# Paint Branch

## 3.14 Gum Springs Farm Stormwater Pond

### 3.14.1 Introduction

The Gum Springs Farm Stormwater Pond was constructed in 2006. The pond is located in the Lower Gum Springs Subwatershed of the Paint Branch (***Figure 3.14.3***). The Gum Springs Tributary is classified as a Use III stream, a cold water system that supports a naturally reproducing brown trout population. One of the goals of this restoration project is to reduce impacts from uncontrolled stormwater runoff, which critical to improving and maintaining the health of the Gum Springs Tributary. Another project goal is to prevent new thermal impacts on the Gum Springs Tributary. The stormwater pond was designed as an off-line system to capture storm flow from the surrounding neighborhood. The vegetated pond was designed to filter runoff and allow water to cool down and more slowly be released back to the stream to reduce thermal impacts and erosive forces from storm flow (***Figures 3.14.1 and 3.14.2***). Native riparian plantings have also been established as part of the restoration and are also important for filtering runoff before it enters the stream, as well as providing shade to the stream and bank stability to the Gum Springs Tributary. All of these improvements are meant to enhance stream's ability to continue to support a healthy aquatic community.

***Figure 3.14.1 – Pre-restoration View of the Gum Springs Farm Stormwater Pond Buffer and Pond Area (2001)***

***Figure 3.14.2 – Gum Springs Farm Stormwater Pond in 2009***

*Subwatershed facts*

Subwatershed Drainage Area: 134.7 acres
Subwatershed Imperviousness: 12 Percent

*Project Facts*

**Project Area:** The project captures stormwater drainage from the single family homes west of Briggs Chaney Road, within the Gum Spring Farm Subdivision. The project included adding a new stormwater facility to capture stormwater runoff from about 52 acres including almost 20 acres in impervious surfaces (rooftops, driveways, roads, etc).

**Costs:** $444,119, Funded in part by Maryland Department of Natural Resources
**Completion Date:** January, 2006
**Property Ownership:** Maryland-National Capital Park and Planning Commission

*Project Selection*

In May 1997, Montgomery County conducted an Upper Paint Branch Watershed Stormwater Management / Stream Restoration Assessment Study to examine stormwater management improvement opportunities and to evaluate and prioritize stream restoration enhancements throughout the Upper Paint Branch Watershed. The watershed study identified the Gum Springs Farm Stormwater Pond as a priority project due to the lack of stormwater management within the Gum Spring Tributary.

*Pre-Restoration Conditions*

The project is located south of Sturtevant Road, in the Lower Gum Springs Subwatershed, in an area that was previously a mowed field with some trees (***Figure 3.14.1***). The Lower Gum Springs Tributary was in need of stormwater quantity control due to the large uncontrolled area located upstream of the project site. Additionally, a limited stream buffer was observed along the Gum Springs Tributary that did not provide shade and bank stability for the stream.

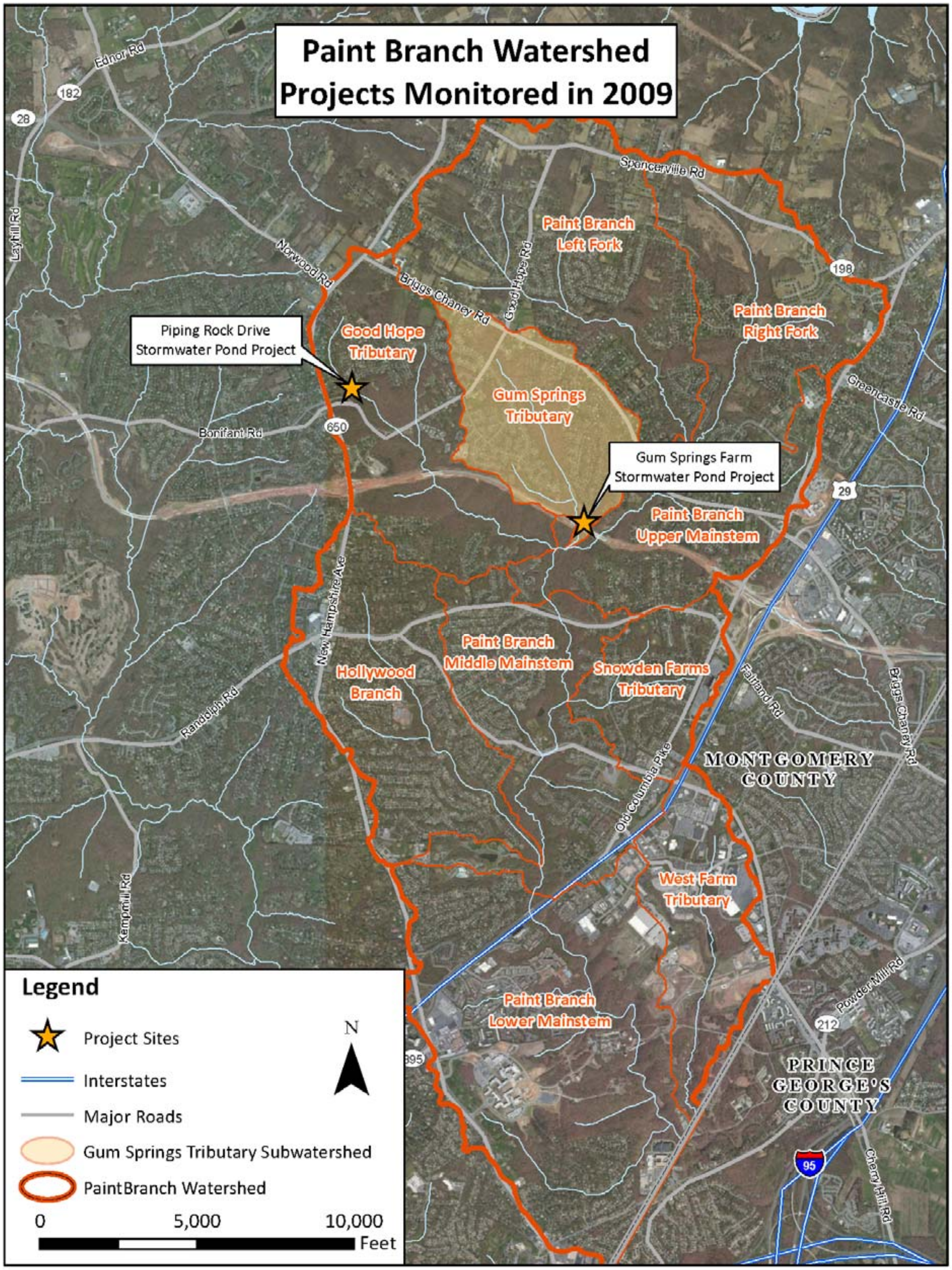


*Figure 3.14.3 – Paint Branch Watershed Projects Monitored in 2009, Including Gum Springs Farm Stormwater Pond Project*

*Restoration Actions Taken*

In 2006, the off-line Gum Springs Farm stormwater management pond was built to capture a two-year storm event and filter runoff from the adjacent residential development. The newly created facility and native landscaping are important features for filtering runoff and supporting a diverse and balanced community for amphibians, insects, fish, birds and other wildlife. The stream buffer was reestablished with 1.5 to 2 inch caliper trees to provide the next generation of forest along the Gum Springs Tributary.

### 3.14.2 Restoration Goals

Pre- and post-restoration monitoring was conducted up and downstream of the pond, and post-restoration monitoring was performed in the riparian zone along Gum Springs Tributary where the reforestation occurred. ***Table 3.14.1*** below presents the restoration goals, monitoring performed to evaluate the success of the goals, and when and where the monitoring occurred.

***Table 3.14.1 – Summary of Restoration Project Goals and Associated Monitoring***

| Why: Restoration Goals | What: Monitoring Done to Evaluate Goal | When: Years Monitored | Where: Station or Location Monitored |
|---|---|---|---|
| • Avoid introduction of new thermal impacts in the Gum Springs Tributary to Paint Branch | • Stream temperature | 2004 (pre), 2009 (post) | PBGS100P1 PBGS100P2 |
| • Improve riparian buffer along the Gum Springs Tributary | • Botanical monitoring | 2009 | PBGS100 (Zones A-F) |

### 3.14.3 Methods to Measure Project Goals

The basic sampling design for the temperature monitoring task was pre-restoration (before) and post-restoration (after) monitoring, located upstream and downstream of the project. Additionally, the riparian zone was monitored post-restoration only, after the plantings were installed and had time to establish. Data were collected at three sites in the vicinity of this restoration project, PBGS100P1, PBGS100P2, and PBGS100 (Zones A-F) (***Figure 3.14.4***).

Sites PBGS100P1, located upstream of the stormwater pond, and PBGS100P2, located downstream of the stormwater pond outfall (***Figure 3.14.4***), were established to monitor the temperature effects of the restoration (***Table. 3.14.1***). At these sites, temperature loggers were deployed to determine if the pond affected the stream temperature regime observed during pre-restoration monitoring. Crews also monitored the riparian plantings at PBGS100 (Zones A-F) to evaluate the overall success of the reforestation. A map showing the stormwater pond and monitoring locations is provided in ***Figure 3.14.4***. All data collected in 2004 are considered pre-restoration data and data from 2009 are considered post-restoration. These data are presented in the results section below. For more information on how this monitoring is performed and used to measure stream health in the County, see the Methods (***Section 2***).

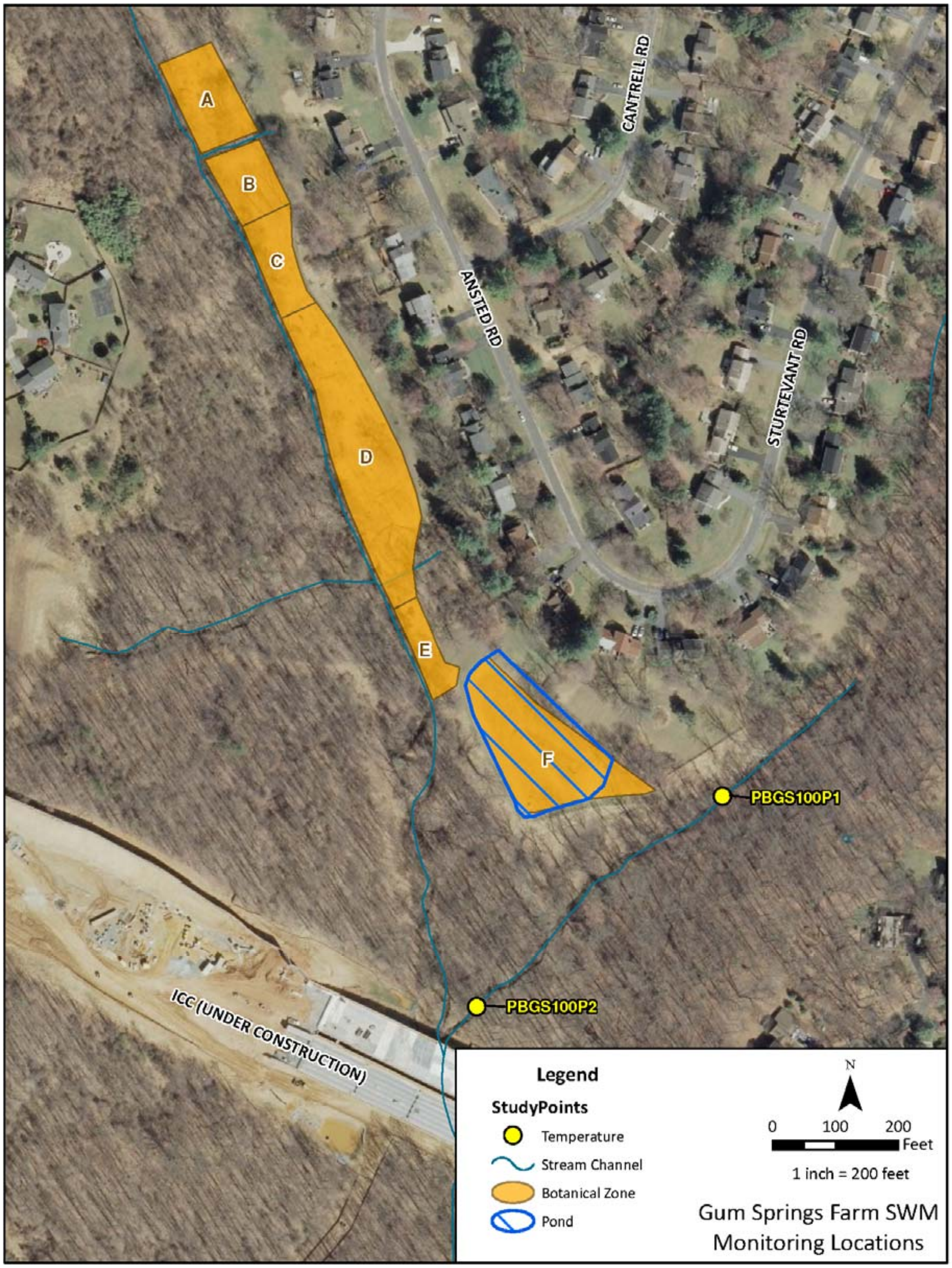


***Figure 3.14.4 – Map of 2009 Monitoring Locations for Gum Springs Farm Stormwater Management Project***

### 3.14.4 Results and Analysis

*Botanical Monitoring*

Monitoring site PBGS100 extends south along the eastern bank of Gum Springs for about 0.25 mile beginning just west of Bart Drive. This site consists of five riparian buffer planting zones (Zones A-E), as well as a stormwater pond planting zone (Zone F). The bulk of the woody plants were installed in October 2006, while a few replacement plantings were installed in March 2007. The riparian buffer plantings consisted of 336 trees, 51 percent of which were alive during the 2009 monitoring visit (***Table 3.14.2***). All six planted species were observed to some extent, including *Quercus bicolor* (swamp white oak), *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Platanus occidentalis* (American sycamore), and *Betula nigra* (river birch). Site-wide survival percentages for these species were 63, 58, 56, 56, 43, and 38, respectively. Several volunteer trees were also observed among the riparian buffer plantings, including *Liriodendron tulipifera* (tuliptree) and *Nyssa sylvatica* (blackgum).

***Table 3.14.2 – Riparian Botanical Reforestation Survival at PBGS100 (Zones A-E)***

| Species | Common Name | No. Planted[1] | No. Observed | Percent Survival |
|---|---|---|---|---|
| *Quercus alba* | white oak | 45 | 25 | 56 |
| *Platanus occidentalis* | American sycamore | 72 | 31 | 43 |
| *Quercus bicolor* | swamp white oak | 40 | 25 | 63 |
| *Betula nigra* | river birch | 64 | 24 | 38 |
| *Quercus rubra* | northern red oak | 48 | 27 | 56 |
| *Acer rubrum* | red maple | 67 | 39 | 58 |
| **Total** | | **336** | **171** | **51** |

[1] This number includes original October 2006 buffer plantings and March 2007 replacement plantings

The stormwater pond plantings consisted of 15 trees and 87 shrubs. Species planted included red maple, swamp white oak, *Aronia arbutifolia* (red chokeberry), *Cornus amomum* (silky dogwood), and *Viburnum dentatum* (southern arrowwood). Planted shrubs fared extremely poorly in this zone, with only three of the 87 plantings surviving into 2009. Only red chokeberry has persisted. Planted trees were only slightly more successful; two individuals of both planted species were alive at the time of the survey (***Table 3.14.3***).

***Table 3.14.3 – Stormwater Pond Botanical Reforestation Survival at PBGS100 (Zone F)***

| Species | Common Name | No. Planted[1] | No. Observed | Percent Survival |
|---|---|---|---|---|
| *Quercus bicolor* | swamp white oak | 7 | 2 | 29 |
| *Acer rubrum* | red maple | 8 | 2 | 25 |
| *Aronia arbutifolia* | red chokeberry | 33 | 3 | 9 |
| *Cornus amomum* | silky dogwood | 25 | 0 | 0 |
| *Viburnum dentatum* | southern arrowwood | 29 | 0 | 0 |
| **Total** | | **102** | **7** | **7** |

[1] This number includes original October 2006 buffer plantings and March 2007 replacement plantings

Zone A is located in the more forested upstream portion of the site, and extends from just west of Bart Drive south to a rip-rap lined ditch that enters the Gum Springs Tributary. Five species were identified in this zone during the 2009 monitoring visit, including white oak, swamp white oak, northern red oak, red maple, and American sycamore (***Table 3.14.4***). These species accounted for 16 stems, of which 88 percent were healthy at the time of the vegetation survey. Only six percent of the observed trees were dead. No evidence of deer browsing was observed, but dense patches of both *Microstegium vimineum* (Japanese stiltgrass) and *Polygonum perfoliatum* (Asiatic tearthumb) were somewhat pervasive in ***Zone A***.

***Table 3.14.4 – Botanical Reforestation Summary by Planting Zone at PBGS100***

| **Species** | **Common Name** | **No. Planted** | **Planting Zone and No. Observed** | | | | |
|---|---|---|---|---|---|---|---|
| | | | **A** | **B** | **C** | **D** | **E** |
| *Quercus alba* | white oak | 45 | 5 | 1 | 2 | 17 | 0 |
| *Platanus occidentalis* | American sycamore | 72 | 4 | 0 | 2 | 22 | 3 |
| *Quercus bicolor* | swamp white oak | 40 | 3 | 0 | 0 | 22 | 0 |
| *Betula nigra* | river birch | 64 | 1 | 1 | 3 | 19 | 0 |
| *Quercus rubra* | northern red oak | 48 | 0 | 1 | 1 | 25 | 0 |
| *Acer rubrum* | red maple | 67 | 1 | 3 | 3 | 32 | 0 |
| **Total** | | **336** | **14** | **6** | **11** | **137** | **3** |

Zone B begins at the aforementioned rip-rap lined ditch and continues south to the edge of the forested portion of the site. This zone contained four species of trees, including white oak, river birch, northern red oak, and red maple. These species accounted for only six stems, all of which were healthy at the time of the vegetation survey. No dead trees were evident, nor did deer browse appear to be affecting any of the planted trees. As in Zone A, Japanese stiltgrass was quite dense throughout Zone B.

Zone C, is adjacent to Zone B and occurs near the center of the site within a more open setting. Five species of trees were identified in Zone C, including white oak, American sycamore, river birch, northern red oak, and red maple. These species accounted for 11 stems, 10 of which were healthy at the time of the vegetation survey. No dead trees were observed among those found to persist into 2009. Japanese stiltgrass was also found in this zone, but was less abundant than in Zones A and B. Deer browsing did not appear to be affecting any of the planted trees.

Zone D is located immediately south of Zone C, also within an open setting. This zone contained the most trees of all zones assessed, with 138 stems counted. All six planted tree species were encountered, as well as one volunteer tuliptree. As in other zones, the condition of trees present was good, with 88 percent of those observed appearing healthy at the time of the vegetation survey. No dead trees were observed among those persisting into 2009. Despite the apparent success of the planted trees observed, invasive plants may soon become a nuisance in this zone, as both Japanese stiltgrass and Asiatic tearthumb were found growing extensively throughout the assessed area. Deer browse however, was observed only on one tree.

Zone E is the southernmost riparian buffer planting zone along the Gum Springs floodplain. This zone contained only three planted American sycamore trees in 2009. Four blackgum volunteers were also present. All seven of the individuals observed were healthy, while none appeared dead at the time of the vegetation survey. Zone E also contained dense patches of Japanese stiltgrass, but no signs of deer browsing were evident.

Zone F constitutes a stormwater pond planting area that was planted in 2006 with mostly shrubs and a small number of trees. Two species of trees and one shrub were observed in 2009, including red maple, swamp white oak, and red chokeberry. Of the seven stems counted, only four appeared healthy. No dead trees or shrubs were observed. The poor success of plantings in this zone remains unclear, since no signs of deer browse were apparent nor were invasive plants present during the vegetation survey.

Across all planting zones, trees have grown on average, 0.5 to 1.75 inches in diameter in the past 2-3 years. All species grew since they were planted in 2006/2007. River birch, American sycamore, and northern red oak have grown the most. The majority of the reforested areas receive partial to full sun exposure. ***Table 3.14.5*** depicts the overall growth of the trees.

***Table 3.14.5 – Site PBGS100 2006/2007 Botanical Planting Sizes verses 2009 Observed Sizes***

| Common name | Scientific Name | Planting Size 2006/2007 (inch diameter) | Observed Size 2009 range (approximate average inch diameter) |
|---|---|---|---|
| *Quercus alba* | white oak | 1-1.5 | 1-2.5 (2) |
| *Platanus occidentalis* | American sycamore | 1-1.5 | 1-4 (2.5) |
| *Quercus bicolor* | swamp white oak | 1-1.5 | 0.5-2.75 (2) |
| *Betula nigra* | river birch | 1-1.5 | 1.75-5 (3.25) |
| *Quercus rubra* | northern red oak | 1-1.5 | 2-3 (2.5) |
| *Acer rubrum* | red maple | 1-1.5 | 0.5-3 (2.25) |

*Temperature*

In 2004, pre-construction stream temperature was monitored upstream (PBGS100P1) and downstream (PBGS100P2) of the proposed Gum Springs Farm Stormwater Pond using continuous data loggers. During this time, the average temperature above the proposed pond was 62.4ºF and the average temperature below the proposed pond was 63.7ºF, with 2.8 and 4.6 percent of all readings exceeding the 68ºF Use III temperature standard, respectively (***Table 3.14.6***).

In 2009, after the pond was created, stream temperatures were also monitored upstream (PBGS100P1) and downstream (PBGS100P2) of the pond. ***Figure 3.14.5*** shows stream temperatures up and downstream of the Gum Springs Farm Stormwater Pond as well as air temperature and daily rainfall from June 1 to September 30, 2009. Rainfall data were obtained from the Weather Underground KMDSILVE11 weather station located in Calverton, MD, approximately three miles from the Gum Springs Farm Stormwater Pond. ***Table 3.14.5*** shows the minimum, maximum, and average temperature at each site, and the differences between these values up and downstream of the pond. It also shows the percentage of readings that exceeded the Use III temperature standard.

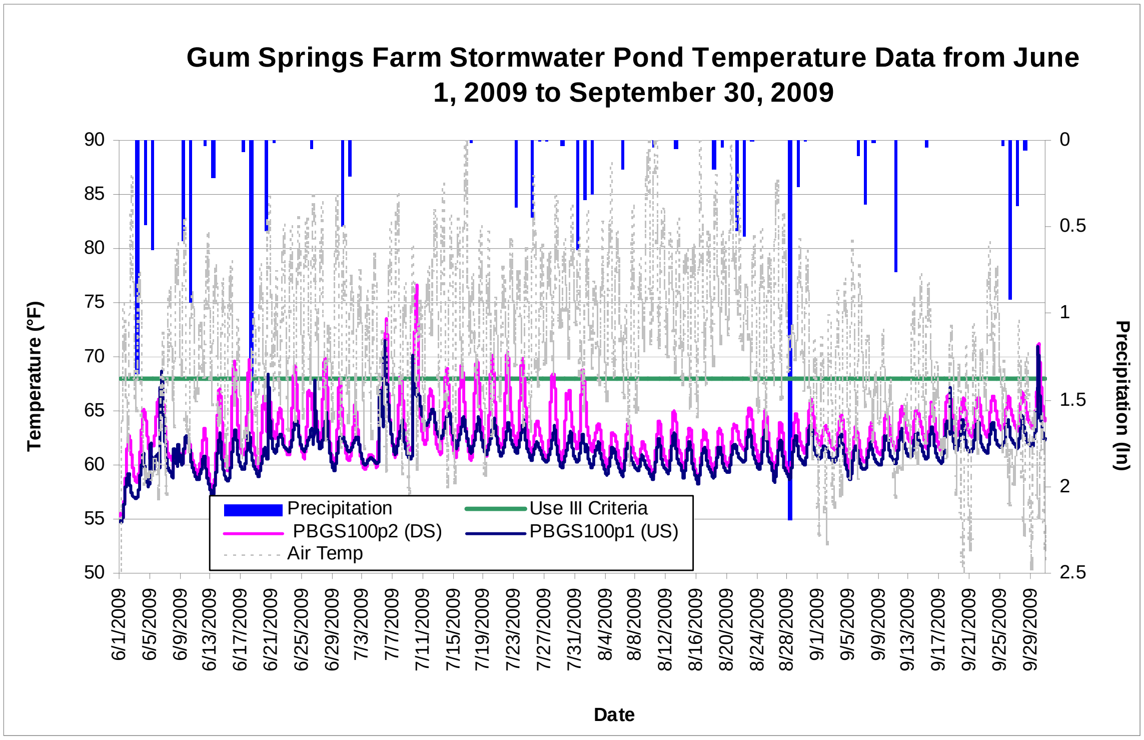


***Figure 3.14.5 – Stream Temperature Upstream and Downstream of the Gum Springs Farm Stormwater Pond in 2009***

In 2009, the minimum temperature below the pond was 7.2°F lower than it was above the pond. The maximum and average temperatures were higher below the pond than above, with temperature differences of 10.5°F and 1.6°F, respectively. Additionally, 11 percent of the readings exceeded the Use III standard below the pond and only 1 percent exceeded the 68°F standard above the pond.

***Table 3.14.6 – Min, Max, and Average Stream Temperatures in the Vicinity of the Gum Springs Farm Stormwater Pond in 2004 (pre-restoration) and 2009 (post-restoration)***

| **Date** | **2004** | | | **2009** | | |
|---|---|---|---|---|---|---|
| **Location** | US | DS | Δ* | US | DS | Δ |
| **Minimum Temperature (°F)** | 57.4 | 56.0 | -1.4 | 54.7 | 47.5 | -7.2 |
| **Maximum Temperature (°F)** | 78.7 | 77.7 | -1.0 | 72.5 | 83.0 | 10.5 |
| **Average Temperature (°F)** | 62.2 | 63.7 | 1.5 | 62.1 | 63.7 | 1.6 |
| **Percentage of readings exceeding Use III standard (68 °F)** | 2.9 | 4.6 | 1.7 | 1.4 | 11.2 | 9.8 |

* The delta symbol (Δ) is used to represent change in temperature from upstream to downstream

A non-parametric paired t-test (Wilcoxon Signed-Rank) was also performed on the 2009 data, comparing the mean difference between the upstream and downstream site. The test detected a highly significant difference (p value <0.0001) between temperatures collected upstream verses temperatures collected downstream of the pond. On average, downstream temperatures were 1.6 degrees warmer than upstream temperatures. To assess whether the pond had contributed new thermal impacts downstream, a non-parametric unpaired t-test (Wilcoxon Rank Sum) was also performed comparing the mean difference in temperature from upstream and downstream sites between 2004 and 2009. The test detected a highly significant difference (p value <0.0001) between the two datasets. Temperature differences between upstream and downstream were on average, 0.3 degrees warmer in 2009 than in 2004.

### 3.14.5 Discussion

***Table 3.14.7*** below provides a summary of project goals, the results of the first year of post-restoration monitoring, and whether each project goal has been met by the restoration actions. One of the project goals was successfully met and one goal was not met as of the first year of monitoring.

***Table 3.14.7 – Summary of Project Goal Results***

| Goal | Result |
|---|---|
| Avoiding introduction of new thermal impacts in the Gum Springs Tributary | Unsuccessful – observed thermal impacts downstream of the Gum Springs Farm stormwater pond. However, temperature differences between the upstream and downstream sites from pre-construction to post-construction were only slight. |
| Riparian reforestation | Successful – A riparian buffer has been established in a vegetated area that was previously open field. While many plantings did not survive near the pond, the riparian tree plantings near the stream were much more successful, ranging from 38 to 63 percent survival. |

*Successful – Riparian Reforestation*

The Gum Springs Farm restoration project appears to have met the goal of reforesting the riparian zone of the Gum Springs Tributary. Many areas that were sparsely vegetated prior to construction have been planted as part of this restoration project and the riparian zone is considerably improved (***Figure 3.14.6***). Some of the plantings have died, including the majority of the shrub and tree plantings in the stormwater pond area (Zone F) (***Figure 3.14.7***). Only seven percent of the trees and shrubs planted in the vicinity of the stormwater pond (Zone F) survived. Riparian tree plantings were much more successful; between 38 to 63 percent of these plantings survived, with an overall average of 51 percent (Zones A-E). The planted trees that were most successful site-wide were swamp white oak, red maple, white oak, and northern red oak. Additionally, the caliper sizes of the individuals observed in 2009 were larger than those that were planted in 2006/2007. The increase in size of the planted individuals is a measure of successful growth and a sign that these trees are well established. The species that grew the most were river birch, American sycamore, and northern red oak.

***Figure 3.14.6 – Gum Springs Farm Botanical Reforestation area in 2005 versus 2009 (dominated by American sycamore and Japanese stiltgrass)***

***Figure 3.14.7 – Gum Springs Farm Stormwater Pond in 2009***

*Unsuccessful – Thermal Impacts*

Prior to and after construction of the Gum Springs Farm Stormwater Pond average stream temperatures were significantly higher below the pond, or future location of the pond, than above. Prior to the pond's construction, temperatures at the downstream location were 1.3 degrees higher than at the upstream location. In 2009, the average stream temperature below the pond was 1.6 degrees higher than it was above the pond. A highly significant difference ($p$ value <0.0001) was detected in the temperature difference between the upstream and downstream sites from before to after the pond was built. Therefore it appears that the installation of the pond has contributed to new thermal impacts downstream, although temperature differences were not substantial (0.3 degrees, on average). To further understand whether the pond is contributing new thermal impacts to the Gum Springs Tributary, the temperature regimes at this stormwater pond will continue to be monitored biennially (every two years) for the next four years.

### 3.14.6 Conclusions

Overall, the Gum Springs Farm stormwater pond restoration met one project goal and did not meet another. The restoration helped reforest the stream buffer in an area once dominated by herbaceous vegetation. Many of the tree plantings have survived to 2009, the first year of restoration monitoring, although most of trees and shrubs planted in the vicinity of the stormwater pond (Zone F) do not appear to have survived. Upstream of the pond, the reestablishment of a riparian buffer was a success. All mowing that had occurred up to the stream's edge was terminated and a wide riparian buffer is now established.

At this time, it appears that the goal of avoiding introduction of new thermal inputs to the Gum Springs Tributary has not been met. Prior to and after the construction of the pond, stream temperatures below the pond were, on average, higher than they were above. Additionally, differences between downstream and upstream temperatures were significantly higher post-restoration than they were prior to restoration. Stream temperatures will continue to be monitored at this site in the future to see if this pattern persists. The goal of avoiding thermal impacts downstream may be better achieved by replanting Zone F, reducing mowing and trimming in and around the pond and allowing trees, shrubs, and pond-side vegetation to grow uninhibited to provide better pond shading. Concerns have been raised about greater plant growth potentially causing blockage of the pond outlet and riser with debris from the vegetation. However, without greater shading, it is unlikely that thermal impacts can be easily remediated. Possible structural changes to the existing pond design to address thermal impacts, such as reducing detention time to reduce potential warming, could increase downstream discharges and erosion. Consequently, more invasive structural changes are not currently recommended without a comprehensive engineering analysis.