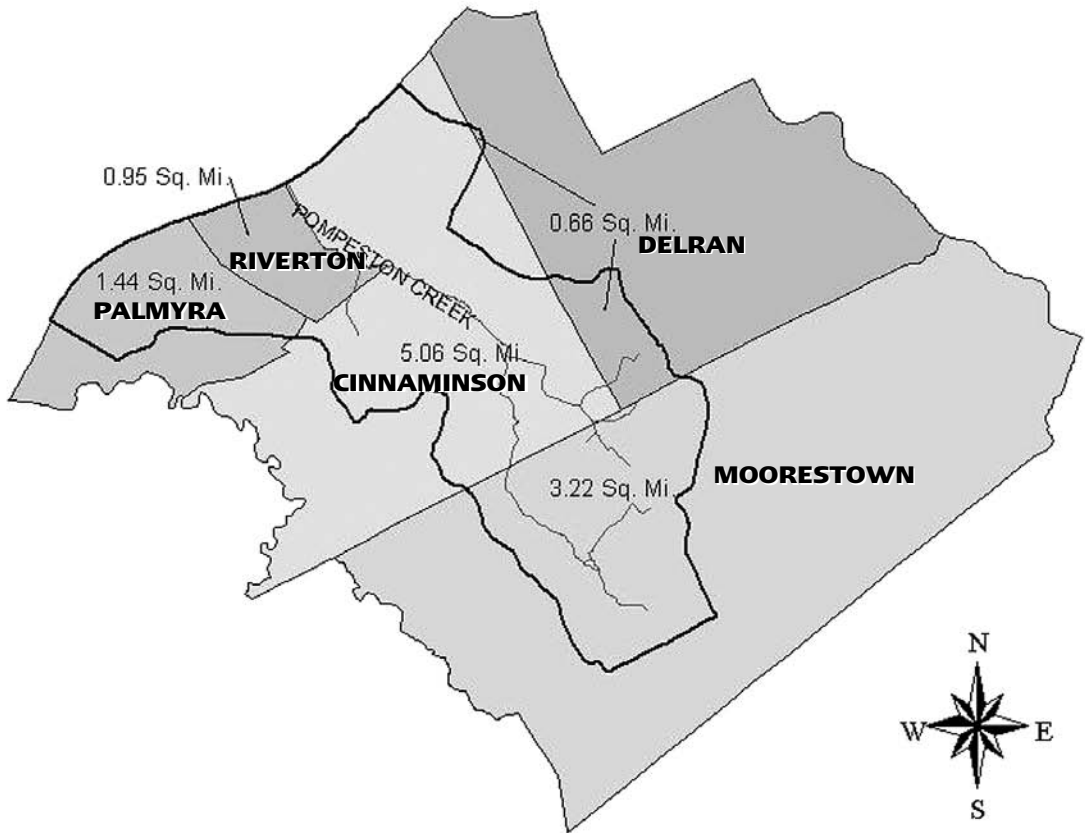
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**Figure 1 - Pompeston Creek Watershed (GIS Map)
SHOWING AREA**



-  Watershed perimeter
- Municipalities Within Watershed Boundary**
-  CINNAMINSON TWP
-  DELRAN TWP
-  MOORESTOWN TWP
-  PALMYRA BORO
-  RIVERTON BORO

2 0 2 Miles



Figure 2 - Map of Site 3

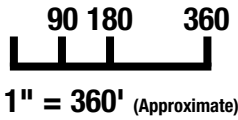
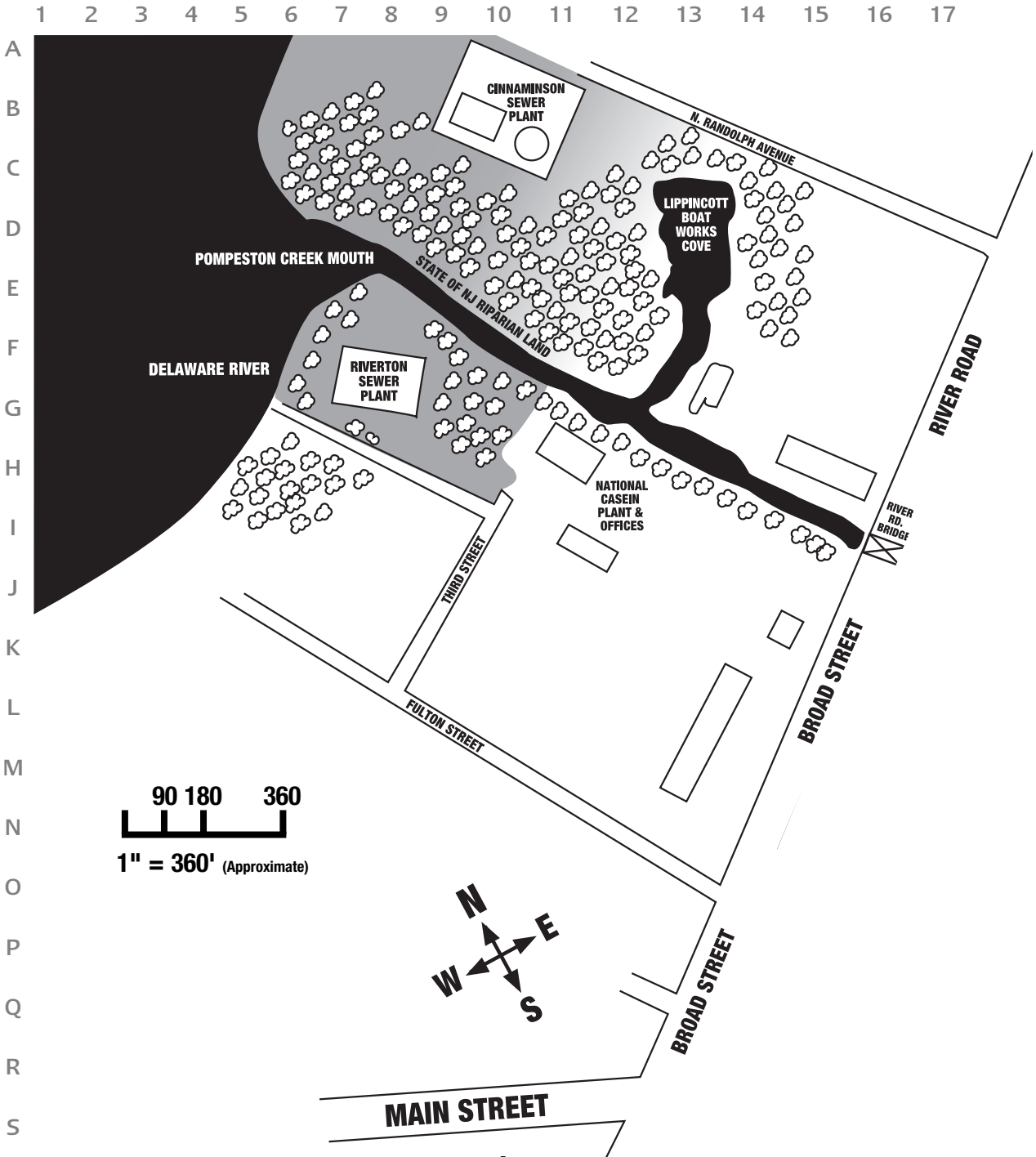


Figure 2 - Map of Sites 2 and 1

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S

Site 2 **Site 1**

**RIVERTON / CINNAMINSON
BORDER LINE**

**HUNTER'S
FARM**

**CINNAMINSON
HIGH SCHOOL**

RIVER ROAD

**RIVER
BRIDGE**

**RIVERTON
MEMORIAL PARK**

LILY POND

**TENNIS
COURTS**

**BASEBALL
DIAMONDS**

PARKING

APARTMENTS

RIVERTON ROAD

TO ROUTE 130

BROAD STREET

NJ TRANSIT RIVER LINE

MAIN STREET

6TH STREET



MAP KEY

- = TREES
- = MARSH
- = TRAIL
- = PUBLIC PROPERTY
- = WATER

**NOTE: THIS IS A CONCEPTUAL MAP.
DISTANCES ARE APPROXIMATE.**

INTRODUCTION

The Borough of Riverton occupies only 9/10 of a square mile (GIS measurement) along the Delaware River, opposite Philadelphia. Riverton is a fully developed suburban town notable for a rich heritage of Victorian architecture (much of the Borough is listed in both the National and State registers of historic places). We are fortunate to be located between the 350 acre Palmyra Cove Nature Park, slightly over a half-mile to the south, and the 140 acre Taylor Wildlife Preserve, the same distance to the north. But Riverton shares with neighboring Cinnaminson a natural treasure of its own: the Pompeston Creek and marsh, a complex wetland ecosystem that offers many of the values and pleasures of larger wild areas, within a compact space.

The Pompeston Creek begins in Moorestown and flows northwest through Cinnaminson and Riverton to the Delaware River, a distance “as the crow flies” of about 4.5 miles.

Through the final three-quarters of a mile the Pompeston forms the border between Cinnaminson (to the north) and Riverton (to the south). This final section (see Figure 2) is the subject of our study, with emphasis on the tidal marsh that extends from River Road (Burlington County Route 543, known locally as Broad Street) to Route 130.

The Pompeston Creek watershed (see *Figure 1*) covers 11.33 square miles, and includes parts of Cinnaminson (5.06 sq. miles), Moorestown (3.22 sq. miles), Riverton (0.95 sq. miles), Delran (0.66 sq. miles), and, although the stream itself does not run through it, Palmyra (1.44 sq. miles).

This publication is intended to provide basic information about the geology, history, plants, animals, and recreational value of the Creek. A discussion of water quality and best management practices is included. It is hoped that this booklet will be useful to our local schools, to those who wish to study or enjoy the natural beauty of the Creek in a canoe or kayak or on foot, to residents living along the Creek and others who want to know what they can do to preserve it, and to officials of the watershed towns who share responsibility for the future of this exceptional resource.

The booklet is reproduced, along with additional material, on a website:

www.pompestoncreek.org

The website, which also serves as the online home of the Pompeston Creek Watershed Association (PCWA), will support ongoing communication concerning

the Pompeston Creek. It will allow for the publication of maps and color photographs, new data, and educational links, and will permit us to update the downloadable version of this booklet. It will also provide a forum for the public sharing of information about the Creek.

The booklet and the environmental inventory upon which it is based were funded by the NJ Department of Environmental Protection and the Borough of Riverton. The accompanying website was designed by Bennett Landsman of the Riverton Environmental Commission.

The environmental inventory was carried out in October of 2002 by a team of researchers headed by Dr. Christopher C. Obropta of the Rutgers Cooperative Extension. Dr. Gerry Moore of the Brooklyn Botanic Garden conducted the plant survey. Kristi MacDonald (Rutgers University) assessed the wildlife habitat. Lisa Galloway Evrard (Rutgers Cooperative Extension) surveyed the benthic macroinvertebrates. Dr. Obropta conducted the visual assessment. The inventory is termed “preliminary”. It provides both a wealth of information and a framework for further study. We hope that the public will join us in continuing the work. Read “The Need For Further Study” and “Suggested Projects”, below, or contact us on the website with your ideas and observations. The booklet summarizes the inventory and contains additional material. The complete text of the original inventory, including technical material not in the booklet, is available on the website.

Further contributions to the project were made by Ned Gilmore, Collections Manager of Vertebrate Zoology at the Academy of Natural Sciences in Philadelphia. Ned’s reports on the geology, birds, mammals, and invertebrates of the Creek represent years of field experience with the Pompeston (Ned’s work appears in this booklet, not in the original inventory). Help from Ned’s colleagues at the Academy of Natural Sciences is also acknowledged with appreciation. Joseph Taylor’s published observations of birds and mammals have been cited by the survey team, and his lists are included in this report. Mrs. Betty Hahle, Riverton’s town historian, helped with historical aspects. Additional content comes from the archives maintained by the dedicated volunteers of the PCWA.

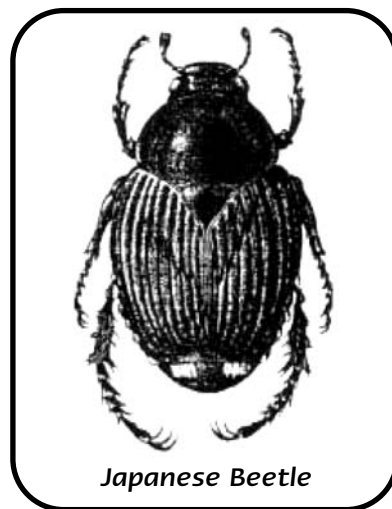
We are also grateful for plant identification done by Thomas and Lee McAvinnia of Riverton, whose efforts were supported by the Burlington County Master Gardeners Program. Jeremiah Bergstrom of TRC Omni Environmental allowed us to use, and altered for our purpose, the lists of native plants suitable for planting within the stream corridor (Table 7).

Debbie Lord, President of the PCWA, provided information on animals present in the Moorestown part of the watershed.

A marsh is a work of nature millions of years in the making. It is a self-sustaining web of life. Our yards and gardens are artificial creations that depend upon the whim of human beings, but the marsh has a beauty and an order that are older and beyond us. It is a reminder that we have not made this world.

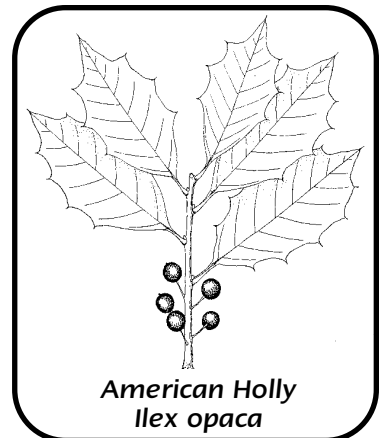
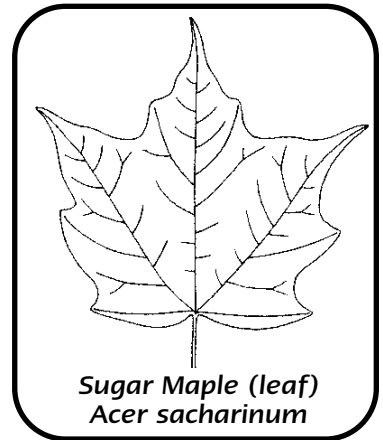
NARRATIVE OVERVIEW: UP THE CREEK IN A CANOE

The Pompeston Creek is a natural oasis in the midst of our densely populated suburban communities. Let's begin our escape at the mouth of the Creek where it enters the Delaware River, about 600 yards north of the Riverton Yacht Club. This is "Site 3" of our survey (see *Figure 2*), extending 1275 feet from the Delaware to the Broad Street Bridge and including sandy forested areas along the Creek as well as more than three wooded acres adjacent to and south of the Creek along the Delaware. Through this section, the Creek is about 60 feet wide. The banks near the mouth are sandy and littered with broken clay flower pots, nearly all that remains of the Henry A. Dreer Company, a plant nursery that occupied both banks of the Pompeston through Riverton and Cinnaminson from 1867 until it was demolished in 1943. We see tall trees completely covered by broad-leaved **kudzu**, a southern import that is rare in our area. **Bamboo** is also present. Our study indicates an exceptional number of exotic or "invasive" plants, probably a legacy from Dreer's, which acquired and grew plants from all over the world. The company had nurseries in at least eleven countries, and was once the world's largest grower of roses. In August of 1916, the **Japanese beetle** was first identified in the United States at Dreer's in Riverton. Reportedly, the insect arrived in the grub stage in a shipment of iris roots imported from Japan five or six years earlier.



Japanese Beetle

Paddling upstream, between muddy banks, we pass the Riverton sewage treatment plant on the right. Although maps from the 1880s show a wide curve and surrounding marsh (see Figure 3), we find neither: reportedly, this part of the Creek was straightened by Dreer's early in the Twentieth Century. Branches hang over the water, and we can reach out and touch the leaves of **box elder** (the only maple tree with compound leaves), **sugar maple**, and **white ash**. **Black locust** and **American holly** are also present. On the Cinnaminson side are 11 acres of mature riparian woods owned by the State of New Jersey. A boy swings out on a rope tied to a tree, and splashes into the water behind us. We turn and shout, "Hello!" After about 650 feet, along the Cinnaminson bank, we pass the entrance to a small cove, the former location of the Lippincott Boat Works, at one time among the largest builders of racing sailboats in the world. Old pilings along the north bank mark the remains of a wharf used by Dreer's, one of several that were located on the Creek through Riverton and Cinnaminson. On the Riverton side is a broad stand of woods, mostly secondary growth. South of the woods is the National Casein glue factory and office building. The two-story stucco office was built in 1867 for Dreer's. Now we approach the Broad Street Bridge, on which River Road and the New Jersey Transit light rail River Line pass over the Pompeston. If it's high tide, we may have to duck our heads. **Pigeons** roosting under the bridge burst into flight, their wing beats amplified in the confined space. We are at the end of Site 3 of the Creek.



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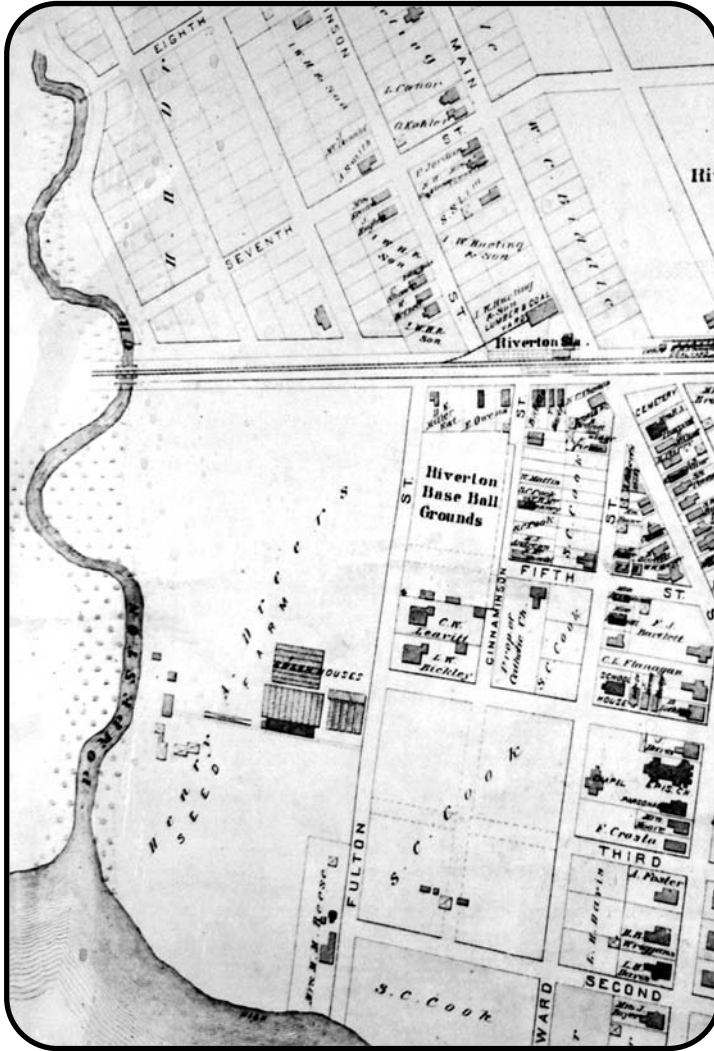


Figure 3

***Detail of 1886 Map of Riverton - "Henry A. Dreer's Seed Farm"
Showing Sites 2 and 3 of the Inventory***

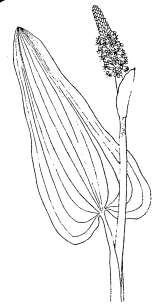
We come out in a different world. This is Site 2 of the inventory, extending nearly 600 feet east from River Road. The Creek has broadened into a classic freshwater tidal marsh. Following the channel, we move between tidal flats densely covered with vegetation. Beyond the flats are the wooded banks of the Creek, low on the Cinnaminson side and high and steep on the Riverton side. To the right, hidden by the trees and shrubs of the stream bank, is Riverton Memorial Park. Directly ahead

is the lily pond, a section of marsh enclosed by a triangular earthen levee, which was once used by Dreer's for raising aquatic plants. The levee is above the tide line, and supports woody shrubs and trees. We have to paddle left (north) around the levee, bringing us close to the Cinnaminson bank. The distinctive plants of the tidal marsh are all around us.

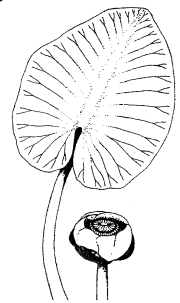
First to emerge from the water as the channel shallows toward the levee are the broad leaves and compact yellow flowers of **spatterdock**, which dominates this open water zone of the low marsh. Other broad-leaved emergents occupy the mud flats in slightly elevated low marsh areas on the Riverton side, including **arrow arum**, **pickerelweed**, and **broad-leaved arrowhead**. On the opposite side, along River Road, where the mud flat is higher, we see a dense tangle of grasses, sedges, and other plants that thrive in wet soil but beyond the zone of extended inundation. Prominent are **jewelweed**, with its small orange orchid-like blossoms; **sweet flag**; **dotted smartweed**; **halberd-leaved tearthumb**; **arrow-leaved tearthumb**, and **bur marigold**. Thin, orange spaghetti-like stands of the parasitic plant, **dodder**, are intertwined with the **jewelweed**. Here we see **spicebush** and **skipper** butterflies. Small blue **dragonflies** skim the surface of the water. We spot a **marsh wren** perched on **clearweed**, eating the seeds. **Swallows** swoop over the marsh, pursuing insects. We see **goldfinches**, and hear the cry of a **catbird**. A break in the levee near the Riverton bank lets tidal water into the lily pond. At that point there are hundreds of small fish darting through the shallows. If we were to get out of the boat and walk into the lily pond, we'd find a marsh-within-a-marsh, a water meadow sheltered by the levee and including all the species mentioned above as well as large stands of **wild rice**. We would see a thicket of **bamboo** rising up the slope on the Riverton side, and the white flowers of **Japanese knotweed** blooming along the inside of the levee. A break in the east side of the levee allows water to flow through the lily pond in small channels hidden by the vegetation (look for them, full of juvenile fish, in the early spring before the plants are high). We continue paddling around the levee. Perhaps we will see the **Turtle Lady** at her snapping turtle nursery on the Cinnaminson side. Have we brought a trash bag? She would want us to collect floating bottles and other debris. We round the levee and leave "Site 2" of our survey.



Jewelweed
Impatiens capensis
ODUM (1984)



Pickerelweed
Pontederia cordata
TINER (1988)

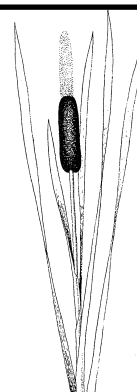


Spatterdock
Nuphar luteum
TINER (1988)

Now the marsh becomes much broader, perhaps 600 feet in width. We are in Site 1, which extends from just beyond the lily pond to the Riverton border, about 2000 feet. The levee is behind us and the channel begins its serpentine course through the main body of the summer marsh. Flights of **red-winged blackbirds** take off across the water from the tall stalks of **wild rice**. The tidal flats and plants along the Creek and the wooded banks and uplands on both sides of the marsh shut out the modern world, so that the scene is much as it must have appeared to the Leni Lenape Indians who gave the Creek its name and used it for fishing and transportation (“Pompeston” is thought to mean “bread in a miry place”). The channel is narrow, perhaps 25 feet. The flats on the Cinnaminson side rise three feet or more above the water, and we pass holes dug into their sides: entrances to the dens of **muskrats** that feed on the marsh plants. We see the paw prints of **raccoons** in the mud. **Bur marigold** is plentiful (in late September, its yellow blossoms will light up the high marsh), and **cattail** can be found toward the center of the flats, although in small, scattered stands that are not easy to see through the higher vegetation. Bordering the marsh is a narrow zone of forested wetlands, dominated by such trees as **red maple** and **black gum** (there was very little forested wetland in site 2). The banks and the wooded uplands, several hundred feet wide on the Riverton side, are notably steep. Rounding a bend, we startle a solitary **snowy egret**, standing on the mud flat. We reach into the water, and pull up a long green necklace of **common waterweed**. **Coontail** is also found under the surface. Here we see the first large stands of tall, plumed **Phragmites australis** (**common reed**), and we see how it crowds out the more varied native vegetation. The long spear-like leaves of **cattail** are more numerous and visible here, and **salt marsh water hemp** is prominent along the edge of the stream. We are near the southeastern border of Riverton: from this point on, both banks of the Creek will be in Cinnaminson. This is the end of Site 1, but not of the marsh.



Bur marigold
Bidens laevis
ODUM (1984)



Cattail
Typha latifolia
TINER (1988)



Phragmites
australis
TINER (1988)

We go on. The channel takes us to the south bank, where Cinnaminson High School is concealed behind a broad band of steep-sloped upland woods. There are many **mallard ducks** in the water, not happy to see us. A hundred yards upstream, a pair of **great blue herons** takes flight. A wide dirt path begins here and continues southeast through the woods parallel to the stream and to Cinnaminson High School, providing a fine long walk with a continuous view of the marsh. Now the stream loops to the north bank, where a substantial bulkhead marks the location of Hunter's Farm. Beyond the High School, the stream returns to the south side and becomes narrower, straighter, and more shallow. Trees and shrubs crowd the channel on both sides, a forested wetland, although the high marsh remains broad on the north side, where the elevation appears to dip behind the forested zone. The quiet water has a warm brown tone, probably due to the brown silt of the stream bed. We see small **crayfish** scuttling along the bottom. Where sunlight reaches the water through the canopy of leaves, the surface takes on a striking amber glow (visible in photographs on the website). This part of the Creek has a quality of peaceful seclusion. A fallen tree lying across the Creek stops our progress. At high tide, in a wet season, with some portage over sandbanks, it is sometimes possible to go as far as Route 130, 1.75 miles from the Delaware. But that would be exceptional. We are ready to turn back.

If we have consulted our tide tables (see the website for a link), we will glide back to the Delaware as the tide turns. If not, we may find that, going around the levee, we are scraping bottom in a few inches of water where earlier we had three feet, or that approaching the bridge we must work our way around flat rocks, barely submerged. We plan to come back: we have only begun to experience the life of the marsh.

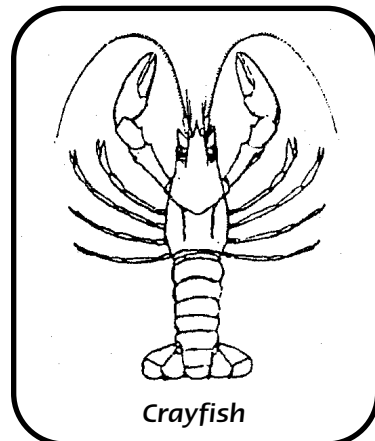


Mallard



Great Blue Heron

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Crayfish

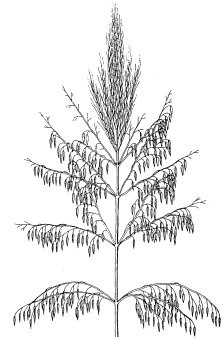
WHAT IS A MARSH?

There is no universally accepted scheme for classifying wetlands. Perhaps the simplest definition of a marsh is that supplied by Collins (1994): a frequently or continuously flooded wetland characterized by emergent herbaceous vegetation. "Herbaceous" plants are those that lack woody stems and branches. "Emergent" refers to a plant that grows rooted in shallow water (or damp soil), but the bulk of which emerges and stands vertically.

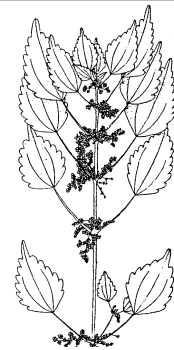
Spatterdock, arrow arum, pickerelweed, and broad-leaved arrowhead are common broad-leaved emergents that dominate the lower levels of the Pompeston marsh throughout the growing season, although they are also found on the high marsh, concealed in summer by taller plants. **Dotted smartweed, halberd-leaved tearthumb, bur marigold, jewelweed, clearweed, Phragmites australis, wild rice, water hemp, sweet flag, and arrow-leaved tearthumb** are prominent emergents which, in the Pompeston, tend to be found at somewhat higher elevation, rooted in the deep muck of the tidal flats. Emergent plants are hydrophytic: adapted to survive under conditions of flooding. These plants give the marsh the appearance of a field covered with grasses and herbs. A marsh may be associated with a river, creek, or saltwater inlet, or may occur at the shallow edges of a lake or pond or even a ditch or depression.

A **swamp**, by contrast, is a wetland that is flooded only occasionally and is dominated by trees and shrubs. A **bog** is characterized by spongy peat soil, rather than muck, and lacks an inflow and outflow of surface water, while a **fen** is another form of peatland, usually found in formerly glaciated portions of the Northeast. Marsh, swamp, bog, and fen are the principal and most familiar types of wetlands.

Marshes are further classified according to salinity and tidal action. In New Jersey, salt marshes are found along the Atlantic Coast, Delaware Bay, and tidal areas of the



Wild Rice -
Zizania aquatica
TINER (1988)



Clearweed -
Pilea pumila
TINER (1988)



Water Hemp -
Acnida cannabina

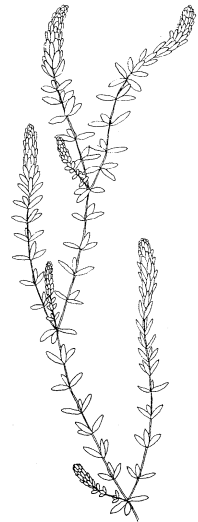
USDA-NRCS Plants Database/Britton, N. L., and A. Brown. 1913. Illustrated flora of the northern states and Canada. Vol. 2:6

lower Delaware. Compared to freshwater marshes, salt marshes are dominated by fewer, salt-tolerant plants (notably ***Spartina alterniflora***). The Delaware River from the Delaware Memorial Bridge to Trenton is fresh water under tidal influence. Throughout this area, the Delaware and its tributaries support some of the most significant stretches of tidal freshwater marsh in the Northeast. Because of the absence of salt stress, freshwater marshes host a greater variety of plants. Tidal action, by creating a range of niches based on the extent of inundation (see Figure 4) further multiplies this diversity. A wide range of plants and habitats encourages in turn a greater variety of insects, waterfowl, reptiles, amphibians, and mammals than can be found in a saltwater marsh (Odum, et al. 1984). The tidal freshwater marsh is therefore an exceptionally rich place for the enjoyment and study of nature, and is especially important for the survival of a diversity of species in areas where habitat is threatened. Where development and sprawl have destroyed the natural environment, a tidal freshwater marsh is a refuge that should be appreciated and protected.

THE PROFILE OF A TIDAL FRESHWATER MARSH: THE MARSH IN SPACE

The most important factor governing the spatial arrangement of plants in a tidal freshwater marsh is thought to be the frequency, depth, and duration of flooding. Even slight changes in elevation can produce micro-habitats that affect the composition of the plant community. It is interesting to see this effect in the pattern of vegetation within the marsh. According to Odum, et al. (1984), although it may be difficult to place a given species of plant within a general structural scheme, most of the commonly occurring vegetation falls into one of the following categories:

- (1) submerged or floating-leaved plants



**Water Weed -
*Elodea canadensis***

TINER (1988)



**Halberd-leaved
tearthumb -
*Polygonum arifolium***

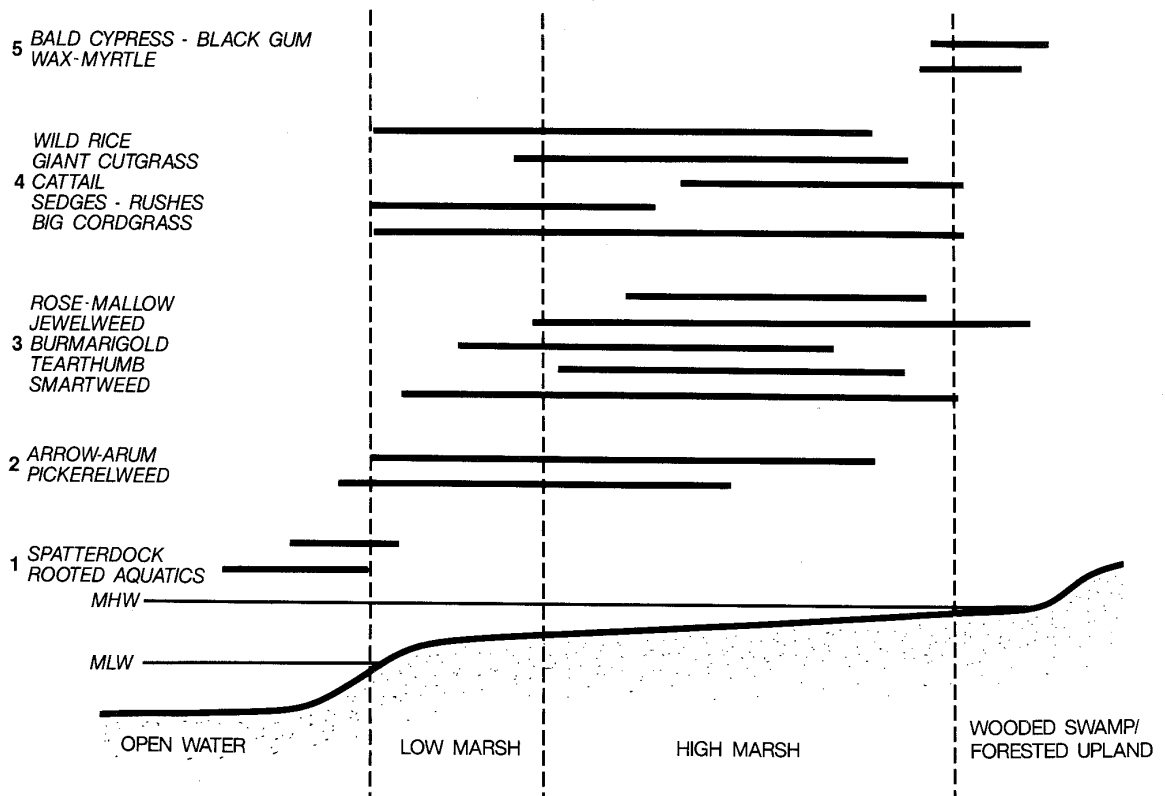
TINER (1988)

- (2) emergent plants with basal leaves and/or leafless stems
- (3) emergent damp soil herbs with stems bearing alternate or opposite leaves
- (4) grasslike or rushlike plants
- (5) broad-leaved shrubs or trees

In Figure 4, these five community types are placed with respect to four levels of inundation, to produce a “profile” of the marsh that corresponds quite closely to what we see in the Pompeston (note that we have not yet found big cordgrass, giant cutgrass, or rose mallow, and that the trees of the Pompeston are different).

Figure 4 -

Characteristic Profile of a Mid-Atlantic Tidal Freshwater Marsh: From Odum (1984)



TERMS AND DEFINITIONS

MHW:

Mean high water/ tide

MLW:

Mean low water/ tide

Wetlands:

Areas that are saturated or covered with water long enough and often enough that their soils and plants differ from those of nearby uplands.

Low marsh:

The area subject to tidal flooding twice each day. It tends to be dominated by broad-leaved emergents.

High marsh:

Flooded less frequently than the low marsh, and supports a more diverse plant community, including many **grasses** and **sedges**. The high marsh may begin only a foot or even less above the low marsh, depending on the height of the tide and the height of the mud flats in a given location. The soil is still saturated most of the time.

Forested wetlands:

Above the high marsh in some places along the Pompeston is a narrow zone of trees and shrubs where the soil and plants are still affected by proximity to the stream. By one definition a forested wetland has a tree canopy of at least 30%.

Uplands:

Beyond the forested wetlands are forested uplands, where the soil and plants do not reflect the effects of saturation.

Riparian zone:

The land adjacent to the stream that is, at least periodically, influenced by flooding (*Mitsch*, 1993). The riparian zone may extend typically from the edge of the stream to the beginning of the uplands, but its borders may be irregular and hard to define. A high water table due to proximity to the stream contributes to riparian character.

Intertidal zone:

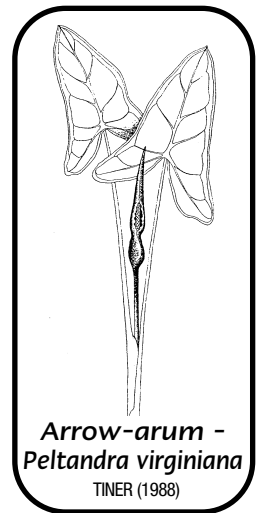
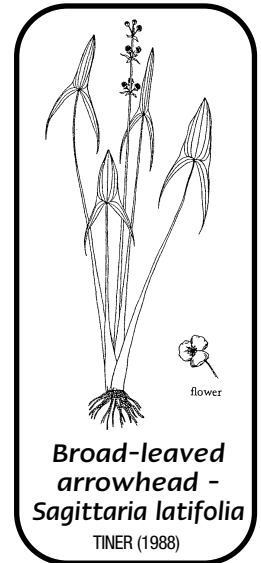
The area between the highest high tide and the lowest low tide; the area covered by the highest tides and exposed during the lowest tides. Alternatively, Mitsch (1993 p. 231) makes “intertidal zone” synonymous with “low marsh”.

SEASONAL SUCCESSION: THE MARSH IN TIME

The appearance of a tidal freshwater marsh varies dramatically over the course of the growing season. The following description is from *Odum, et al.* (1984), slightly modified.

During the winter, the marsh looks like a barren mudflat with a stream meandering through it. The first sign of renewed plant life is the emergence of **spatterdock** in the low intertidal zone. Shortly thereafter, as temperatures rise, the spike-like projections of **arrow-arum** and **pickerel weed** poke through the muck from underground rhizomes. Interspersed among these emerging perennials are large numbers of seedlings, mostly **wild rice**, **bur marigold**, **halberd-leaved tearthumb**, **arrow-leaved tearthumb**, and **smartweeds**. By early May, the broad-leaved emergents totally dominate the intertidal zone, forming a low dense canopy over the other species. In places, this canopy may be overtopped by the long pointed leaves of **cattail**. **Yellow flag** blooms at the water's edge, and can be found at the Creek mouth and along the inner edge of the levee. **Sweet flag** is prominent on the high mud flat adjacent to Broad Street in Site 2. The distinctive flowers of **arrow-arum** appear: a 4-8 inch leaf-like spathe curled around a yellowish, pencil-shaped spadix. By early summer, grasses such as **wild rice** begin to overtop the broad-leaved perennials, to be followed by **bur marigold**, **tearthumb**, **jewelweed**, **smartweed**, **clearweed**, **water hemp**, and many annuals. By July, the diversity has become noteworthy, with as many as 30 to 50 species appearing in a single location. **Pickerelweed**, until now hard to distinguish from arrow-arum, produces its conspicuous purple flowers. In late July, the leaves of **arrow-arum** begin to yellow and die back, due to the intense summer heat. August brings a surge of growth in the flower-bearing stalks of **wild rice** and other grasses.

In September, thickets of **bur marigold** are outlined by bright yellow blossoms. The delicate white blossoms of **broad-leaved arrowhead**, and the small bud-like flowers of **halberd-leaved tearthumb** and **arrow-leaved tearthumb** appear. The spathe of **arrow-arum** has become a plump pod-like organ full of small green fruits, hanging at the end of a long thick stem. As the autumn progresses, the stems and leaves of **tearthumb** turn red, stands of **wild rice** fall under the force of the wind, and dense clumps of **arrow arum** are reduced to mud-covered stubs. November frosts kill the remaining plants. By winter, all that is left is a tangled mat of dead stems which breaks up and disperses under tidal action, leaving a barren mudflat until spring.



GEOLOGY

The underlying geology of the Creek consists of stratified sand and clay deposited during the late Cretaceous period, over 85 million years ago. These deposits consist of the Magothy Formation (perhaps 50 feet thick) and the underlying Potomac Formation (up to 200 feet thick). They are part of the aquifer that supplies drinking water in our region. Although the regional aquifer is often referred to as the Potomac-Raritan-Magothy, in Riverton the Raritan deposits are absent, and the Magothy directly overlies the Potomac (based on *Bedrock Geologic Map of Central and Southern New Jersey*, USGS Map I-2540-B). The Pompeston Creek watershed is part of the recharge area for the aquifer: that is, an area in which water from the surface can percolate directly down to refill the aquifer. Development that seals the surface of the land reduces the rate of recharge, and chemical pollution of the watershed can lead to contamination of the aquifer.

The Creek itself was formed at the end of the Pleistocene Age (about 11,000 years ago), when the climate was cold, the landscape barren, and sea levels lower than now. Although southern New Jersey was not glaciated, the melting of glaciers in northern New Jersey, Pennsylvania, and New York produced streams and rivers that carved out valleys and shaped the landscape here. The Pompeston is a “drowned valley” from that era, a valley that is now filled and emptied twice daily by tidal water from the Delaware. The Creek exhibits features of a periglacial (cold climate) phenomenon called valley asymmetry, which can be seen by comparing the two sides, as noted in the narrative. The south-facing banks (on the Cinnaminson side) are lower, while the north-facing slopes (on the Riverton side) still stand. This is the result of differences in weathering due to microclimates on opposite sides of the Creek. The south-facing banks were warmed and cooled to a greater extent, causing greater breakdown.

SOIL

The Pompeston Creek is located in the Inter Coastal Plain of New Jersey. The upland soil from the mouth of the Creek to River Road is Klej fine sand. The soil northeast and southwest of River Road, beyond the tidal marsh deposits, is Galestone sand. Klej fine sand also runs along the marsh between the Creek and the Galestone deposits, just northeast of the Creek upstream from River Road. Both soils are well drained and have a sandy to loamy subsoil resting on beds of gravel (small rocks measuring 0.25 to 2.5 inches across) and “cobblestones” (medium-sized rocks measuring 2.5 to 10 inches across). Within the marsh, the soil consists of fine sand, brown silt, and muck, which form tidal flats from 3 to 10 feet thick. The height of the flats visible above the water is typically 1 to 4 feet. The center of the channel is made up of coarse sand, gravel, and small stones.

Characterization of soil, like the presence of hydrophytic plants, is an important criterion for identifying wetlands. Soils that support the growth of hydrophytes are called “hydric soils”, defined as “soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part”. Extended wetness inhibits the breakdown of plant material by aerobic bacteria, which can’t survive under these conditions, so organic matter (muck or peat) builds up on the surface. Muck is organic matter that breaks down into a greasy mass upon rubbing between the hands (try it!), of which less than one-third can be identified (leaves, stems, roots). In peat, more than two-thirds of the organic material can be identified (in-between are mucky peats and peaty mucks). If this organic layer is less than 16 inches thick, and has a mineral (non-organic) soil beneath it, the soil is classified as predominantly mineral. If a shovel or auger easily penetrates at least 16 inches, the surface layer is presumed to be muck or peat and the soil is classified as organic. The upper layers of the flats in the Pompeston appear to be muck to a depth of more than 16 inches. This muck is saturated during most of the year. If you step on it, you will sink in from a few inches to a foot or more.

The anaerobic condition of marsh soil explains the predominance of marsh plants, which are adapted for growth and reproduction in soil that is deficient in oxygen. An adaptation found in nearly all wetland plants, for example, is the development of air spaces (*aerenchyma*) in roots and stems, which allows oxygen to diffuse from the aerial parts of the plants into the roots (*Mitsch* 1993).

A good introduction to other aspects of the art of identifying wetland soils (e.g., color, sand content) can be found in *Tiner* (1998).

THE INVENTORY: PLANTS

Table 1 shows the 100 species of plants identified in October of 2002 by Dr. Gerry Moore. The table indicates the sites in which the plants were seen. The table also indicates whether the plant is listed in the U.S. Fish and Wildlife Service’s *1996 National List Of Vascular Plants That Occur In Wetlands, Northeast Region*. Each listed plant is classified according to its status as an indicator of wetlands, using the following system:

Obligate (OBL): A greater than 99% chance that the plant, if located, will be in wetlands

Facultative Wetland (FACW): Usually occurs in wetlands (67%-99% probability), but sometimes found in non-wetlands

Facultative (**FAC**): Equally likely to be found in wetlands or non-wetlands (34%-66%)

Facultative Upland (**FACU**): A 67%-99% chance that the plant will be found in non-wetlands, but occasionally found in wetlands (1-33%)

Obligate Upland (**UPL**): A greater than 99% chance that the plant occurs in non-wetlands in the specified region (i.e., the Northeastern U.S.), but may occur in wetlands in another region.

N/A: not on the F&WS list

A + or – after the abbreviation indicates whether the plant is on the wetter or drier side of the range, respectively.

TABLE 1

Plants found in Pompeston Creek watershed during 21 October 2002 survey

Site 1: area near the Cinnaminson/Riverton border; **Site 2:** area adjacent to County Route 543; **Site 3:** area near confluence with the Delaware River; * = non-native species

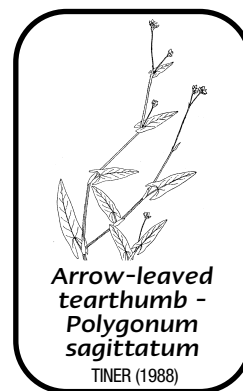
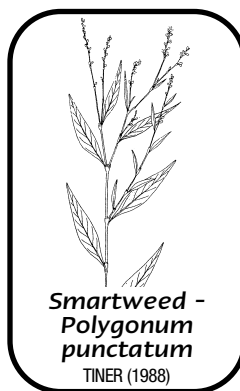
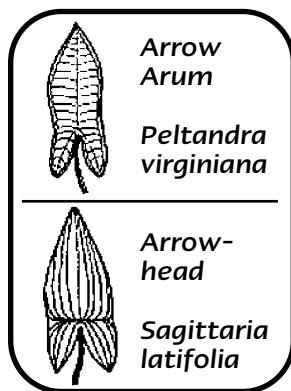
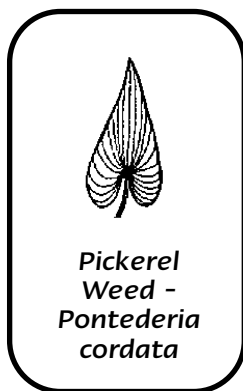
LATIN NAME	COMMON NAME	SITES	WETLANDS CATEGORY
<i>Acer negundo</i>	box elder	1,2,3	FAC +
<i>Acer platanoides</i> *	Norway maple	1,2	UPL
<i>Acer rubrum</i>	red maple	1,2	FAC
<i>Acer sacharinum</i>	sugar maple	1,2,3	FACW
<i>Achillea millefolium</i>	yarrow	3	FACU
<i>Acnida cannabina</i>	saltmarsh water hemp	1,2	OBL
<i>Ailanthus altissima</i> *	tree-of-heaven	1,3	FACU -
<i>Alliaria petiolata</i> *	garlic mustard	1,2,3	FACU -
<i>Allium vineale</i>	field garlic	1,2,3	FACU -
<i>Amelopsis brevipedunculata</i> *	porcelain-berry	1,2,3	N/A
<i>Amorpha fruticosa</i>	bastard indigo	1,2,3	FACW
<i>Artemisia annua</i> *	fragrant wormwood	3	FACU
<i>Artemisia vulgaris</i> *	common mugwort	3	UPL
<i>Arundinaria sp.</i> *	bamboo	2,3	Depends on species
<i>Aster spp.</i>	aster	1,2,3	Depends on species
<i>Bidens laevis</i>	large bur-marigold	1,2	OBL
<i>Catalpa bignonioides</i> *	catalpa	1,2,3	UPL
<i>Celastrus orbiculatus</i> *	oriental bittersweet	1	FACU
<i>Celtis occidentalis</i>	hackberry	1,2,3	FACU
<i>Ceratophyllum demersum</i>	coontail	1	OBL

LATIN NAME	COMMON NAME	SITES	WETLANDS CATEGORY
<i>Chenopodium album</i>	lamb's quarters	3	FACU +
<i>Chenopodium spp.</i>	goosefoot	2,3	Depends on species
<i>Clematis ternifolia</i> *	Japanese clematis	1,2,3	N/A
<i>Clethra alnifolia</i>	sweet pepperbush	1,2,3	FAC +
<i>Conyza canadensis</i>	horseweed	3	UPL
<i>Cornus amomum</i>	silky dogwood	2	FACU
<i>Cornus florida</i>	flowering dogwood	2	FACU -
<i>Daucus carota</i> *	Queen Anne's lace	3	N/A
<i>Dechampsia flexuosa</i>	crinkled hairgrass	2	N/A
<i>Digitaria sp.</i>	crabgrass	2	Depends on species
<i>Eupatorium rugosum</i>	white snakeroot	1,2	N/A
<i>Euthamia graminifolia</i>	flat-topped goldenrod	3	FAC
<i>Fagus grandifolia</i>	beech	1,2,3	FACU
<i>Fraxinus americana</i>	white ash	1,2,3	FACU
<i>Hedera helix</i> *	English ivy	1	N/A
<i>Heterotheca subaxillaris</i>	camphorweed	3	UPL
<i>Humulus japonicus</i> *	Japanese hops	2,3	FACU
<i>Ilex opaca</i>	American holly	1,3	FACU
<i>Ilex verticillata</i>	winterberry	1	FACW +
<i>Impatiens capensis</i>	jewelweed	1,2	FACW
<i>Juniperus virginiana</i>	red cedar	1	FACU
<i>Kalmia latifolia</i>	mountain laurel	1,2	FACU
<i>Leersia oryzoides</i>	rice cutgrass	1,2	OBL
<i>Lindera benzoin</i>	spicebush	1	FACW -
<i>Liriodendron tulipifera</i>	tulip poplar	2	FACU
<i>Lonicera japonica</i> *	Japanese honeysuckle	1,2,3	FAC -
<i>Lycopus sp.</i>	horehound	1,2	Depends on species
<i>Malus sp.*</i>	crabapple	2	N/A
<i>Morus alba</i> *	white mulberry	1,2,3	UPL
<i>Nuphar advena</i>	spatterdock	1,2	OBL
<i>Nyssa sylvatica</i>	black gum	1,2,3	FAC
<i>Oenothera biennis</i>	evening primrose	3	FACU -
<i>Onoclea sensibilis</i>	sensitive fern	1,2	FACW
<i>Panicum clandestinum</i>	deer-tongue grass	2	N/A
<i>Parthenocissus quinquefolia</i>	Virginia creeper	1,2,3	FACU
<i>Paulownia tomentosa</i> *	princess tree	2	UPL
<i>Peltandra virginiana</i>	arrow arum	2	OBL
<i>Philadelphus coronarius</i> *	mock orange	2	N/A
<i>Phragmites australis</i> *	common reed	1	FACW
<i>Physocarpus opulifolius</i>	ninebark	2	FACW -
<i>Phytolacca americana</i>	pokeweed	2,3	FACU +

LATIN NAME	COMMON NAME	SITES	WETLANDS CATEGORY
<i>Pilea pumila</i>	clearweed	1,2	FACW
<i>Platanus occidentalis</i>	sycamore	1,2,3	FACW -
<i>Polygonum aviculare</i> *	prostrate knapweed	2	FACU
<i>Polygonum cespitosum</i> var. <i>longisetum</i> *	long-bristled smartweed	1,2,3	FACU -
<i>Polygonum cupsidatum</i> *	Japanese knotweed	2	FACU -
<i>Polygonum punctatum</i>	dotted smartweed	1,2,3	OBL
<i>Polygonum sagittatum</i>	arrow-leaved tearthumb	1,2	OBL
<i>Polygonum virginianum</i>	Virginia knotweed	1	FAC
<i>Prunus serotina</i>	black cherry	1,2,3	FACU
<i>Pueraria montana</i> *	kudzu	3	N/A
<i>Quercus alba</i>	white oak	1,2	FACU
<i>Quercus montana</i>	chestnut oak	1	N/A
<i>Quercus palustris</i>	pin oak	2	FACW
<i>Quercus velutina</i>	black oak	1,2,3	N/A
<i>Robinia pseudoacacia</i> *	black locust	1,2,3	FACU -
<i>Rosa multiflora</i> *	multiflora rose	2	FACU
<i>Rubus pensilvanicus</i>	leafy-flowered blackberry	2	N/A
<i>Rubus</i> spp.	blackberry	1,2,3	Depends on species
<i>Sagittaria latifolia</i>	broad-leaved arrowhead	1,2	OBL
<i>Salix babylonica</i> *	weeping willow	2	FACW -
<i>Salix nigra</i>	black willow	1,3	FACW +
<i>Sambucus canadensis</i>	elderberry	1	FACW
<i>Saponaria officinalis</i> *	bouncing bet	2,3	FACU -
<i>Sassafras albidum</i>	sassafras	1,2	FACU -
<i>Sicyos angulatus</i>	star cucumber	3	FACU
<i>Smilacina racemosa</i>	false solomon's seal	1	N/A
<i>Smilax glauca</i>	glaucous greenbrier	2	FACU
<i>Smilax rotundifolia</i>	common greenbrier	1,2,3	FAC
<i>Solidago</i> spp.	goldenrod	1,2,3	Depends on species
<i>Taxus cuspidata</i> *	Japanese yew	1	N/A
<i>Toxicodendron radicans</i>	poison ivy	1,2,3	FAC
<i>Typha x glauca</i>	cat-tail	1	OBL
<i>Ulmus americana</i>	American elm	1,2	FACW -
<i>Urtica dioica</i>	stinging nettle	1	FACU
<i>Verbascum thapsus</i> *	common mullein	3	N/A
<i>Vernonia noveboracensis</i>	New York ironweed	2	FACW +
<i>Viburnum dentatum</i>	arrow-wood	1,2	FAC
<i>Vitis labrusca</i>	fox grape	1,2,3	FACU
<i>Zizania aquatica</i>	wild rice	1,2	OBL

Notable to the survey team was the presence of a large number of invasive species. **Of the 100 plants identified, 29 (29%) are not native to New Jersey.** These plants are indicated with an asterisk. Some of the most common invasive plants are **Norway maple, porcelain-berry, garlic mustard, bamboo, oriental bittersweet, Japanese clematis, Japanese hops, Japanese honeysuckle, Phragmites australis, prostrate knapweed, Japanese knotweed, and black locust.** Dr. Moore recommends monitoring and control to limit the spread of these plants. Elimination of **kudzu** from the ground and trees of Site 3 would allow the development of a more normal understory and tree canopy. Removal of **Phragmites australis**, the spread of which seems to be limited so far, would help to preserve the diversity of the marsh. Both projects appear to be feasible.

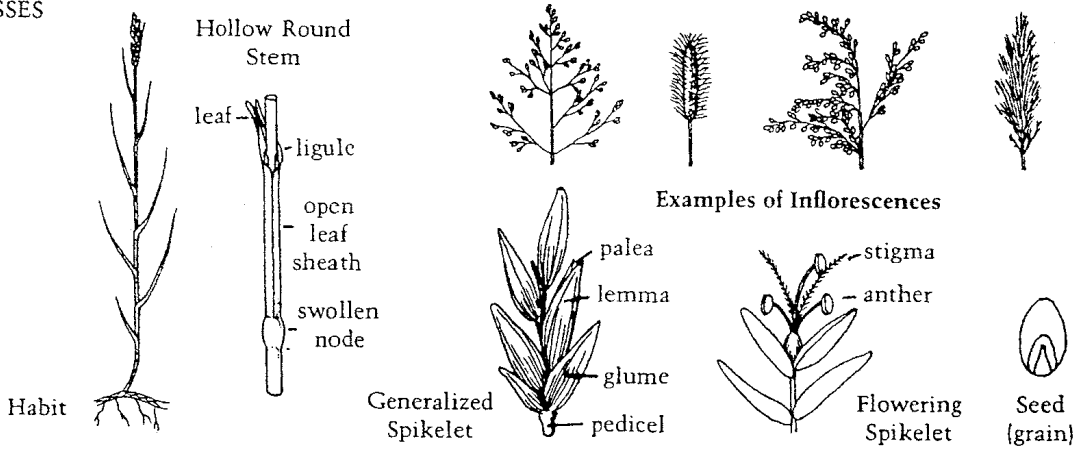
Additional plants (table below) were identified by Tom and Lee McAvinnia of the Burlington County Master Gardeners Program. Photographs of some of these 12 plants as well as others included in the table above can be found on the website.



LATIN NAME	COMMON NAME	WETLANDS CATEGORY
<i>Asarum canadense</i>	wild ginger	FACU-
<i>Berberis sp.</i>	barberry	Depends on species
<i>Osmunda Cinnamonea</i>	cinnamon fern	FACW
<i>Cornus Canadensis</i>	bunchberry dogwood	FACW
<i>Cuscutor sp.</i>	dodder	N/A
<i>Decodon verticillatus</i>	swamp loosestrife	OBL
<i>Epimedium</i>	barrenwort	N/A
<i>Philadelphus inodorus</i>	scentless mock orange	N/A
<i>Pontederia cordata</i>	pickerelweed	OBL
<i>Tradescantia L.</i>	spiderwort	Depends on species
<i>Iris pseudacorus*</i>	yellow flag	OBL
<i>Acorus calamus</i>	sweet flag	OBL

Figure 5 - Guide to distinguishing Grasses, Sedges & Rushes

GRASSES



SEDGES

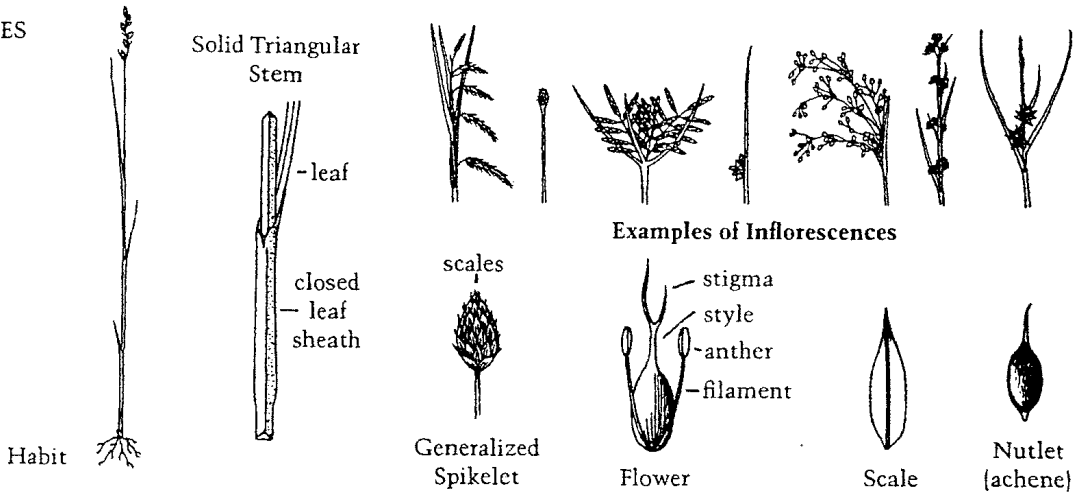


Figure 5 - Guide to distinguishing Grasses, Sedges & Rushes Continued

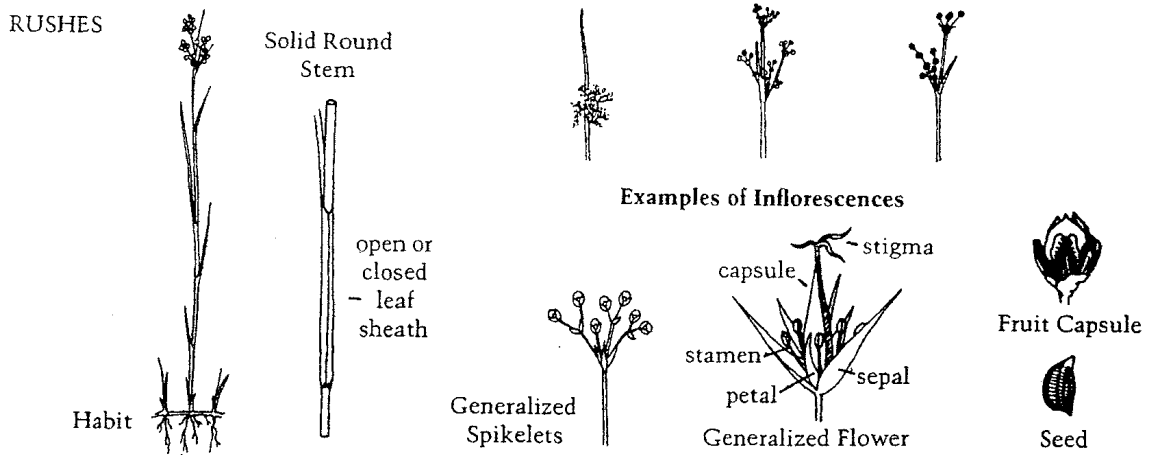


Figure 5. Distinguishing characteristics of grasses, sedges, and rushes. (Source: modified from *A Field Guide to Coastal Wetland Plants of the Northeastern United States*, Tiner 1987) Grasses have hollow round stems with swollen nodes, open leaf sheaths, and grainlike seeds covered by two papery scales. Sedges usually have solid triangular stems lacking nodes, closed leaf sheaths, and nutlets covered by one papery scale. Rushes have solid round stems lacking nodes, true flowers with six petals, and fruit capsules bearing numerous small seeds.

ANIMALS (INTRODUCTION)

Tidal wetlands are used by wildlife for feeding, nesting, and shelter. Some species are wetland obligates and spend all of their time in the wetlands and creeks. Many of the species found in freshwater tidal wetlands are facultative wetland species. They benefit from the wetland habitat for some aspect of their existence, but are capable of using other types of habitat. Many obligate and facultative species found in tidal wetlands require adjacent upland habitat (the woods and open space that still surround the Creek at a number of locations) for some part of their daily activities and life cycles. **The survival of these species in our area may depend upon preservation of this upland habitat.**

For example, terrestrial species that use the marshes at lower tides move into shallow waters and dry uplands to escape high tides. Several bird species that feed within the wetlands use adjacent forests as nesting areas. Forest edges provide perching sites overlooking hunting grounds for some raptor species. Turtles leave wetlands to lay their eggs in sunny embankments adjacent to wetlands. Some turtles burrow into creek embankments lined with roots to hibernate. Muskrats make their burrows in these embankments.

The diversity of wildlife species in a wood is generally related to the structural diversity of the vegetation (i.e., ground, shrub, and canopy layers) both vertically and horizontally, as well as the presence of unique habitats (vernal pools and other features). The survey team notes that structural diversity of vegetation at the mouth of the Creek has been suppressed by the dominance of invasive kudzu and other problems. This section of the stream corridor would benefit from a major effort at restoration, which would encourage wildlife.

The species composition of tidal wetlands varies seasonally. During spring and fall, birds migrating along the Delaware River seek food, shelter, and rest in the marshes, reaching high concentrations in these rich habitats. Some stay, along with year-round residents, to breed in the marsh or adjacent uplands in late spring and summer. Fish move into the marsh to spawn at this time. In winter, the marsh provides shelter and foraging habitat for resident species.

The food chain in tidal freshwater wetlands is detrital-based with the exception of a few grazers such as muskrat, some fish species, and some insects. Invertebrates (including mollusks) and fish provide a food source for the abundant bird and small mammal community. In turn, these species are consumed by top predators such as hawks, owls, fox, and raccoons.

The rarity of healthy natural habitats in urbanized landscapes results in the funneling of species into the habitat that remains, inflating the importance of places like the Pompeston for maintaining regional wildlife diversity.

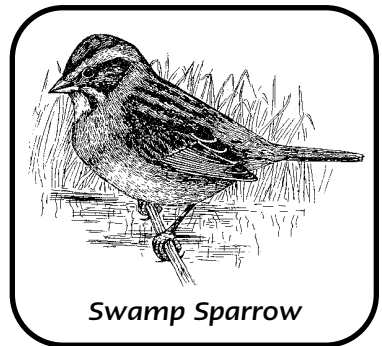
BIRDS

Freshwater tidal marshes support a greater variety of birds than any other type of wetland. The following are confirmed sightings:

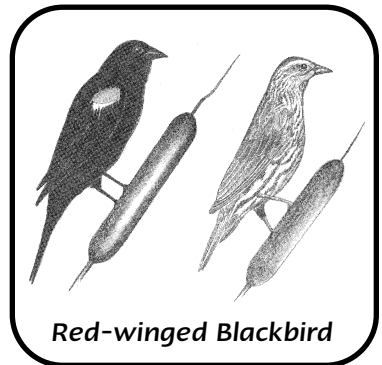
The survey team identified 13 birds during their visit: **Ruby-crowned Kinglet**; **White-throated Sparrow**; **Song Sparrow**; **American Goldfinch**; **Mallards**; **Grey Catbird**; **Red-tailed Hawk**; **Common Grackle**; **White-breasted Nuthatch**; **Blue Jay**; **Junco**; **Marsh Wren**; and **Red-winged Blackbird**.



Marsh Wren



Swamp Sparrow



Red-winged Blackbird

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Ned Gilmore adds **Great Blue Heron**; **Osprey**; **American Egret**; **Tree Swallow**; **Warblers**; and the **Belted Kingfisher**. We have also seen the **Snowy Egret**, and, tentatively, **Marsh Sparrows** and **Cormorants** (confirmation would be welcomed!). Within the last few years, although not at present, a **Bald Eagle** was roosting for weeks in the woods adjacent to the Creek mouth and was seen by many residents. **Bald Eagles** are present within the watershed. On October 3rd, 2003, a **Bald Eagle** spotted by Debbie Lord landed in a field in Pompeston Park near New Albany Road in Moorestown, less than 300 yards from the Creek. **Wild Turkey** have also been seen in the Pompeston watershed in Moorestown.

The survey team has provided the following list that includes birds that *might* be found in and around the Pompeston Creek, given the habitat. This list indicates, both for the possibles and for some of the confirmed species, when the birds might be seen, and whether they are likely to be breeding in the marsh or surrounding woods; wintering; stopping during migration; or merely feeding. Birds that are threatened or endangered at the state or federal level are also noted. Some species observed within the Pompeston Creek watershed in Moorestown are also mentioned, and identified as such. We hope that visitors to the Creek will keep an eye out for these birds, especially the threatened and endangered species. We welcome all reports of sightings. Contact us on the website.

Waterfowl: Emergent vegetation and the small aquatic invertebrates of tidal wetlands are an important source of food for waterfowl. Species using the marsh for food and breeding may include **Mallard** (confirmed), **Black Duck**, and **Canada Goose** (confirmed). **Wood Ducks** may nest in tree cavities. Species using the marsh and the Delaware for wintering or for shelter from storms may include those listed above as well as **Blue-winged Teal**, **Green-winged Teal**, **Gadwell**, **Ruddy Duck**, **Common Merganser**, **Redhead**, **American Widgeon**, **Northern Shoveler**, **Northern Pintails**, **Ring-necked Ducks**, **Greater and Lesser Scaup**, and **Bufflehead**.

Grebes: The **Pied-bill Grebe**, a NJ state-endangered species, might be found in the marsh, although probably not in winter, when these birds move to coastal areas.

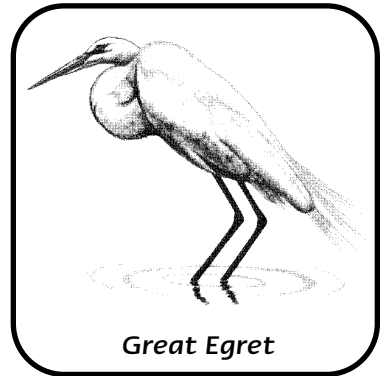
Rails and their Allies: **Rails** are obligate wetland species, specialized for breeding in wetlands with emergent vegetation like that of the Pompeston. They eat seeds and small invertebrates, and build up hummock nests to about 6 inches above water level. Species that may breed in the marsh include **King Rail**, **Virginia Rail**, **Yellow Rail**, **Sorra Rail**, **American Coot**, and **Common Moorhen**. All of these excepting **American Coot** migrate south after the breeding season.

Cormorants: **Double-crested Cormorants** (year-round) and **Great Cormorants** (winter) may be found feeding in the open water or marsh.

Wading Birds: **Bitterns**, **Hérons**, and **Egrets** (excepting **Cattle Egrets**) depend upon wetlands. **Least Bittern** and **American Bittern** (the latter endangered in New Jersey) may breed in the marsh. **Green Heron** are common in New Jersey, and may nest in woods adjacent to the marsh. **Great Blue Heron** and **Snowy Egret** have been seen in the marsh, and **Great Egret** may be present, but none of these species is thought to be breeding in the marsh. **Black-crowned Night Heron** was once found in Burlington County, but is now limited to coastal marshes.



Belted Kingfisher



Great Egret

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Kingfishers: **Belted Kingfisher** may build their nest burrows in the banks at the edge of the marsh, and can be seen year-round diving after fish.

Passerines and Woodpeckers: **Red-winged Blackbirds** and **Marsh Wrens**, wetland species that build their nests in tall emergent vegetation, appear to be breeding in abundance. **Swamp sparrows** are also likely breeding, although their low nests are more vulnerable to flooding. Among other species not dependent on wetlands but known to nest in freshwater marshes are **American Goldfinch**, which is common in the marsh, **Song Sparrow** (also present), and **Rufous-sided Towhee**. The narrow riparian woodlands and forested uplands may harbor **Yellow Warbler**, **Wood Thrush**, **American Robin**, **Blue Jay** (confirmed), **Catbird** (confirmed), **Baltimore Oriole**, and **Red-bellied Woodpecker**. **Woodpeckers** are present (species need to be identified). **Bobolink**, a State-endangered species, might be found eating the seeds of marsh plants. **Great-crested Flycatchers** may perch in trees to hunt for aerial insects. **Swallows** have been seen swooping after insects. **Indigo Buntings**, **Scarlet Tanagers**, and **Cedar Waxwings** have been seen by Debbie Lord at the Creek in Moorestown.

Shorebirds: **Killdeer**, **Woodcock**, and **Spotted Sandpiper** are potentially breeding in the marsh. **Gulls** and **Terns** are found on the Delaware in spring, fall, and winter, and probably use the Creek as well.

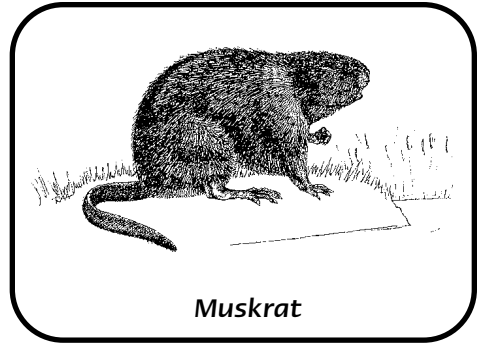
Birds of Prey: **Northern Harrier**, a NJ-endangered low-nesting raptor, might be found in the marsh. **Red-tailed Hawk** may be nesting in sites 1 and 2. **Great-Horned Owls** may nest in the woods. **Long-eared** and **Short-eared Owls** (State-threatened and endangered, respectively) and **Rough-legged Hawks** may winter here (this hawk has been seen in Riverton). Other species that might be seen hunting rodents, insects, and small birds are **Sharp-shinned Hawk**, **Cooper's Hawk** (state-threatened), **American Kestrel**, **Broad-winged Hawk**, and **Red-shouldered Hawk** (state-endangered). **Bald Eagle** (state and federal endangered) has been known to visit the woodlands adjacent to the Creek. **Turkey Vultures** are present in the watershed in Moorestown.

MAMMALS

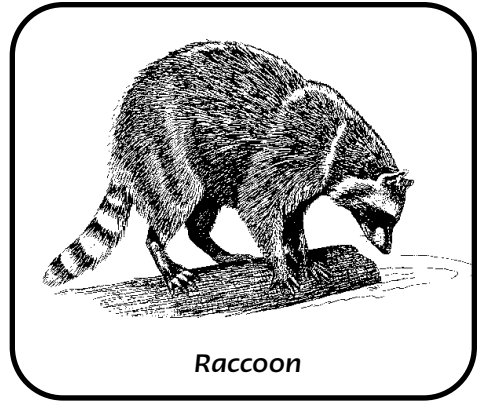
Muskrats live in burrows and lodges within the Pompeston marsh. They feed heavily on the roots, rhizomes, and shoots of marsh plants. Because these roots and rhizomes are the fiber that binds the soil of the flats, muskrat “eat-out” can have a deleterious effect on a marsh, resulting in the loosening and washing away of soil.

Woodchucks (Groundhogs) are known to build their burrows close to the Pompeston, but it is not known whether they regularly enter the marsh to forage for vegetation at low tide. **Raccoon**, **Opossum**, and **Skunk** have been seen. These animals are omnivorous, and might be found looking for food in the marsh. **Raccoons** are thought to be responsible for raiding the nests of turtles for eggs and injuring adult turtles. **Eastern Mole** has been seen in the upland woods. The **Eastern Grey Squirrel** and **Eastern Chipmunk** are present in the woods and riparian strip along the Creek. J.H. Taylor has reported **White-Tailed Deer**, **Eastern Cottontail**, **Meadow Mouse**, and **Vole** within the watershed, although not specifically on the Pompeston. Taylor also cites the **Kangaroo Mouse**, which does frequent marshes, but which the survey team believes may be an incorrect identification.

Other mammals not confirmed but potentially present are **Beaver** (active at the nearby Taylor Wildlife Preserve and undoubtedly historically present in the Pompeston); **Mink** and **River Otter**, probably present historically but likely to have been driven away by urbanization; and **Long-tailed Weasel**, more of a habitat generalist than **Mink** and **River Otter** and therefore potentially still present at the marsh edges and in the marsh at low tide. There is evidence of recent **Beaver** activity near Pompeston Park in Moorestown.



Muskrat



Raccoon

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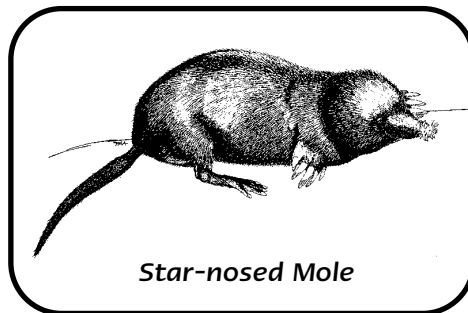
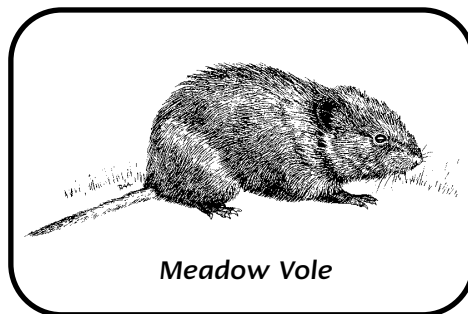
Insectivores such as **Masked Shrew**, **Least Shrew**, **Shorttail Shrew**, and **Starnose Mole** may live at the marsh edge and in the woods. **Starnose Mole** is adapted to marsh habitat, and confirmation of its presence would be interesting. Rodents such as **White-footed Mouse**, **House Mouse**, and **Norway Rat** are likely to be present in the woodlands and in the marsh at low tide. **Meadow voles**, which are capable of living under very wet marsh conditions due to their ability to swim, are probably common. **Woodland Jumping Mouse** (Taylor's "**Kangaroo Mouse**"?) may be living in and around the marsh. **Rice Rat**, a semiaquatic wetland species, is at the northern extreme of its range in this area, and may be present in the marsh.

Bats are roosting in adjacent woods and buildings, foraging for insects in the marsh. Ned Gilmore confirms the presence of **Little Brown Myotis**, **Red Bat**, and **Big Brown Bat**. The survey team suggests that the finding of **Small-footed Myotis**, **Silver-haired Bat**, **Eastern Pipsistral**, and **Hoary Bat** would be consistent with the habitat.

White-tailed Deer are present in the watershed within a mile of the Creek, notably at the Taylor Wildlife Preserve and the Palmyra Cove Nature Park. There is a herd of **White-tailed Deer** in Pompeston Park in Moorestown. They may also be present at times in the woods along the Pompeston in Riverton and Cinnaminson.

Grey Fox and **Red Fox** live within the watershed and may be present along the Pompeston. **Coyote** are possible but unlikely. The **Bobcat**, an extremely secretive animal that is on the State Endangered Species List, is a possible although very unlikely inhabitant of the watershed.

Feral Cats and **Dogs** are probably present. **Cats** can take a heavy toll on native songbirds and ground-nesting species.



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FISH

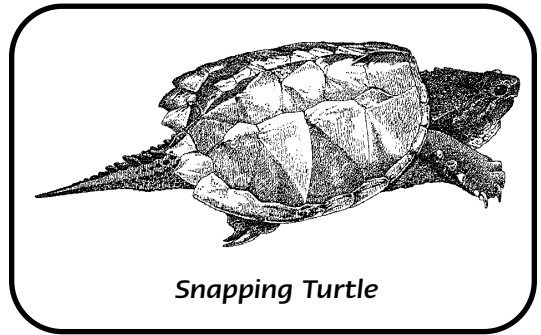
The upper Delaware estuary supports more than 60 species of fish, many of which can be found in the river at Riverton and in the Pompeston Creek. Creeks like the Pompeston serve as spawning grounds, shelter, nurseries, and juvenile habitat for many freshwater fish.

Ned Gilmore reports that fish abundance returned to the Delaware with cleaner water in the early 1980s. Prior to that, the common catch for anglers was **Brown Bullhead Catfish, American Eel, Yellow Perch, and Carp**. Now, **Large-mouth Bass, Striped Bass, White Perch, Channel Catfish, and White Catfish** are also commonly caught. Most of the fish are year-round inhabitants. Other fish are anadromous: they spend most of their lives in salt water but return to fresh water to spawn. In our area, these include **American Shad, Hickory Shad, Sea Lamprey, Herring, Alewife, and Atlantic Sturgeon**. The **American Eel**, by contrast, is catadromous. This fish, which may take up to 25 years to reach maturity, lives in fresh and brackish water when mature and returns to the Sargasso Sea to spawn, lay eggs, and die.

The Creek supports large schools of **Shiners, Mummichog, and Banded Killifish**, which can be seen at low tide as they dart from the shallows to deeper pools. The **Tessellated Darter** rests on the bottom among the aquatic plants, while **Pumpkinseed Sunfish** prefer to stay hidden along steep banks or around submerged objects.

REPTILES

Six species of turtles inhabit the Creek and uplands. The largest, capable of reaching 35 pounds, is the **Common Snapping Turtle**. Rarely leaving the water, a female **Snapping Turtle** will emerge for a short time in late May through June to lay eggs in soil near the Creek. Larger turtles can lay over 20 eggs, which will hatch in late summer to early fall. Cinnaminson's "**Turtle Lady**" (Cindy Pierson) has devoted enormous effort to monitoring and supporting the **Snapping Turtle** population, from hatching and releasing, to education, to posting "Turtle Crossing" signs along local roads and keeping track of the number of turtles hit by cars. Four other aquatic turtles live in the Creek. The **Red-Bellied Turtle**, second in size to the **Snapping Turtle**, can be seen basking on the banks or on logs. It has a black head and carapace and a pinkish plastron with gray smudges, and a serrated jaw for ripping apart plants. The **Eastern Painted Turtle** and **Musk Turtle** are abundant in the Creek. A population of **Red-eared Sliders**, native to the Gulf Coast and Mid-western States, has become established due to the escape of pets. The effect of this turtle on the ecosystem is unknown. The **Box Turtle** is the only terrestrial turtle found along the Creek, and although once common in our area, has become rare because of human activity.



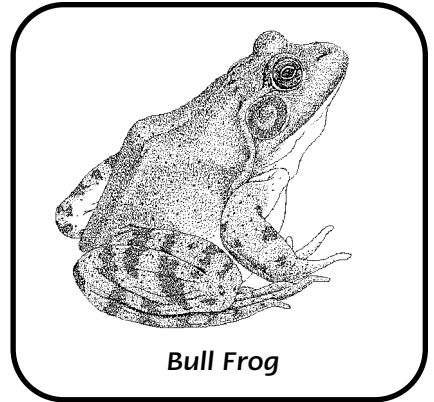
Snapping Turtle

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Only five species of snakes are known to occur along the Creek. The **Northern Water Snake**, although not abundant, can sometimes be seen at the water's edge as it hunts for fish and frogs. The **Eastern Garter Snake** and **Northern Brown Snake** are far more common, although not easy to see. There have been several sightings of **Black Rat Snakes** in the past few years, but this snake is assumed to be uncommon. The collection of the Academy of Natural Sciences in Philadelphia contains a specimen of **Northern Black Racer** collected from Riverton in 1901. None has been seen in recent years in Riverton or Cinnaminson, but a **Black Racer** was found in a yard on Fernwood Road (off New Albany) in Moorestown during the summer of 2003. It was relocated to Pompeston Park in Moorestown.

AMPHIBIANS

The **Bullfrog** and **Green Frog** inhabit the Creek and may be seen or heard in pools within the lily pond area. **Fowler's Toad** may be encountered along the trails. **Red-Backed Salamander** is the only salamander found along the tidal portion of the Creek. It lives on the forested slopes under rotten logs and other debris. The **Northern Two-Lined Salamander** is living and breeding in the Creek in Moorestown. **Spring Peepers** and **New Jersey Chorus Frogs** are found in Pompeston Park in Moorestown.



Bull Frog

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INSECTS

Several hundred species of insects have been identified in Riverton, which was once regarded as a popular collecting location. Insects caught here can be found in several museum collections, including that of the Academy of Natural Sciences in Philadelphia.

Dragonflies, damselflies, butterflies, moths, beetles, wasps and **cicadas** can be found in abundance in warm weather. Within the marsh, look for insects on the leaves of plants. Be sure to check the undersides of leaves. Species collected during the benthic macroinvertebrate survey are listed in Table 4, below. Larvae of a number of species can be collected from the stream bottom.

Two insects are especially noteworthy. In 1902, the entomologist Charles W. Johnson collected several specimens of an unknown **cranefly** in the vicinity of Jack's Run, a small tributary of the Pompeston that runs parallel to Tenth Street in Riverton. He named it **Aeshnosoma rivertonensis**. Although this **cranefly** has not been seen in Riverton since that time, it has recently been found in Salem County. The second is the **Japanese beetle**, discussed in the *Narrative* above.

TABLE 2**Animals Identified or Potentially Present in the Pompeston Corridor**

Asterisks indicate species confirmed by the survey team or by Ned Gilmore as being present in the survey area.

A few species of interest identified as recently present in the Moorestown part of the watershed are noted with a parenthetical "Moorestown".

More extensive information about the Moorestown section of the Creek and its wildlife will appear on the website.

COMMON NAME	LATIN NAME
GEESE	
Canada goose*	<i>Branta canadensis</i>
DABBLING DUCKS	
American black duck	<i>Anas rubripes</i>
American wigeon	<i>Anas americana</i>
Blue-winged teal	<i>Anas discors</i>
Northern pintail	<i>Anas acuta</i>
Gadwall	<i>Anas strepera</i>
Green-winged teal	<i>Anas crecca</i>
Mallard *	<i>Anas platyrhynchos</i>
Northern shoveler	<i>Anas clypeata</i>
Wood duck	<i>Aix sponsa</i>
DIVING DUCKS	
Common merganser	<i>Mergus merganser</i>
Bufflehead	<i>Bucephalavalbeola</i>
Greater scaup	<i>Aythya marila</i>
Lesser scaup	<i>Aythya affinis</i>
Redhead	<i>Aythya americana</i>
Ring-necked duck	<i>Aythya collaris</i>
Ruddy duck	<i>Oxyura jamaicensis</i>
WADING BIRDS	
American bittern	<i>Botaurus lentiginosus</i>
Black-crowned night heron	<i>Nycticorax nycticorax</i>
Cattle egret	<i>Bubulcus ibis</i>
Great blue heron *	<i>Ardea herodias</i>
Great egret /American egret *	<i>Casmerodius albus</i>
Green heron	<i>Butorides striatus</i>
Least bittern	<i>Ixobrychus exilis</i>
Snowy egret *	<i>Egretta thula</i>

COMMON NAME	LATIN NAME
RALLIDS	
American coot	<i>Fulica americana</i>
Common gallinule (Moorhen)	<i>Gallinula chloropus</i>
King rail	<i>Rallus elegans</i>
Sora rail	<i>Porzana carolina</i>
Virginia rail	<i>Rallus limicola</i>
Yellow rail	<i>Coturnicops noveboracensis</i>
SHOREBIRDS	
Killdeer	<i>Charadrius vociferus</i>
Spotted sandpiper	<i>Actitis macularia</i>
Woodcock	<i>Scolopax minor</i>
OTHER WATERBIRDS	
Belted kingfisher *	<i>Ceryle alcyon</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Great cormorant	<i>Phalacrocorax carbo</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>
BIRDS OF PREY	
American kestrel	<i>Falco sparverius</i>
Bald eagle *	<i>Haliaeetus leucocephalus</i>
Broad-winged hawk	<i>Buteo platypterus</i>
Cooper's hawk	<i>Accipiter cooperii</i>
Eastern screech owl (Moorestown)	<i>Otis asio</i>
Great horned owl	<i>Bubo virginianus</i>
Long-eared owl	<i>Asio otus</i>
Northern harrier	<i>Circus cyaneus</i>
Osprey *	<i>Pandion haliaetus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Red-tailed hawk *	<i>Buteo jamaicensis</i>
Rough-legged hawk	<i>Buteo lagopus</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Short-eared owl	<i>Asio flammeus</i>
Turkey vulture (Moorestown)	<i>Cathartes aura</i>

COMMON NAME	LATIN NAME
SONGBIRDS	
Marsh wren *	<i>Cistothorus palustris</i>
Red-winged blackbird *	<i>Agelaius phoeniceus</i>
Common yellowthroat	<i>Geothlypis trichas</i>
Yellow warbler	<i>Dendroica petechia</i>
Swamp sparrow	<i>Melospiza georgiana</i>
Indigo bunting (Moorestown)	<i>Passerina cyanea</i>
Barn swallow	<i>Hirundo rustica</i>
Grey catbird *	<i>Dumetella carolinensis</i>
Willow flycatcher	<i>Empidonax traillii</i>
Tree swallow *	<i>Tachycineta bicolor</i>
Bank swallow	<i>Riparia riparia</i>
Song sparrow *	<i>Melospiza melodia</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
American goldfinch *	<i>Carduelis tristis</i>
American robin	<i>Turdus migratorius</i>
Baltimore oriole	<i>Icterus galbula</i>
Common grackle *	<i>Quiscalus quiscula</i>
Ruby-crowned kinglet *	<i>Regulus calendula</i>
White-breasted nuthatch *	<i>Sitta carolinensis</i>
Wood thrush	<i>Hylocichla mustelina</i>
Blue jay *	<i>Cyanocitta cristata</i>
Northern cardinal	<i>Cardinalis cardinalis</i>
Great-crested flycatcher	<i>Myiarchus crinitus</i>
White-throated sparrow *	<i>Zonotrichia albicollis</i>
Dark-eyed junco *	<i>Junco hyemalis</i>
Rufous-sided towhee	<i>Pipilo chlorurus</i>
Scarlet tanager (Moorestown)	<i>Piranga olivacea</i>
Cedar waxwing (Moorestown)	<i>Bombycilla cedrorum</i>
WOODPECKERS *	Unidentified species
Yellow-shafted flicker	<i>Colaptes auratus</i>
Red-bellied woodpecker	<i>Melanerpes carolinus</i>
PHEASANTS	
Bobwhite quail	<i>Colinus virginianus</i>
Ring-necked pheasant	<i>Phasianus colchicus</i>
Wild Turkey (Moorestown)	<i>Meleagris gallopavo</i>

COMMON NAME	LATIN NAME
MAMMALS	
Muskrat *	<i>Ondatra zibethica</i>
Beaver	<i>Castor canadensis</i>
River otter	<i>Lutra canadensis</i>
Mink	<i>Mustela vison</i>
Longtail weasel	<i>Mustela frenata</i>
Masked shrew	<i>Sorex cinereus</i>
Least shrew	<i>Cryptotis parva</i>
Shorttail shrew	<i>Blarina brevicauda</i>
Star-nose mole	<i>Condylura cristata</i>
Eastern mole	<i>Scalopus aquaticus</i>
White-footed mouse	<i>Peromyscus leucopus</i>
Norway rat	<i>Rattus norvegicus</i>
House mouse	<i>Mus musculus</i>
Woodland jumping mouse	<i>Napaeozapus insignis</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Rice rat	<i>Oryzomys palustris</i>
Little brown myotis *	<i>Myotis lucifugus</i>
Keen myotis	<i>Myotis keeni</i>
Small-footed myotis	<i>Myotis subulatus</i>
Silver-haired bat	<i>Lasiurus noctivagans</i>
Eastern pipistrel	<i>Pipistrellus hesperus</i>
Red bat *	<i>Lasiurus borealis</i>
Big brown bat *	<i>Eptesicus fuscus</i>
Hoary bat	<i>Lasiurus cinereus</i>
Eastern cottontail	<i>Sylvilagus nuttalli</i>
Woodchuck *	<i>Marmota monax</i>
Gray squirrel *	<i>Sciurus carolinensis</i>
Southern flying squirrel	<i>Glaucomys volans</i>
Eastern chipmunk *	<i>Tamias striatus</i>
Raccoon *	<i>Procyon lotor</i>
Opossum *	<i>Didelphis marsupialis</i>
Striped skunk *	<i>Mephitis mephitis</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Red fox	<i>Vulpes fulva</i>
Coyote	<i>Canis latrans</i>
Bobcat	<i>Lynx rufus</i>
White-tailed deer (Moorestown)	<i>Odocoileus virginianus</i>
Domestic cat (feral)	<i>Felis catus</i>
Domestic dog (feral)	<i>Canis familiaris</i>

COMMON NAME	LATIN NAME
FISH	
American shad *	<i>Alosa sapidissima</i>
Atlantic sturgeon	<i>Acipinser oxyrinchus</i>
Shortnose sturgeon	<i>Acipenser brevirostrum</i>
Blueback herring	<i>Alosa aestivalis</i>
Sea lamprey *	<i>Petromyzon marinus</i>
Striped bass *	<i>Morone saxatilis</i>
Alewife *	<i>Alosa pseudoharengus</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Yellow perch *	<i>Perca flavescens</i>
Spottail shiner	<i>Notropis hudsonius</i>
Shiners *	[Various species]
White perch *	<i>Morone americana</i>
White sucker	<i>Catostomus commersoni</i>
Atlantic tomcod	<i>Microgadus tomcod</i>
American eel *	<i>Anguilla rostrata</i>
Carp *	<i>Cyprinus carpio</i>
Largemouth bass *	<i>Micropterus dalmoides</i>
Brown bullhead catfish *	<i>Ameriurus nebulosus</i>
Channel catfish *	<i>Ictalurus punctatus</i>
White catfish *	<i>Ameiurus catus</i>
Hickory shad *	<i>Alosa medirocris</i>
Mummichog *	<i>Fundulus heteroclitus</i>
Herring *	<i>Clupea sp.</i>
Banded killifish *	<i>Fundulus diaphanus</i>
Tesselated darter *	<i>Etheostoma olmstedi</i>
Pumpkinseed sunfish *	<i>Lepomis gibbosus</i>
REPTILES	
Snapping turtle *	<i>Chelydra serpentina</i>
Eastern painted turtle *	<i>Chrysemys picta picta</i>
Redbelly turtle	<i>Pseudemys rubriventris</i>
Musk turtle (Stinkpot) *	<i>Sternotherus odoratus</i>
Eastern Mud turtle	<i>Kinosternon subrubrum</i>
Spotted Turtle	<i>Clemmys gutata</i>
Map turtle	<i>Graptemys geographica</i>
Wood turtle	<i>Clemmys insculpta</i>
Eastern box turtle *	<i>Terrapene carolina carolina</i>
Red-bellied turtle *	<i>Pseudemys sp.</i>

COMMON NAME	LATIN NAME
REPTILES (CONT'D)	
Five-lined skinks	<i>Eumeces fasciatus</i>
Northern water snake *	<i>Nerodia sipedon sipedon</i>
Eastern garter snakes *	<i>Thamnophis sirtalis sirtalis</i>
Milk snake	<i>Lampropeltis triangulum</i>
Black racer	<i>Coluber constrictor constrictor</i>
Black rat snake *	<i>Elaphe obsoleta obsoleta</i>
Eastern ribbon snake	<i>Thamnophis sauritus sauritus</i>
Northern brown snake *	<i>Storeria dekayi dekayi</i>
Northern ringneck snake	<i>Diadophis punctatus edwardsii</i>
Rough green snake	<i>Opheodrys aestivus</i>
Northern black racer * (last seen in 1901)	<i>Coluber constrictor</i>
AMPHIBIANS	
Red-spotted newt	<i>Notophthalmus viridescens</i>
Eastern tiger salamander	<i>Ambystoma tigrinum tigrinum</i>
Marbled salamander	<i>Ambystoma opacum</i>
Spotted salamander	<i>Ambystoma maculatum</i>
Redback salamander *	<i>Plethodon cinereus</i>
Upland chorus frog	<i>Pseudacris triseriata feriarum</i>
New Jersey chorus frog (Moorestown)	<i>Pseudacris triseriata kalmi</i>
Spring peeper (Moorestown)	<i>Pseudacris crucifer</i>
Gray treefrog	<i>Hyla versicolor</i> and <i>Hyla chrysoscelis</i>
Northern cricket frog	<i>Acris crepitans crepitans</i>
Green frog *	<i>Rana clamitans melanota</i>
Bullfrog *	<i>Rana catesbeiana</i>
Southern leopard frog	<i>Rana utricularia</i>
Pickrel frog	<i>Rana palustris</i>
Wood frog	<i>Rana sylvatica</i>
American toad	<i>Bufo americanus</i>
Fowler's toad *	<i>Bufo woodhousi fowleri</i>
Northern two-lined salamander (Moorestown)	<i>Eurycea bislineata</i>

J.H. Taylor compiled the following list of birds identified within the Taylor Farm and the Taylor Wildlife Preserve, 0.6 miles north of the Pompeston, along the Delaware in Cinnaminson.

TABLE 3
Bird Species Listed by J. H. Taylor

Red-Throated Loon	Common Loon
Pied-Billed Grebe	Horned Grebe
Double-Crested Cormorant	Least Bittern
American Bittern	American Egret
Great Blue Heron	Little Blue Heron
Snowy Egret	Green Heron
Cattle Egret	Glossy Ibis
Black-Crowned Night Heron	Wood Duck
Canada Goose	American Black Duck
Green-Winged Teal	Northern Pintail
Mallard	American Wigeon
Blue-Winged Teal	Redhead Duck
Canvasback	Lesser Scaup
Greater Scaup	Bufflehead
Common Goldeneye	Common Merganser
Hooded Merganser	Ruddy Duck
Red-Breasted Merganser	Osprey
Turkey Vulture	Marsh Hawk
Bald Eagle	Cooper's Hawk
Sharp-Shinned Hawk	Broad-Winged Hawk
Red-Shouldered Hawk	Rough-Legged Hawk
Red-Tailed Hawk	Merlin (Pigeon Hawk)
Kestrel (Sparrow Hawk)	Bob White Quail
Peregrine Falcon	Common Gallinule
Ring-Necked Pheasant	Greater Yellowlegs
Virginia Rail	Spotted Sandpiper
American Coot	Common Snipe
Killdeer	Buonaparte's Gull
Lesser Yellowlegs	Herring Gull
Ruddy Turnstone	Common Tern
American Woodcock	Mourning Dove
Laughing Gull	Yellow-Billed Cuckoo
Ring-Billed Gull	Screech Owl
Great Black-Backed Gull	Barn Owl
Rock Dove (Pigeon)	Black-Billed Cuckoo

Great Horned Owl	Short-Eared Owl
Saw-Whet Owl	Nighthawk
Chimney Swift	Ruby-Throated Hummingbird
Belted Kingfisher	Red-Bellied Woodpecker
Red-Headed Woodpecker	Downy Woodpecker
Yellow-Bellied Sapsucker	Flicker
Hairy Woodpecker	Willow Flycatcher
Wood Peewee	Phoebe
Least Flycatcher	Kingbird
Great Crested Flycatcher	Purple Martin
Horned Lark	Bank Swallow
Tree Swallow	Blue Jay
Barn Swallow	Fish Crow
Common Crow	Carolina Chickadee
Black-Capped Chickadee	Bed-Breasted Nuthatch
Tufted Titmouse	Brown Creeper
White-Breasted Nuthatch	House Wren
Carolina Wren	Marsh Wren
Winter Wren	Ruby-Crowned Kinglet
Golden-Crowned Kinglet	Bluebird
Blue-Gray Gnatcatcher	Gray-Cheeked Thrush
Veery	Hermit Thrush
Swainson's Thrush	Robin
Wood Thrush	Mockingbird
Catbird	Starling
Brown Thrasher	Red-Eyed Vireo
Cedar Waxwing	Tennessee Warbler
White-Eyed Vireo	Yellow Warbler
Blue-Winged Warbler	Magnolia Warbler
Parula Warbler	Black-Throated Blue Warbler
Chestnut-Sided Warbler	Pine Warbler
Cape May Warbler	Bay-Breasted Warbler
Blackburnian Warbler	Black and White Warbler
Palm Warbler	Worm-Eating Warbler
Blackpoll Warbler	Northern Waterthrush
American Redstart	Yellow-Breasted Chat
Ovenbird	Cardinal
Common Yellowthroat	Indigo Bunting
Scarlet Tanager	Rose-Breasted Grosbeak

Towhee (Chewink)	Tree Sparrow
Chipping Sparrow	Field Sparrow
Lark Sparrow	Savannah Sparrow
Fox Sparrow	Song Sparrow
Swamp Sparrow	White-Throated Sparrow
White-Crowned Sparrow	Junco
Bobolink	Red-Winged Blackbird
Meadowlark	Rusty Blackbird
Boat-Tailed Grackle	Common Grackle
Cowbird	Orchard Oriole
Baltimore Oriole	House Finch
Pine Siskin	Goldfinch
House Sparrow	

INVERTEBRATES

Exploring the Creek at low tide reveals a rich diversity of invertebrate life.

Turning over an old log or large stone on the stream bed will uncover many small crustaceans called **scuds** scurrying for cover. These are flattened, shrimp-like animals that swim on their sides. Also under rocks or among the aquatic plants are **crayfish**, **leeches**, **insect larvae**, **snails**, **hydras**, **flatworms**, and **segmented worms**. Among the **mollusks** are several native freshwater bivalves, including **freshwater mussels** that can be recognized by their thin oblong shells, which have a brown to greenish exterior and pearly white interior. The more numerous, invasive **Asiatic clam** is smaller and has a rounded shell. Several species of freshwater snails live in the Creek. The small **physa (Physella)** is very abundant on rocks, aquatic plants, and debris. Thirty years ago a non-native “**mystery snail**” could be found on the mud flats at the Creek mouth, but this species seems to have been naturally eradicated, probably due to predation by fish. On the land, the **white-lipped helix** and the **bladetooth wedge** are two of the more familiar snails. Careful searching of the leaf litter may produce some of the smaller species, such as **vallonia** and **discus**. The large European slug, **Limax maximus**, is also very abundant.

BENTHIC MACROINVERTEBRATES: A SURVEY OF WATER QUALITY

Invertebrates are an important part of the food web of the marsh. Benthic macroinvertebrates (stream-dwelling invertebrates large enough to be seen by the naked eye) are also good indicators of water quality, because they have differing tolerances to pollutants. A reduction in the variety of organisms or low numbers of species sensitive to degraded water quality may point to problems with organic enrichment (e.g., sewage discharge or fertilizer runoff), toxic chemicals, or sedimentation.

Benthic macroinvertebrates were collected by the survey team at Sites 1 and 2 on October 21, 2002. The results were used to calculate a New Jersey Impairment Score (NJIS), which compares a given stream to high quality streams within the region according to the following criteria:

1. *Taxa Richness* The total number of families in the sample
2. *EPT Index* The total number of families of the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) in the sample: these organisms require clear running water
3. *%EPT* The relative abundance of mayflies, stoneflies, and caddisflies
4. *%CDF (Contribution of the Dominant Family)* A measure of the balance among the different organisms
5. *Family Biotic Index* A measure of the relative tolerance to organic enrichment of the benthic macroinvertebrate families found, from 0 (intolerant) to 10

The three tables that follow give the results of the sampling (Table 4), the criteria for scoring the results (Table 5), and the NJIS for the Pompeston (Table 6). The sampling technique and other details can be found in the full text of the survey, on the website.

TABLE 4
Results of Benthic Macroinvertebrate sampling

TAXA:	LOCATION 1 NUMBER:	LOCATION 2 NUMBER:
Tricladida (flatworms) Planariidae Dugesia sp.	1	2
Tubificida (worms) Naididae	2	2
Arhynchobdellida (leeches) Erpobdellidae Erpobdella punctata	1	0
Rhynchobdellida (leeches) Glossiphoniidae Helobdella stagnalis Placobdella ornata	1	1
Limnophila (freshwater snails) Physidae Physa sp.	0	1
Heterodonta (freshwater clams) Corbiculidae Corbicula fluminea	8	15
Amphipoda (scuds/side swimmers) Gammaridae Gammarus sp.	44	67
Odonata (damselflies) Coenagrionidae Enallagma sp.	9	3
Hemiptera (true bugs) Hebridae Hebrus sp. (semi-aquatic)	0	3
Coleoptera (beetles) Dytiscidae Dytiscus sp.	0	7
Diptera (true flies) Chironomidae Chironominae Orthocladiinae Tanypodinae	2 1 1	2 0 0
Total # taxa:	10	10
Total # individuals:	70	103

TABLE 5
Scoring Criteria for Rapid Bioassessments in New Jersey Streams

BIOLOGICAL CONDITION SCORE:	NON-IMPAIRED	MODERATELY IMPAIRED	SEVERELY IMPAIRED
	6	3	0
BIOMETRICS:			
1. <i>Taxa Richness</i>	>10	10-5	4-0
2. <i>EPT Index - Northern, NJ</i>	>5	5-3	2-0
<i>- Southern, NJ</i>	>4	4-2	1-0
3. <i>%CDF</i>	<40	40-60	>60
4. <i>%EPT</i>	>35	35-10	<10
5. <i>Family Biotic Index</i>	0-4	4-6	6-10
BIOLOGICAL CONDITION:	Total Score		
<i>Non-impaired</i>	24-30		
<i>Moderately impaired</i>	9-21		
<i>Severely impaired</i>	0-6		

TABLE 6
Calculation of Biological Condition

TAXA	TOLERANCE VALUE	LOCATION 1 # OF INDIVIDUALS	LOCATION2 # OF INDIVIDUALS
Planariidae	4	1	2
Naididae	7	2	2
Erpobdellidae	1	1	0
Glossiphoniidae	8	1	1
Physidae	7	0	1
Corbiculidae	8	8	15
Gammaridae	4	44	67
Coenagrionidae	9	9	3
Hebridae	8	0	3
Dytiscidae	4	0	7
Chironomidae	6	4	2
ANALYSIS			
Taxa Richness		8	10
EPT Index		0	0
%CDF		62.9%	65%
		Gammaridae	Gammaridae
%EPT		0	0
Family Biotic Index		5.3	5.0
NJIS Rating		6	6
Biological Condition		severely impaired	severely impaired

With a NJIS rating of 6 at both sites, the Pompeston is classified as “severely impaired”. However, further assessment is needed to determine the significance of this finding. A low NJIS score may be due to differences in habitat between the Pompeston and the reference streams. For example, the effects of tidal action on benthic population were not considered. On the other hand, the rating may be the result of upstream contamination by chemicals or organic enrichment (no tests for chemicals were carried out), or of sedimentation caused by bank erosion and runoff from the watershed. Technical details of the sampling approach can be found in the full text of the inventory, on the website.

Until 2001, testing conducted by the NJDEP in the Pompeston Creek at Route 130 yielded a water quality rank of “9” (moderately impaired). In 2001, the rank dropped to “6” (severely impaired). This result is consistent with the findings of our survey, and suggests that water quality in the Pompeston may be deteriorating.

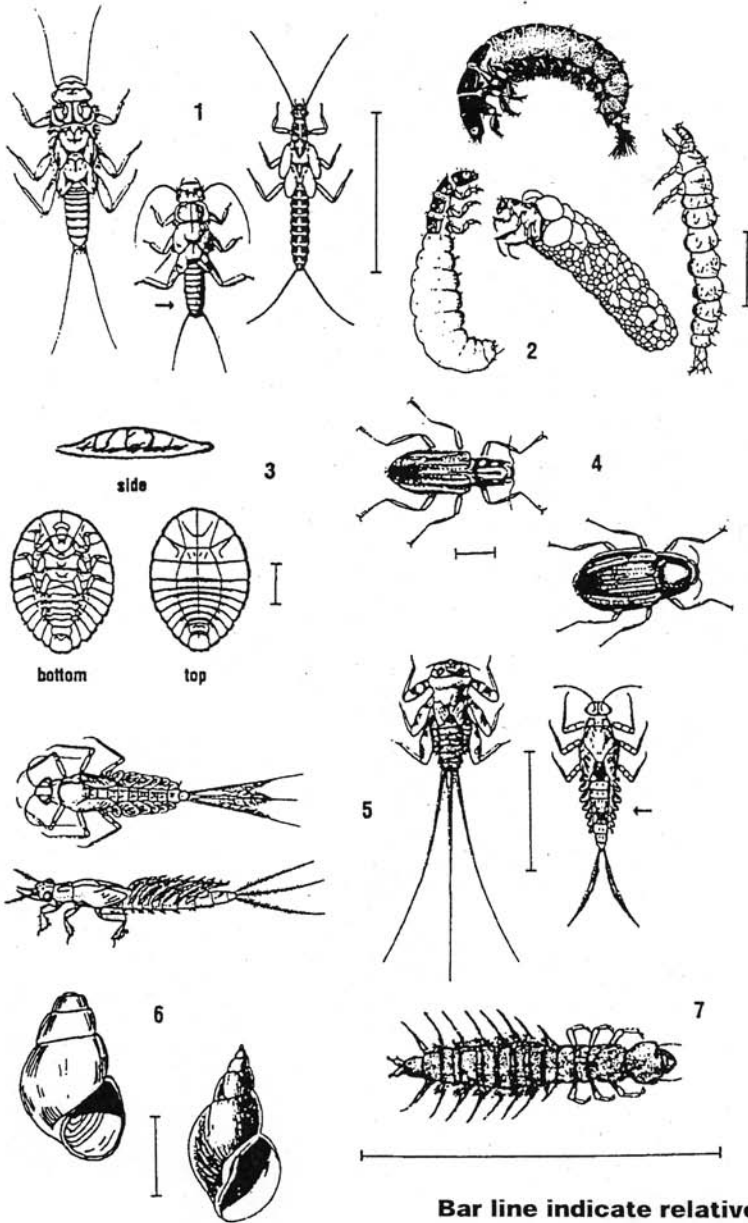
An assessment of the benthic habitat (as distinct from water quality) was made as part of the macroinvertebrate survey. This assessment, which takes into account the natural bending of the channel (a positive indicator); variety of habitat; presence of pools; stream bank stability; bank vegetation; and quality of the riparian zone (width and shading), yields a score of “good” for Sites 1 and 2. In contrast to the NJIS water quality rating, then, it appears that some of the structural fundamentals for a healthy stream are in place in the Pompeston.

FIGURE 6:
Guide to Macroinvertebrates

Stream Invertebrates

Group One Taxa

Pollution sensitive organisms found in good quality water.



- 1 **Stonefly Order Plecoptera.** 1/2" to 1 1/2", 6 legs with hooked tips, antennae, 2 hair-line tails. Smooth (no gills) on lower half of body (see arrow).
- 2 **Caddisfly: Order Trichoptera.** Up to 1", 6 hooked legs on upper third of body, 2 hooks at back end. May be in a stick, rock, or leaf case with its head sticking out. May have fluffy gill tufts on underside.
- 3 **Water Penny: Order Coleoptera.** 1/4", flat saucer-shaped body with a raised bump on one side and 6 tiny legs and fluffy gills on the other side. Immature beetle.
- 4 **Riffle Beetle: Order Coleoptera.** 1/4", oval body covered with tiny hairs, 6 legs, antennae. Walks slowly underwater. Does not swim on surface.
- 5 **Mayfly: Order Ephemeroptera.** 1/4" to 1", brown, moving, plate-like or feathery gills on the sides of lower body (see arrow), 6 large hooked legs, antennae, 2 or 3 long hair-like tails. Tails may be webbed together.
- 6 **Gilled Snail: Class Gastropoda.** Shell opening covered by thin plate called operculum. When opening is facing you, shell usually opens on right.
- 7 **Dobsonfly (Hellgrammite): Family Corydalidae.** 3/4" to 4", dark-colored, 6 legs, large pinching jaws, eight pairs feelers on lower half of body with paired cotton-like gill tufts along underside, short antennae, 2 tails, and 2 pairs of hooks at back end.

Bar line indicate relative size

FIGURE 6 (Continued): Guide to Macroinvertebrates

Group Two Taxa

Somewhat pollution tolerant organisms can be in good or fair quality water.

8 Crayfish: Order Decapoda. Up to 6", 2 large claws, 8 legs, resembles small lobster.

9 Sowbug: Order Isopoda. 1/4" to 3/4", gray oblong body wider than it is high, more than 6 legs, long antennae.

Source: Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878-2983. (800) BUG-IWLA

10 Scud: Order Amphipoda. 1/4", white to gray, body higher than it is wide, swims sideways, more than 6 legs, resembles small shrimp.

11 Alderfly Larva: Family Sialidae. 1" long. Looks like small Hellgramite but has long, thin, branched tail at back end (no hooks). No gill tufts underneath.

12 Fishfly Larva: Family Cordulidae. Up to 1 1/2" long. Looks like small hellgramite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

13 Damselfly: Suborder Zygoptera. 1/2" to 1", large eyes, 6 thin hooked legs, 3 broad oar-shaped tails, positioned like a tripod. Smooth (no gills) on sides of lower half of body. (See arrow.)

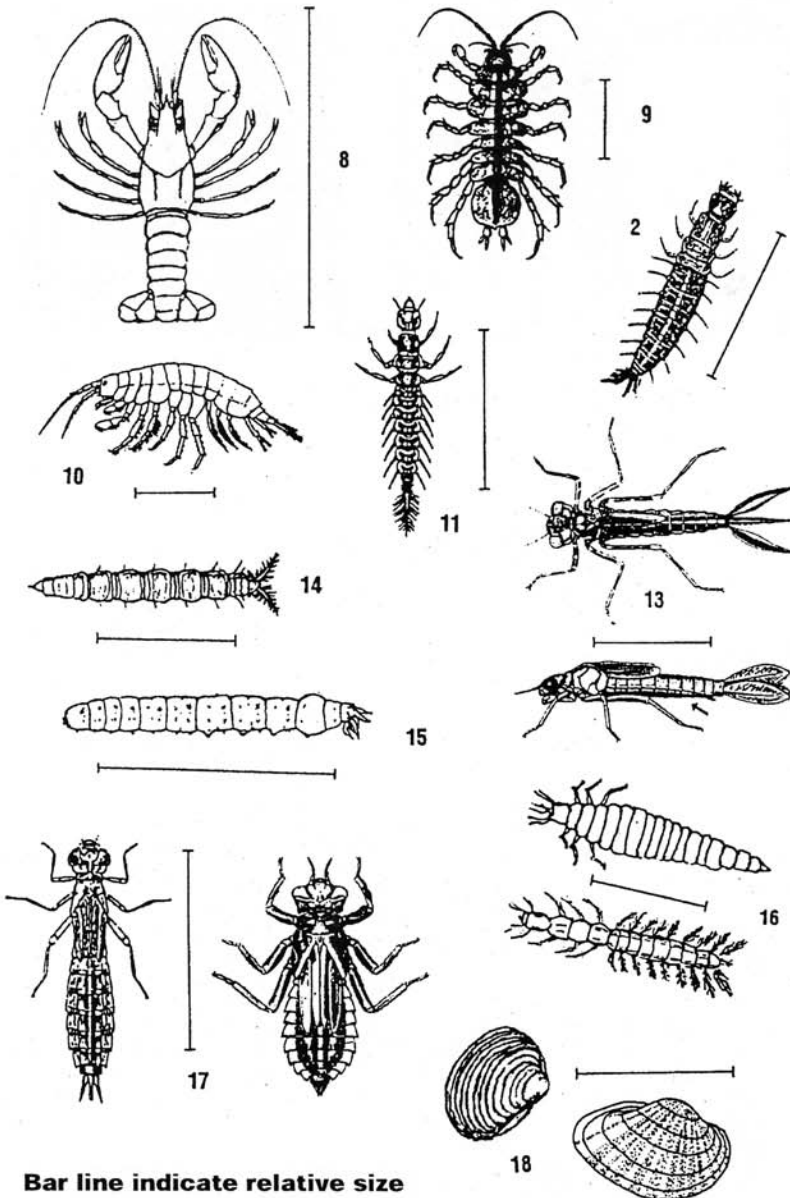
14 Watersnipe Fly Larva: Family Athericidae (Atherix). 1/4" to 1", pale to green, tapered body, many caterpillar-like legs, conical head, feathery "horns" at back end.

15 Crane Fly: Suborder Nematocera. 1/3" to 2", milky, green, or light brown, plump caterpillar-like segmented body, 4 finger-like lobes at back end.

16 Beetle Larva: Order Coleoptera. 1/4" to 1", light-colored, 6 legs on upper half of body, feelers, antennae.

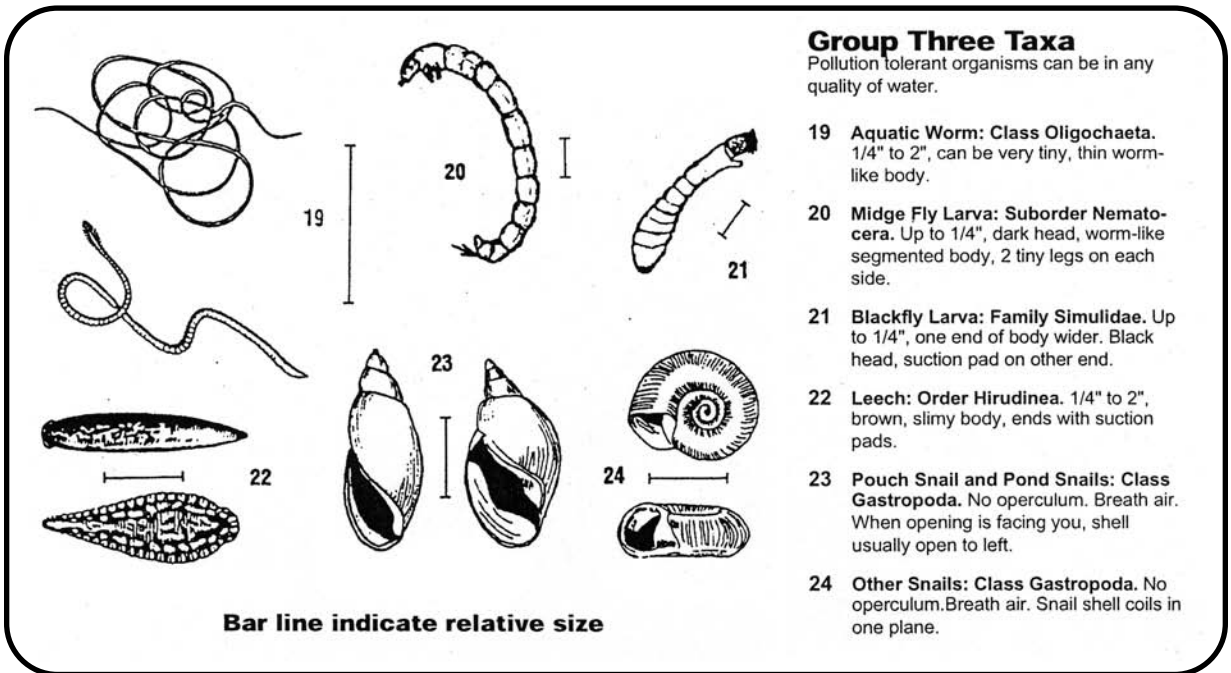
17 Dragon Fly: Suborder Anisoptera. 1/2" to 2", large eyes, 6 hooked legs. Wide oval to round abdomen.

18 Clam: Class Bivalvia.



Bar line indicate relative size

FIGURE 6 (Continued): Guide to Macroinvertebrates



Group Three Taxa

Pollution tolerant organisms can be in any quality of water.

- 19 **Aquatic Worm: Class Oligochaeta.** 1/4" to 2", can be very tiny, thin worm-like body.
- 20 **Midge Fly Larva: Suborder Nematocera.** Up to 1/4", dark head, worm-like segmented body, 2 tiny legs on each side.
- 21 **Blackfly Larva: Family Simuliidae.** Up to 1/4", one end of body wider. Black head, suction pad on other end.
- 22 **Leech: Order Hirudinea.** 1/4" to 2", brown, slimy body, ends with suction pads.
- 23 **Pouch Snail and Pond Snails: Class Gastropoda.** No operculum. Breath air. When opening is facing you, shell usually open to left.
- 24 **Other Snails: Class Gastropoda.** No operculum. Breath air. Snail shell coils in one plane.

VISUAL ASSESSMENT: A SURVEY OF THE PHYSICAL CONDITION OF THE CREEK

A broader visual assessment of the physical condition of the stream corridor (beyond the benthic habitat), using a standard procedure, provided further information about the health of the Creek:

On October 21, 2002, an assessment of stream corridor conditions was carried out at Sites 1 and 2 using the United States Department of Agriculture (USDA) **Stream Visual Assessment Protocol (SVAP)** to rank 9 elements of the stream corridor on a scale from 1 (worst) to 10 (best). The scores are given below in brackets. Where there are two scores, they represent the left (Cinnaminson) bank and the right (Riverton) bank, respectively. An overall score less than 6.0 indicates poor quality; 6.1-7.4 is fair; 7.5-8.9 is good; and greater than 9.0 is excellent.

Channel Conditions: natural and stable vs. channelized and/or eroding [8]

Hydrologic Alteration: access of the stream to the floodplain [not applicable]

Riparian Zone: wide vegetated buffer vs. narrow, disturbed buffer [3, 8]

Bank Stability: low, stable banks vs. actively eroding banks [8, 8]

Water Appearance: clear vs. turbid [5]

Nutrient Enrichment: clear water with diverse aquatic community vs. greenish with dense macrophytic vegetation [8]

Barriers to Fish Movement: no barriers vs. dams, culverts, etc. [10]

Instream Fish Cover: diverse cover (logs, rocks, pools, overhanging plants) vs. no cover [8]

Invertebrate Habitat: clean water with gravel/organic substrate vs. cloudy water with sediment-laden substrate [8]

The overall scores for the Pompeston were 7.1 for the left bank and 8.8 for the right bank, for an average of 7.4, which is in the high “fair” range. The riparian zone in Site 1 was “very healthy”, but the banks were relatively unstable, with clear evidence of erosion and excessive deposition of sediment (see the photograph in the full inventory on the website). Instream fish cover was relatively poor, but the invertebrate habitat was good, consistent with the results obtained during the benthic macroinvertebrate survey. These results indicate once again that although there are problems with water quality and erosion, important elements of the structure of the Creek are in reasonably good condition. Technical details concerning the Assessment are provided in the online text of the inventory.

The unstable banks in Site 1 and the problem of sedimentation are probably due to upstream development in Moorestown and Cinnaminson, coupled with Riverton’s fully developed status. Over the years, there has been a dramatic increase in impervious cover, resulting in more runoff and “flashy” hydrology during storms, which erodes the stream banks. **This is the probable cause of deteriorating water quality.**

The width of the riparian zone in Site 2 is limited by housing and proximity to River Road, reducing the score for this section. The water was cloudy, probably due to high tidal flooding currents. The survey team notes that although Riverton is highly developed, there are significant areas of open space along most of the stream corridor. The persistence of this buffer has undoubtedly worked to reduce deterioration of the stream and marsh. **Preservation of the buffer should be a priority.**

THE IMPORTANCE OF STREAM CORRIDOR PRESERVATION

The most important effort that can be made to protect the Pompeston Creek is to preserve and maintain the stream corridor: the buffer of wetlands, floodplains, woods, and steep slopes through which water drained from upland areas runs. Preservation involves saving as much of the corridor as possible from development, while maintaining or where necessary restoring the physical condition of the corridor: for example, by planting shrubs and trees where erosion has occurred. The more natural and undisturbed this buffer is, the better it can perform its functions, which include:

- **Slowing and absorbing the flow of storm water, thereby reducing bank erosion** caused by a sudden increase in the volume and velocity of water, and reducing the risk of flood damage in residential areas. Regional storm water management is an urgent need within the Pompeston Creek watershed.
- **Preserving the stream's "baseflow"**, the gradual release of water absorbed by the woodlands and wetlands near a stream, which helps to keep the stream from drying up during periods of low rainfall.
- **Retaining nutrients and sediments carried by storm water.** Runoff carries chemicals, excess nutrients, and sediment. Where stream corridor vegetation has been destroyed, there is no barrier to prevent these pollutants from reaching the Creek. Plants within the corridor absorb excess nutrients, such as nitrogen and phosphorus, that are damaging to stream life. Plants, soil, and organic matter capture and filter chemicals and sediments, and give imported organic matter a chance to decompose before it can overload the stream. Sediments in the stream smother fish eggs and bottom-dwelling organisms, reduce oxygen levels, and clog the gills of fish. It should also be remembered that a healthy Creek helps to assure a healthy Delaware River.
- **Providing the vegetative basis, through natural decay, for the balanced release of appropriate nutrients to the Creek and marsh.**
- **Providing a physical barrier against development** that would increase non-point source pollution, such as lawn chemicals, and against the encroachment of impervious cover, such as housing and parking lots.
- **Shading the stream.** Loss of shade can cause the water to overheat, which can encourage the growth of algae and make the stream uninhabitable by fish.

-
- **Providing habitat** for plants and animals, including a greenway corridor for passage to and from the Delaware and nearby natural areas (e.g., the Taylor Wildlife Preserve and the Palmyra Cove Nature Park).
 - **Helping to maintain a flow of filtered water to the aquifer, and reducing pollution of the Delaware River.**
 - **Maintaining the unique, unspoiled natural appearance of the Creek and marsh** for those who visit it, live near it, or study it.
 - **Preserving an intact, natural ecosystem** in an artificial suburban environment.

RECOMMENDATIONS: PLANNING FOR RESTORATION AND WATER QUALITY IMPROVEMENT

A haphazard approach to watershed restoration and storm water control can result in high costs with little benefit to water quality. The best hope for preserving a healthy stream corridor and improving water quality would be the establishment of a **Stream Corridor Restoration Master Plan (SCRMP)**, including a **Regional Storm Water Management Plan (RSWMP)**. A **SCRMP** would involve assessment of the health of the riparian zone; identification of nonpoint sources of pollution and other causes of impairment; and documentation of Best Management Practices (**BMPs**) for restoration and storm water control. The **RSWMP** would address in detail the problem of excessive runoff and the resulting pollution and sedimentation. Action based on such plans would require the cooperation of Riverton, Cinnaminson, and Moorestown, and possibly, to a lesser extent, Delran and Palmyra. Efforts to restore the downstream portions of the Creek (e.g., through bank stabilization), and to improve water quality in the Creek and marsh, are unlikely to succeed without addressing upstream development issues.

Another very helpful tool would be the incorporation of the numeric **SVAP** data into a GIS mapping system. This would allow the physical stream assessment data to be linked to the physical features of the watershed, clarifying and lending force to arguments for specific action.

The text of the inventory on the website includes (as Appendix C) the *National Water and Climate Center Technical Note 99-1, the Stream Visual Assessment Protocol (SVAP)*. Here you will find detailed instructions on how to carry out an **SVAP** assessment like the one conducted by Dr. Obropta for our inventory (above). **Rutgers Cooperative Extension is available to train and supervise volunteers in carrying out further SVAP studies of the Pompeston in Riverton.** Several PCWA volunteers have taken the NJDEP's Assessment Training and are in the process of assessing segments of the Creek in Moorestown, Cinnaminson, and Riverton.

Short of a regional effort, or in addition to it, each of the stream corridor towns could consider enacting a **Stream Corridor Protection Ordinance** tailored to its specific circumstances. State regulations require a 50-foot buffer on both sides of “Intermediate Resource Value Wetlands” like the Pompeston Creek, with reductions to 25 feet possible. But a wider barrier may be needed to secure the benefits of stream corridor preservation listed above. *Tiner* (1998, pg. 86) states that **“A forested wetland buffer strip of 300 feet can provide enormous water quality benefits...A 100-foot vegetated buffer strip along streams also yields substantial improvement in water quality.”** The **Stony Brook-Millstone Watershed Association (2002)** recommends a vegetated barrier of at least 100 feet outside the 100-year floodplain. Towns within the Pompeston Creek watershed are not limited by the State’s 25-50 foot limit, but are free to develop their own local stream corridor ordinances. The Borough of Riverton, for example, has for some time intended to preserve a corridor of at least 100 feet through undeveloped property adjacent to the Creek, but this intention has not been incorporated in a **Stream Corridor Protection Ordinance**. Significant portions of the stream corridor in Riverton and Cinnaminson still have wooded or open space buffers of 100 to 300 feet. Will they be preserved? Moorestown has a **Stream Corridor Protection Ordinance**. Riverton and Cinnaminson do not.

To summarize: both the macroinvertebrate survey and the visual assessment suggest a stream corridor under stress from development, but with good potential for improvement and long-term health if problems are recognized and addressed.

BEST PRACTICES FOR PRESERVING THE STREAM CORRIDOR - YOUR PROPERTY ON THE CREEK

If you live along the Pompeston Creek, there is a lot that you can do to be a good neighbor:

- Maintain a vegetated zone along the stream. Fifty feet or more is desirable, but any buffer is better than none. Herbacious plants (including unmown native grasses that do not require fertilizer or pesticides) and shrubs are suitable for gently sloping banks. Shrubs are needed to preserve the integrity of steep banks, and trees are appropriate at the tops of banks. Native species are best. The plant inventory in this report includes a number of shrubs and trees native to New Jersey and growing along the Creek (those without asterisks). **The lists following this section (Table 7) indicate native plants that are appropriate for the Pompeston corridor.**

-
- Never mow to the Creek. Where you have a lawn, set the mower to at least 3 inches high. Taller grass resists drought, needs less fertilizer, and reduces runoff.
 - Minimize or eliminate the use of fertilizer and pesticides everywhere. Use organic fertilizer. Spot-treat pest problems. Plant native grass varieties that are resistant to insects and drought. **Never apply pesticides near the stream.** Select pesticides that degrade quickly, and apply pesticides only during dry periods. Rutgers Cooperative Extension has information on alternatives to chemical pesticides. The NJ Environmental Federation (NJEF) has an integrated Pest Management program, and will work with homeowners to reduce or eliminate the need for fertilizers and pesticides (contact Jane Nogaki at 856-767-1110). Test your soil before implementing any fertilizer or pesticide program. Rutgers Cooperative Extension does soil testing at extension offices. There is one in Mount Holly.
 - Avoid applying fertilizer or lawn chemicals near the stream or on slopes that drain into the stream. Avoid applying fertilizer or lawn chemicals during rainy seasons and when the soil is saturated with water or frozen: if the soil can't absorb the water or chemicals, runoff into the stream is likely.
 - Pay special attention to erosion on your property. Plant native grass, shrubs, or ground cover to correct the problem. Be alert to and correct erosion on steep slopes that drain into the Creek. Get help from the PCWA or professionals if necessary.
 - If a driveway or patio is promoting runoff into the stream, put in gravel-lined trenches and vegetation along the perimeter to catch runoff and filter it into the soil.
 - Compost yard waste, but store yard waste and grass clippings away from the Creek. Keep all trash, leaves, and yard waste away from storm drains on your street. **Debris entering storm drains washes directly into the Creek or river when it rains.**
 - Place a conservation easement or deed restriction on wetlands portions of your property. Consider donating property or granting an easement for preservation purposes to government or environmental organizations (there can be tax advantages to such contributions).

The suggestions above were derived in part from *Hinkle* (1992) and *Tiner* (1998), and from Debbie Lord of the PCWA. See also "25 Ways to Protect Your Stream and Streamside Property" by Delaware Riverkeeper Network.

TABLE 7
Include Native Plants in Your Landscape.
They require less water and fertilizer and provide great habitat
for our birds and butterflies.

Thanks to Jeremiah Bergstrom of TRC Omni Environmental

LATIN NAME	COMMON NAME
AQUATIC/EMERGENT SPECIES	
<i>Aster puniceus</i>	purple stemmed aster
<i>Calamagrostis canadensis</i>	blue-joint grass
<i>Carex crinita</i>	fringed sedge
<i>Carex stricta</i>	tussock sedge
<i>Carex vulpinoidea</i>	fox sedge
<i>Iris versicolor</i>	blueflag iris
<i>Pontederia cordata</i>	pickerelweed
<i>Sagittaria latifolia</i>	duck-potato
<i>Saururus cernus</i>	lizard tail
<i>Scirpus atrovirens</i>	green bulrush
<i>Sparganium americanum</i>	lesser bur-reed
HERBACEOUS SPECIES	
<i>Aesclepias incarnata</i>	swamp milkweed
<i>Aster novae-angliae</i>	New England aster
<i>Aster novi-belgi</i>	New York aster
<i>Carex lurida</i>	shallow sedge
<i>Chelone glabra</i>	turtlehead
<i>Eupatorium perfoliatum</i>	boneset
<i>Hibiscus moscheutos</i>	swamp rose-mallow
<i>Juncus effusus</i>	soft rush
<i>Lobelia cardinalis</i>	cardinal flower
<i>Lobelia siphilitica</i>	blue lobelia
<i>Onoclea sensibilis</i>	sensitive fern
<i>Osmunda cinnamomea</i>	cinnamon fern
<i>Osmunda regalis</i>	royal fern
<i>Vernonia noveboracensis</i>	New York ironweed

LATIN NAME	COMMON NAME
SHRUB SPECIES	
<i>Alnus serrulata</i>	smooth alder
<i>Aronia melanocarpa</i>	black chokeberry
<i>Cephalanthus occidentalis</i>	buttonbush
<i>Clethra alnifolia</i>	sweet pepperbush
<i>Cornus amomum</i>	silky dogwood
<i>Cornus sericea</i>	redosier dogwood
<i>Ilex glabra</i>	inkberry
<i>Ilex verticillata</i>	winterberry holly
<i>Lindera benzoin</i>	spicebush
<i>Rhododendron viscosum</i>	swamp azalea
<i>Rosa palustris</i>	swamp rose
<i>Salix discolor</i>	pussy willow
<i>Vaccinium corymbosum</i>	highbush blueberry
<i>Viburnum dentatum</i>	arrowwood viburnum
<i>Viburnum trilobum</i>	cranberrybush viburnum
TREE SPECIES	
<i>Acer rubrum</i>	red maple
<i>Betula nigra</i>	river birch
<i>Fraxinus americana</i>	white ash
<i>Fraxinus pensylvanica</i>	green ash
<i>Nyssa sylvatica</i>	black tupelo
<i>Platanus occidentalis</i>	sycamore
<i>Quercus bicolor</i>	swamp white oak
<i>Quercus palustris</i>	pin oak
<i>Viburnum lentago</i>	nannyberry viburnum
<i>Viburnum prunifolium</i>	blackhaw viburnum

WHAT EVERYONE CAN DO:

Everyone in the watershed can take action on behalf of the stream:

- Follow the same environmental-friendly lawn care practices recommended above.
- Never discard paints, pesticides, lawn chemicals, or petroleum products where they might reach the groundwater or stream. Be aware that runoff entering city street storm drains ends up in the river or Creek (the blue fish stenciled on the storm drain covers in some of the watershed towns are there to make that point). Support municipal street sweeping, which keeps debris out of the watershed.
- Write to your elected representatives at all levels and tell them that you support preservation of wetlands through acquisition, regulation, and restoration.
- Be aware of the local projects that need funding or regulatory support (e.g., applications, supported by the PCWA, for a State grant to create a **RSWMP**; attempts by the PCWA to have a NJDEP water quality monitoring site installed in the Pompeston).
- Get involved in local programs aimed at preserving, restoring, and cleaning up the Pompeston. Join or support the Pompeston Creek Watershed Association or Junior PCWA and help with their efforts at monitoring water quality, restoring stream bank integrity, and other projects (**the PCWA has planted hundreds of shrubs and trees within the upper reaches of the stream corridor**).
- Attend meetings of your town's environmental committee, commission, or advisory board. Express your support for a municipal **Stream Corridor Protection Ordinance**. Encourage development of a **Stream Corridor Restoration Master Plan** and a **Regional Storm Water Management Plan**.
- **Let your County government know about the need for preservation of open space along the Pompeston Creek**. Contact officials in charge of State, County, or municipal preservation/land acquisition programs and be an advocate for our area. Support or initiate efforts by government and private preservation groups to preserve the stream corridor through donation, purchase, or easement.

EXPLORING THE CREEK: IF YOU GO

The site map (Fig. 2) shows the Creek, marsh, and stream corridor. Distances and points of access are marked. Public property is distinguished from private property. Much of the first mile of the Creek and marsh on the Riverton side is accessible. On the Cinnaminson side, private property and housing make access more difficult. You can walk to the Creek mouth through riverfront woods at the end of North Randolph Street (which runs West off of River Road) on property occupied by the Cinnaminson sewage plant. Note that on the Riverton side, access to the Delaware River and the Creek mouth is possible from the Riverton Sewage Plant, which can be entered by way of a dirt road running west from the dead end of Third Street. At present, this access is fairly inconvenient, due to the presence of dense ground cover and municipal dumping of tree stumps and other debris. On the other side of Broad Street, Riverton Memorial Park parallels the Creek and marsh. The slopes are steep and the vegetation at the top of the banks is dense, but there are two relatively good points of entry where opposite ends of the lily pond levee touch the bank (as indicated on the map). At the eastern (upstream) point of access, it is possible to walk out on the levee until you reach the gap. There is parking near both of these points of access.

The tidal range at the mouth of the Creek is 6 feet. The range at the Riverton/Cinnaminson border less than a mile upstream of the mouth is only 3 feet. There are two high tides and two low tides every day. Consult tide tables before attempting to take a boat up the Creek (the website includes a link to online tide tables for the Creek). A kayak or canoe or even a rowboat that doesn't draw too much water will work well at high tide. Always wear a life jacket.

Take sunscreen or wear a hat: in most places the channel is not shaded. Bottled water is a good idea. Surprisingly, you are unlikely to be bothered much by mosquitoes. Mosquito larvae need standing water; periodic inundation and tidal action are not congenial to them. Do take a trash bag and help to keep the Creek clean (and the Turtle Lady happy).

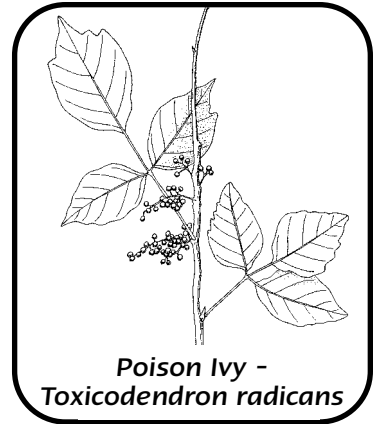
If you are hiking, the map indicates the accessible route. There is a narrow nature trail, marked by signs, along the Creek through Riverton Park. Be careful: it tends to harbor **poison ivy** and, reportedly, **poison sumac**. Know how to identify these plants. There are benches along the trail, overlooking the marsh.



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Access to the trail along the south side of the Creek in Cinnaminson is through the woods north of the parking lot of Cinnaminson High School.

If you enter the marsh on foot, never go alone, and you will need high boots. Rubber hip boots work best. The water in the lily pond tends to be shallower than elsewhere, and this is a good place to find many of the marsh plants, birds, and benthic animals. Here, as elsewhere, however, the muck is deep. If you sink in more than a foot or so, it takes time and effort to pull your leg out without losing the boot. **Children will find this especially difficult.** If you are bare-legged in the water, leeches will find you quickly. It is an effective method for collecting them.



**Poison Ivy -
*Toxicodendron radicans***
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It can be dangerous to walk into the marsh. You can get stuck in the muck, and be in trouble when the tide comes in. Repeat: never go alone. Children should visit the marsh only under close adult supervision.

THE NEED FOR FURTHER STUDY

The survey team has identified the following areas in which further study is needed to fill out the environmental inventory:

- Plant identification should be conducted throughout the year, especially during the summer.
- Breeding birds should be surveyed three times during each season (e.g., May-July).
- Winter birds should be surveyed a few times between January and February.
- Mammals should be surveyed at any time, but especially just after snowfall, when tracks can be seen. Tracks can also be found on the exposed mud banks.
- Direct sampling of fish might be undertaken. The NJDEP is starting a fish survey program like the one for macroinvertebrates.
- Invertebrate sampling should continue: e.g., butterflies, moths, dragonflies, and all other invertebrates.
- Further assessment of water quality and the condition of the stream corridor is needed, as described above. At present, the PCWA monitors water quality monthly at two sites in Moorestown and Cinnaminson, and will soon start a third site. Monitoring in the area of the marsh would be useful.

SUGGESTED PROJECTS

The following projects (and many more that you can think of) would yield interesting information:

- Identify and locate on a chart the trees and shrubs of the lily pond levee, to serve as a guide to people boating around the levee or exploring the marsh within the levee. Or select other areas for the same approach.
- Identify as many marsh plants as possible. Photograph plants that you cannot identify, and forward the pictures for identification to the website or to the contact people mentioned on it. Be sure to note the date and the location within the marsh. Try to include a ruler or other indication of size in the photograph.
- Look at the marsh profile (Figure 4). Locate additional plant species and create a more complete profile.
- Identify the trees of the 11 acre State of NJ riparian zone on the Cinnaminson bank in Site 3 (access the area from the Creek in a boat, or from North Randolph Street on foot, as indicated under “If You Go”, above). Identify and note the location of upland trees in the three survey sites.
- Read the section on seasonal change. Study the marsh during the growing season and create a more complete record of seasonal change in the appearance, maturation, flowering, and dominance of plants.
- Take photographs of the Creek and marsh during different seasons. Create a photo essay that conveys the beauty and diversity of the wetlands.
- Identify insects found on plants within the marsh. Note the type of plant. Keep a record of how often each species is found on the same type of plant: determine whether certain insects prefer certain plants. Photograph or sketch the insects if possible.
- Measure the depth of the water at specific locations in the three survey sites at high tide and low tide at different seasons.
- Read a book or article about wetlands and see if the things described can be found in our Creek or marsh.
- Research plant adaptation to flooding (for example, adaptation to anaerobic soil) and identify the adaptations in the structure or reproductive strategies of the plants. (e.g., see *Mitsch*, 1993, chapter 6).

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- Use a fine net to gather benthic animals. Study them with a magnifying glass, identify them, and release them.
 - Visit the marsh in spring, summer, and fall, and identify the flowering plants. Draw or photograph the flowers.
 - Learn to distinguish the broad-leaved emergent plants: **spatterdock**, **arrow arum**, **broad-leaved arrowhead**, and **pickerel weed**, by leaf and by flower. Map out their distribution in the marsh and determine whether there are differences in location due to differences in exposure to water.
 - Carry out a marsh study for a school or regional science fair. For example, the parasitic plant **dodder** is found tangled in **jewelweed**, but some species of **dodder** are known to favor **pickerel weed**. Mature **dodder** has no connection with soil, but feeds on its host. See if you can determine which plant or plants **dodder** is attached to.
 - Research wetland soils (see *Tiner* 1988, *Tiner* 1999, or *Mitsch* 1993), and characterize a cross-section of soil from the tidal flats.
 - Survey the Pompeston Creek in Cinnaminson and Moorestown east of Route 130, and determine whether there are areas of marsh in these upstream sections. Identify wetland vegetation in this area of the stream corridor.
 - Raise awareness of the beauty and value of the Pompeston. Encourage local schools to include the Creek and marsh as part of their science curriculum.
 - Visit the Creek and marsh. Report problems (dumping, erosion) to your town, to the PCWA, or to the Pompeston Creek website. Report sightings of plants and animals and other Creek-related experiences to the website. **Use the number/letter coordinates on the map (Figure 2) to identify the location of your findings.**

CONCLUSION

We have discussed the geology, history, animals, structure, and value of the Creek and marsh, as well as water quality, the physical condition of the stream corridor, and best management practices for preservation and restoration. This is a preliminary study, a framework for further discovery and action. There is much more to do and learn, and anyone can help. The lists of plants and animals are an ongoing project. Get a guidebook to birds, trees, plants, mammals, or soils; a guide to identifying animal tracks or trees and shrubs in winter; initiate a clean-up program to gather trash from the marsh and woods; lobby for preservation; or, if you live by the Creek, carry out some of the “good neighbor” practices mentioned above. Use the maps in this booklet to note the location of sightings as precisely as possible, and keep a record of the date, time, and place. Then, contact us at the address on the first page of this booklet or on the website and share what you have found or accomplished. In this way, we can encourage one another, share ideas, and create a climate for preservation and positive action within the Pompeston Creek watershed.

The survival and health of the Pompeston Creek and the woods and open space along its banks should be of vital interest to those concerned about the quality of life in our communities.

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**Figure 7 - Pompeston Creek Watershed (GIS Map)
WITH MAJOR ROADS**

