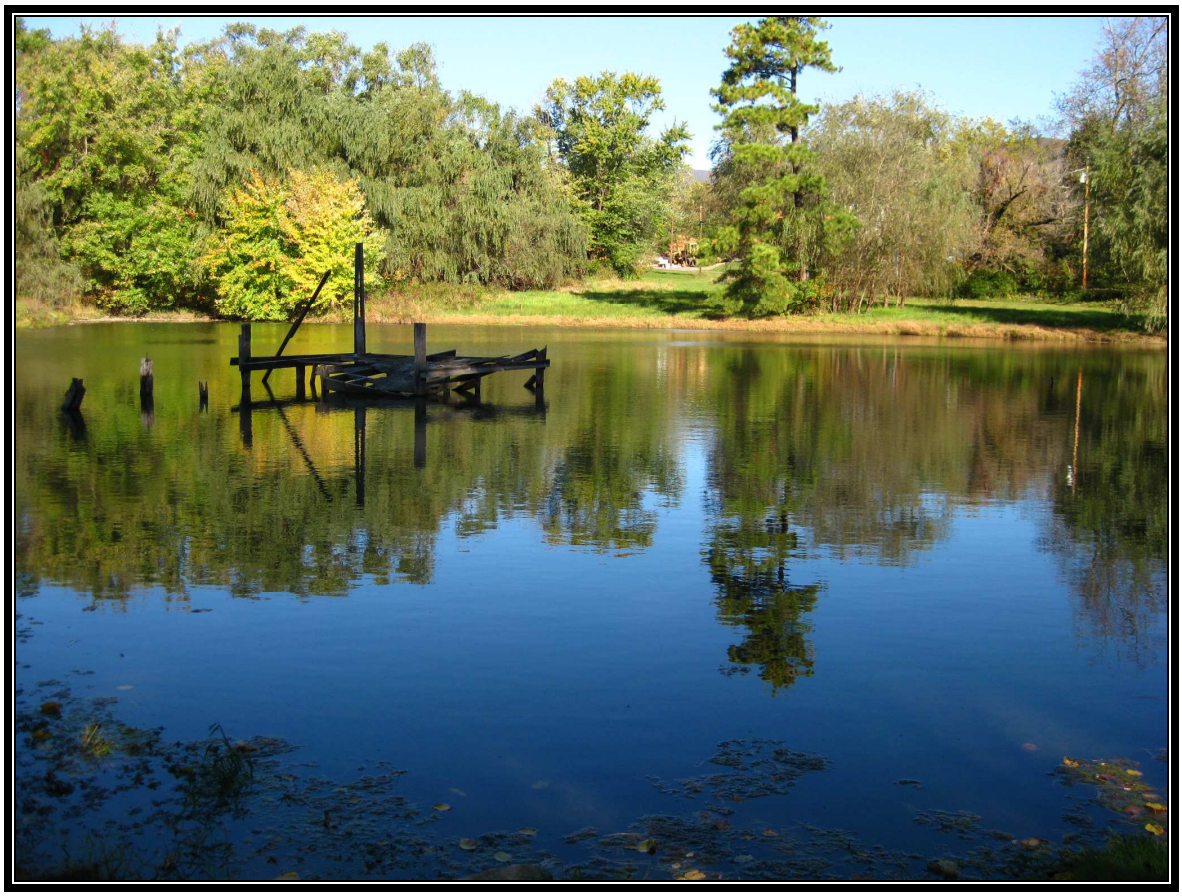
Recommendations for Enhancing Avon Hall Pond



Presented to the Town of Washington, Virginia
By RappFLOW
December 2008

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Photo by Virginia Valentine

Introduction

The mission of RappFLOW (Rappahannock Friends and Lovers of Our Watershed) is to protect the health of watersheds in Rappahannock County and to provide outreach and education to the community. In 2008 RappFLOW chose as part of this mission to focus on County ponds. There are over 540 ponds in Rappahannock County, the majority of which currently do not have vegetative buffers to reduce nutrient and bacteria loadings into our waterways. Early in the year, RappFLOW contacted officials of the Town of Washington to discuss Avon Hall pond which is owned by the Town. Avon Hall pond was thought to be an excellent location to demonstrate proper pond management due to the fact that it is a well known and highly visible landmark in the community. RappFLOW proposed to analyze the current condition of the pond and to make recommendations for improvements if necessary. The Town Council expressed support for this proposal.

In the Fall of 2008 RappFLOW conducted a preliminary site investigation to evaluate current pond conditions, and collected macro-invertebrate and water samples for further testing. Our volunteers analyzed this data and developed recommendations to improve the water quality and the biodiversity of Avon Hall pond. The purpose of this document is to present our findings and recommendations to the Town for their consideration. Support for this work by RappFLOW is provided by a grant from the National Fish and Wildlife Foundation (NFWF).

Site Evaluation and Sampling

Existing Site Conditions:

The grounds surrounding the pond are primarily maintained as a mowed lawn, with a smaller area between the pond and the road having been allowed to grow up with sages and other hydrophytic (water loving) vegetation. Plants adjacent to water provide critical shade, habitat and diversity to a pond environment. Plants protect shorelines from wave erosion and serve as feeding and nesting habitat for waterfowl. Most need to be adaptable to wet soil conditions and occasional flooding. Aquatic plants supply oxygen, uptake excess nutrients, provide cover and can be food for insects, amphibians and fish. We found few submerged aquatic plants during our investigation. Submerged aquatic plants are desirable and beneficial to fish communities for protection of young fish and minnows as well as eggs. They are also important to amphibians that need to be protected from larger fish. Sometimes aquatic plant communities prosper too well in a pond environment and can become a problem for ponds that are not well maintained. Control and avoidance of certain species needs to be practiced for a healthy pond.

Picture of the embankment and driveway to Avon Hall Pond. Photo by Virginia Valentine

The embankment of the Avon Hall dam contains a number of large white pine trees along with other woody vegetation growing on the dam. Woody vegetation is inadvisable on pond dams due to the fact that it can weaken the structure of the embankment. Water in a pond is always looking for a way out. Large plant roots and animal burrows are ways that water can escape. A good maintenance check of a dam is to look for seepage points on its downstream side. Seeping areas are an issue because they weaken the structural integrity of the dam, and during large rain events with the added pressures of more and more water can lead to a dam failure. The volume of vegetation growing on the Avon Hall dam prevented us from evaluating any seepage points. An additional danger to the dam is the possibility of the white pine trees overtopping. During high wind events trees can fall over, exposing their roots and undermining the embankment.

We observed at least four sources feeding water into the western edge of the pond. Most of these sources consist of springs seeping out of the ground at the toe of the slope, but one of the sources is being feed by a pipe of an unknown origin. This pipe may be an old clay tile pipe used for drainage purposes, but further investigation should be made.

The photo on the left is an image of one of the springs feeding Avon Hall Pond.
On the right is a picture of the unknown pipe. Photo by Virginia Valentine

Pond Depth:
A contour map was created to delineate the depth of Avon Hall Pond by transecting a grid pattern across the pond and measuring the depths along the grid (Attached Sheet 2). On average the middle of the pond is 5 to 8 ft. deep with a maximum depth of 8.5 ft. at the over flow pipe. Pond depth is important because it not only affects the amount of water the pond can hold, but also impacts where and what kind of vegetation can be planted. While measuring depths, we also used a Secci Disk to measure water clarity. A Secci Disk is a brightly colored disk that is lowered into the water and the depth at which it cannot be seen is recorded. The device we were using had a maximum testing depth of about 3 ft. We measured several locations and found that we could clearly see the disk at three ft., meaning that the water is fairly clear and would provide enough light for the plants we are recommending. In our recommendations, we have created four zones for plants that are dependent upon water depth.

Virginia and B.J. Valentine relay depth measurements to Marc Malik who records the depths and later drafted the contour map. Photo by Pat Dorsey

Wildlife:
Evidence of wildlife was very apparent at Avon Hall. Raccoon and deer footprints were found around the pond along with active groundhog burrows on and near the dam embankment. We also found turtles, minnows, and sampled for aquatic macro-invertebrates. Just like other animals, macro-invertebrates have certain habitats and conditions that they require to live. Evaluating the species of macroinvertebrates, and the relative numbers of each species over time can yield an estimate of water quality. RappFLOW's certified macroinvertebrate stream monitor volunteers carried out the sampling. Although the protocol we use is designed for streams and rivers, we believe it is still a good baseline indication of the water quality. Our volunteers collected two samples in still water approximately eight inches deep and two feet from the shoreline. The water samples yielded seven dragonfly larvae, four damselfly larvae, three clams measuring approximately 3mm, and two lunged snails. The sample count was notable in that all of the organisms found are types that range from "somewhat tolerant" to "extremely tolerant" to impaired waters, meaning that these organisms can tolerate and

can live in water quality that is poor. This indicates that there may be an impairment consisting of bacteria, nutrients or sediment and that further chemical tests (see page 7) are indicated.

RappFLOW volunteers Louise Bondelid and Ed Dorsey search for aquatic macroinvertebrates.
Photo by Pat Dorsey

A species of wildlife that is most likely to be significantly impacting the site is Canada Geese. During one site visit we witnessed at least 34 Canada Geese on the water. The banks along the pond are littered with goose droppings and show bare patches in the grass which are further evidence of highly trafficked areas for geese. Our recommendations later on in the report will discuss ways to fight this problem because Canada Geese not only increase loading of nutrients into waterways and ponds but also are a source of bacteria.

Canada Geese trying to land during our field study at Avon Hall Pond.
Photo by Virginia Valentine

Water Quality Sampling

Water samples were taken, and submitted to Joiner Micro Labs in Warrenton, Virginia. These samples were tested for Nitrogen, Phosphorous, and Biological Oxygen Demand and results were:

Sample	Results
BOD	5 mg/Liter
Phosphorous	0.0480 mg/Liter
Nitrite-Nitrate	0.243 mg/Liter

Biological Oxygen Demand (BOD) is a measure of the amount of oxygen used by microorganisms to decompose organic material. If Avon Hall Pond had a large quantity of organic waste (leaves, grass clipping, manure, sewage, etc.) entering the pond, this would create the perfect environment for bacteria to multiply and thus the demand for oxygen by bacteria would be high. The levels of BOD at Avon Hall Pond are considered to be "Moderate" which is encouraging information because this means that there is not a large quantity of decomposing material at the bottom of the pond. The nutrient levels of phosphorous and nitrite-nitrate also indicate a minimal impact to water quality and were not significantly high. If Avon Hall Pond did have a problem with excessive nutrients there would most likely be observable evidence because excess nutrients lead to algae blooms, and high yields of aquatic vegetation. Since we witnessed minimal algae and few to no aquatic plants the lab results support what we observed in the field.

Several water samples were also tested onsite for dissolved oxygen, pH, and bacteria. The pH levels were in a range from 7.8-10, dependent on the area of the pond that was tested (western edge, middle of pond, eastern edge), and were deemed to be within acceptable ranges. The dissolved oxygen (DO) readings varied from 9.4-10, which also were considered to be in a normal range. Dissolved oxygen readings evaluate the amount of oxygen available for organisms. DO has an inverse relationship to BOD in that when the demand for oxygen is high, DO readings are low due to organisms taking in large amounts of oxygen. Measurements of DO can be highly variable depending upon the time of day and the time of year.

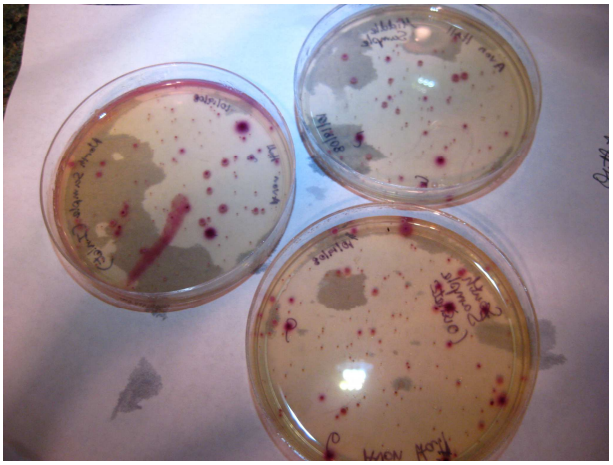
Statistically, this one day of sampling provides only a snap shot in time and does not allow us to account for fluctuations over a longer period. More lab and field sampling should be done throughout the year to get a better understanding the chemistry of the pond water. Each pond is unique and the factors that affect the chemistry and ecology are almost too numerous to mention in this report (e.g. pond design, sources of water, adjacent land uses, etc.), but by taking samples throughout the year we will expand our understanding of Avon Hall Pond and perhaps that of surrounding ponds in Rappahannock County as well.

Virginia Valentine uses a test kit to measure pH and Dissolved Oxygen (D.O.) at Avon Hall Pond. Photo by Pat Dorsey

The Bacteria count results are a tell-tale sign that Avon Hall Pond is in need of assistance. E. Coli is a bacteria that is found in the excrement of warm-blooded animals. The Commonwealth of Virginia standards for E. Coli bacteria in waterways are levels lower than 235 colonies per 100 milliliters of water, which is considered a safe level for swimmers. Avon Hall's three samples were plated for E. coli testing using the Coliscan method, and the following results were counted:

Pond Sample Location	**Count (per 100 ml)**
Middle	500 colonies
North (Inlet)	700 colonies
South (Outlet)	1100 colonies

The high E. coli levels are most likely due to the large number of geese which have been observed to congregate in and around Avon Hall Pond although some of the bacteria could be from sources such as other wildlife and nearby failing septic systems. A more specific test called bacteria point source tracking could be used to identify the different sources of E. Coli, but this step should only be considered if the E. Coli levels remain high after the pond's buffer is restored. The buffer we are proposing should limit Canada geese activities at the pond. Geese would still be able to land in the water but the vegetation would deter them from staying.



E. Coli samples taken from Avon Hall Pond. Each dark purple spot on the plates indicate a colony of E. Coli. Photo by Virginia Valentine

Recommendations

RappFLOW's recommendations for the improvement of Avon Hall Pond target three specific issues: 1) Establishing a vegetative buffer around the pond, 2) Reducing the impacts of Canada Geese, and 3) Maintenance and Monitoring

Vegetative Buffer

The buffer zone recommended is shown on the attached sheet 1 of 4. This zone should not be mowed more often than once per year during the dormant period. For the first few years no mowing is best until the plants are established. In the areas that include wet soil areas and springs, we recommend planting trees and shrubs that will grow in soils that have a high water table (See sheet 4 of 4). These plants, when established, will provide ground cover and a root system that will prevent erosion. Low perennials and grasses are also important to provide diversity and aesthetics. Once this zone is established it should greatly reduce the amount of bacteria entering the pond and will increase the balance of animals and plant life.

The aquatic zone planting plan is based on water depth which is illustrated on sheet 3 of 4. Four aquatic zones are defined in order to increase the diversity of habitat in the pond: Shallow water plants (Depths 0-1'), Water plants (Depths 1'-2'), Floating leaf plants (Depths 2'-4'), and Submerged plants (Depths 4'-6'). The list of recommended plant species for the vegetative buffer and aquatic zones are shown below. On sheet 4 of 4 each plant is labeled with two numbers (e.g.. 3-2). The first number gives the identification of the plant species. The second number indicates how many are to be planted in that area. For example "3-2" means to plant two buttonbushes.

Common Name	Botanical Name	Type of Species	I.D. # of plant	Total # of plants
Red Maple	*Acer rubrum*	Tree	1	4
River Birch	*Betula nigra*	Tree	2	9
Buttonbush	*Cephalanthus occidentalis*	Shrub	3	18
Flowering Dogwood	*Cornus florida*	Shrub	4	9
Eastern Redbud	*Cercis Canadensis*	Shrub	5	18
Silky Dogwood	*Cornus amomum*	Shrub	6	20
Winterberry	*Ilex verticillata*	Shrub	7	25
American White Waterlilly	*Nymphaea odorate*	Aquatic plant	8	12
Arrowleaf	*Sagittaria lancifolia*	Aquatic plant	9	7
Cardinal Flower	*Lobelia cardinalis*	Aquatic plant	10	20
Canadian Waterweed	*Anacharis canadensis*	Aquatic plant	11	37
Pickerelweed	*Pontederia cordata*	Aquatic plant	12	16
Soft Rush	*Juncus effusus*	Aquatic plant	13	16
Joe-Pye-Weed	*Eupatorium fistulosum*	Aquatic plant	14	10
Water Iris	*Iris laevigata*	Aquatic plant	15	14
Sedges	*Carex*	Aquatic plant	16	100
			Total # of plants	335

Reducing Impacts by Canada Geese

The proposed buffer should greatly reduce the impacts of geese on the pond. According to a publication by the Virginia Cooperative Extension entitled Managing Wildlife Damage…Canada Goose, well-fed, healthy adult Canada geese can produce up to 1.5 pounds of fecal material a day (Link: http://www.ext.vt.edu/pubs/wildlife/420-203/420-203.html). Thus it would not take a lot of geese to produce a problem of excessive nutrients and bacteria in a small pond like Avon Hall Pond. The publication also describes techniques to deter problem geese using Integrated Pest Management (IPM). IPM is a practice for conflict resolution whereby the landowner first evaluates the seriousness of the problem, reviews the options available and then, by evaluating costs and techniques, chooses a practice that best fits the situation. If the first option doe not work the landowner then moves on to the next technique. IPM practices generally view lethal options as a last resort.

We believe that properly implemented vegetative buffer and aquatic zones should reduce resident goose populations. Canada geese congregate near ponds and lakes that provide easy access to nearby foraging areas (i.e. mowed areas). So, by allowing the riparian edge to grow up, a landowner reduces foraging areas and leaves geese more susceptible to attack by predators. The Cooperative Extension publication recommends reducing or eliminating all mowing of vegetation within 50-75 feet of the water's edge. The buffer we are proposing is not as wide as this recommendation. We believe that by reestablishing a smaller buffer the impacts of the geese should be minimized. If this technique does not sufficiently dissuade geese, other recommendations include scare strategies using visual (scarecrows, owl effigies), auditory (loud noises, pyrotechnics, recordings of distress calls), and physical deterrents (remote control vehicles, dogs, sprinklers). All of these techniques require that the landowner switch the tactics from time to due to the fact that Canada geese can adapt easily to their environment.

Maintenance and Monitoring

Clearing the dam embankment of woody vegetation presents the biggest maintenance issue we found at Avon Hall Pond. Removing trees and shrubs from the embankment will significantly increase the longevity of the structure. The large white pine trees currently growing in a row across the embankment should probably be removed before they cause any damage. In addition the ground hog burrows should be filled in and if ground hogs continue to burrow, it may be advisable to trap and relocate them. As stated near the beginning of this report, the current level of vegetation growing on the embankment masks any points where water could be seeping out. Clearing out this vegetation and maintaining grass will allow the town to monitor for any issues more easily.

RappFLOW would like to continue to monitor Avon Hall Pond for E. Coli bacteria, dissolved oxygen, pH and possibly nitrogen and phosphorous levels. Future monitoring could record seasonal fluctuations in bacteria and chemical levels. If the Town of Washington follows our recommendations and establishes a buffer, a continuation of monitoring would yield data to illustrate to other pond owners the vital importance of buffers in improving water quality.

Conclusion

After completing the basic field investigation and reviewing the laboratory results RappFLOW believes that the best way to improve water quality and increase biodiversity at Avon Hall Pond is to establish a vegetative buffer and an aquatic plant zone. We believe such a buffer would greatly reduce impacts by Canada geese while filtering and cleaning the water before it goes downstream. Our other recommendations consist of clearing woody vegetation off of the dam, filling in ground hog burrows, and continuing to monitor water quality at the pond. RappFLOW offers to partner with the Town of Washington in future efforts to improve Avon Hall Pond.