

3.18 Little Falls III Mall Tributary Stream Restoration

3.18.1 Introduction

The Little Falls III Mall Tributary Stream Restoration project was constructed in 2005. The project site is located along the Little Falls III Mall Tributary to the Potomac River, between Sangamore Road and Sentinel Drive in Bethesda, Maryland. *Figure 3.17.3* in the Little Falls I Mainstem Stream Restoration report depicts the location of the Little Falls III Mall Tributary site. The Little Falls III Mall Tributary has been classified by the Code of Maryland Regulations (COMAR) as Use I-P, for water contact recreation and protection of aquatic life. Prior to restoration, this site had severely eroded stream banks and an exposed sewer line, both caused by stormwater received from a concrete channel at the upper portion of the site. The lower section of the concrete channel was undermined and had fallen apart, causing severe stream erosion. Immediately below the failing concrete channel there was extreme channel down-cutting (*Figure 3.18.1*). The goal of the project was to address severely degraded conditions along the Little Falls III Mall Tributary through stream channel restoration, stabilization, and reforestation, while also providing improved or increased aquatic insect and fish communities. *Figure 3.18.2* depicts the site following restoration in 2007.



Figure 3.18.1 – Little Falls III Mall Tributary Pre-Restoration in 2005



Figure 3.18.2 – Little Falls III Mall Tributary Post- Restoration in 2009

Subwatershed facts

Subwatershed Drainage Area: 58 acres
Subwatershed Imperviousness: 40 Percent

Project Facts

Project Area: The stream restoration begins near the outfall from the Shops at Summers Place on Sangamore Road and continues downstream to the pedestrian bridge crossing within the Little Falls Branch Park. The project included stabilizing approximately 528 linear feet of stream and planting native vegetation.

Costs: Structural and Reforestation (\$352,308), Funded in part through a Maryland Department of the Environment (MDE) Grant.

Completion Date: December 2005

Property Ownership: Maryland-National Capital Park and Planning Commission

Project Selection

The Little Falls Mall Tributary was identified as a priority stream reach within the Metropolitan Washington Council of Governments' (COG) Rapid Stream Assessment Technique (RSAT) Survey of the Little Falls Branch Watershed (1996). In addition to the project site being identified in this Watershed Study, Montgomery County residents called the County's Department of the Environmental Protection with concerns over the site's exposed sewer line and severe erosion.

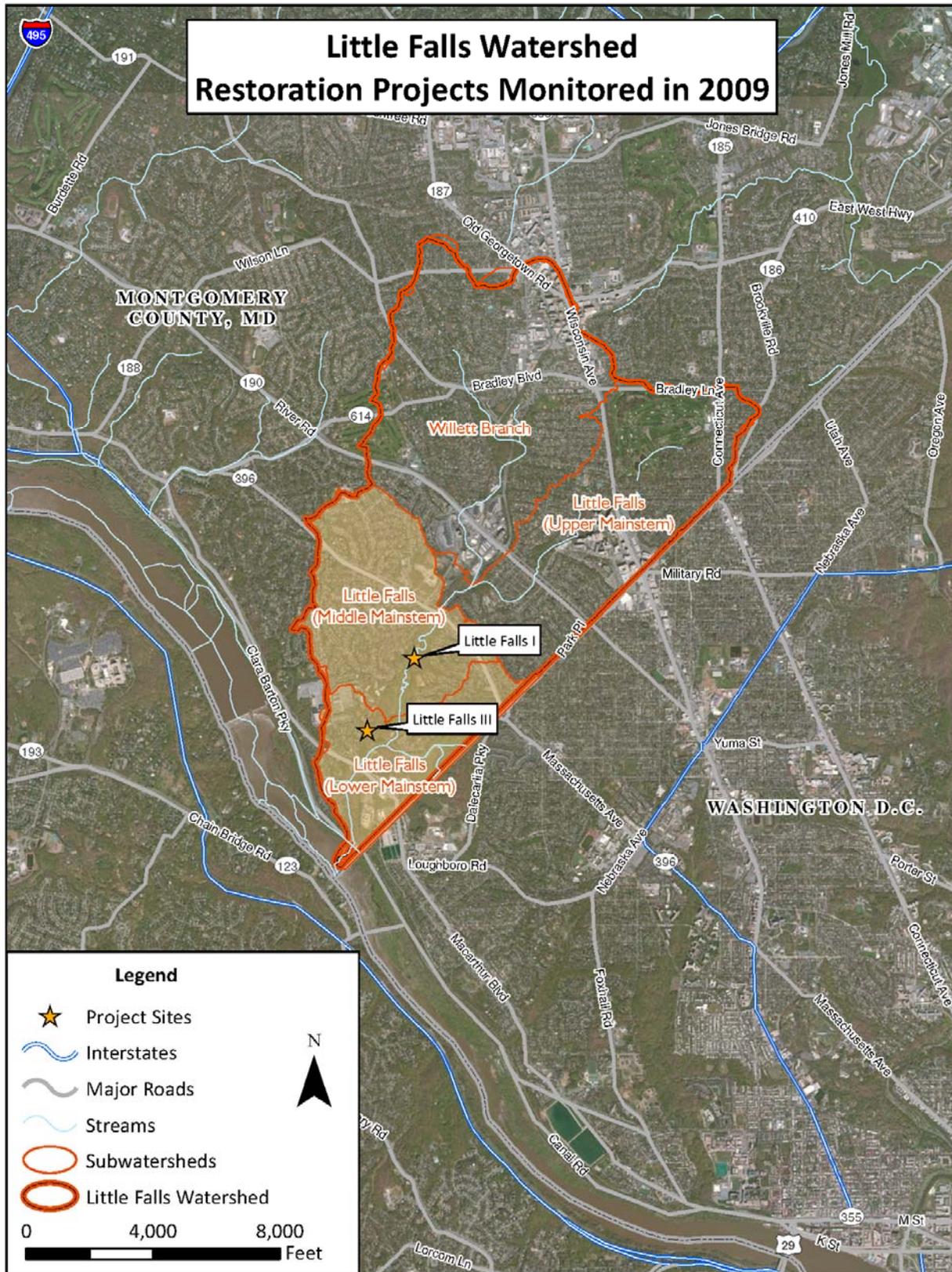


Figure 3.18.3 – Little Falls Watershed Including Little Falls III Mall Tributary (LFMT101) Stream Restoration

Pre-Restoration Conditions

The majority of drainage into the Little Falls Mall Tributary comes from the Shops at Summers Place where the stormwater flows into a "U" shaped concrete channel. The lower section of the concrete channel is undermined and has fallen apart, causing severe stream erosion. Immediately below the failing concrete channel, there is extreme channel down-cutting. On average, the streambank height within the project area was nine feet, with very minimal vegetation for streambank protection. An exposed, leaking sewer line was found toward the upper end of the project limits. Stream erosion was further increased by five storm drain outfalls that had minimal outfall channel protection.

Restoration Actions Taken

Portions of the undermined and unstable "U" shaped concrete channel were removed and replaced with a step pool system to gradually bring the flows from the mall down to the existing grade of the stream. During the step pool construction, WSSC replaced the exposed, leaking sewer line and advised DEP on the placement of the stone step pool structures to ensure their sewer line was protected. Rock pools were constructed at each of the storm drain outfalls to help dissipate the energy associated with the stormwater entering the stream. The vertical eroding stream banks were graded back and planted with native grass seed, ferns, shrubs, and trees. The project attempted to save trees on undercut stream banks with supportive rock packing. Seriously damaged trees were flush cut, allowing root systems to remain in the bank for stabilization.

Once the stream restoration project was completed, the access road was replanted with various native trees and shrubs. At the access road closer to Sangamore Road, DEP planted twelve white pine trees to provide a natural screen between the townhouses on Sangamore Court and Sangamore Road. *Figure 3.18.4* shows ground-level images before and after restoration.



Figure 3.18.4 – Little Falls III Mall Tributary Stream Restoration Before (2005) and After Restoration (2007)

3.18.2 Restoration Goals

Restoration goals were defined during the planning and implementation of the Little Falls III Mall Tributary Stream Restoration project. Pre- and post-restoration monitoring was conducted within the stream and in the riparian area. *Table 3.18.1* below presents the restoration goals,

monitoring performed to evaluate the success of the goals, and when and where the monitoring occurred.

Table 3.18.1 – 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
<ul style="list-style-type: none"> • Improve aquatic habitat conditions • Improve quality and density of benthic macroinvertebrate community in the Little Falls III Mall Tributary • Help establish a fish community 	<ul style="list-style-type: none"> • Qualitative habitat • Aquatic communities: <ul style="list-style-type: none"> ▪ Benthic macroinvertebrates ▪ Fish • Water chemistry 	2002 (pre) 2009 (post)	LFMT101
<ul style="list-style-type: none"> • Reduce stream erosion • Reduce erosive stream flows 	<ul style="list-style-type: none"> • Quantitative habitat (stream morphology surveys) 	2011(post) ¹	LFMT101
<ul style="list-style-type: none"> • Reforest riparian zone 	<ul style="list-style-type: none"> • Botanical survey 	2009 (post)	LFMT101

¹ Quantitative habitat surveys were scheduled for 2009, but were delayed due to missing benchmarks. These benchmarks were located and survey work was performed in 2011. The 2011 report will include updates for this monitoring.

3.18.3 Methods to Measure Project Goals

The basic sampling design for the Little Falls III Mall Tributary Stream Restoration project was pre-restoration (before) and post-restoration (after) monitoring. However, pre-restoration data are not available for the fish community, thus no comparisons will be made to baseline conditions for fish. The County monitored the biological communities (benthic macroinvertebrate and fish), took in-situ water chemistry measurements performed rapid habitat assessments (RHAB), and conducted a botanical survey, at one biological monitoring site (LFMT101) within the restoration project to evaluate the aquatic habitat conditions, water quality, and botanical reforestation during the post-restoration period in 2009. Pre-restoration data were collected at this site in 2002 and post-restoration data were collected at this site in 2009. *Figure 3.18.4* depicts the location of the LFMT101 monitoring site.



Figure 3.18.5 –Monitoring Location Map for Little Falls III Mall Tributary (LFMT101) Stream Restoration

3.18.4 Results and Analysis

Benthic Macroinvertebrates

BIBI (Benthic Index of Biological Integrity) Scores

The benthic macroinvertebrate community at LFMT101, as assessed using the MCDEP Benthic Index of Biological Integrity (BIBI), was Poor in both the pre- and post-restoration periods (*Figure 3.18.6*). The baseline BIBI percentage prior to restoration was 20, which is the lowest possible BIBI percentage. Note that prior to restoration, the number of individuals collected was 29, which is below the threshold for calculating the BIBI, thus the lowest possible BIBI score was assigned at this site in 2002. Following restoration, the number of individuals increased to 127, but the BIBI percentage remained at 20. Field data sheets from 2009 benthic macroinvertebrate monitoring are included in *Appendix D*.

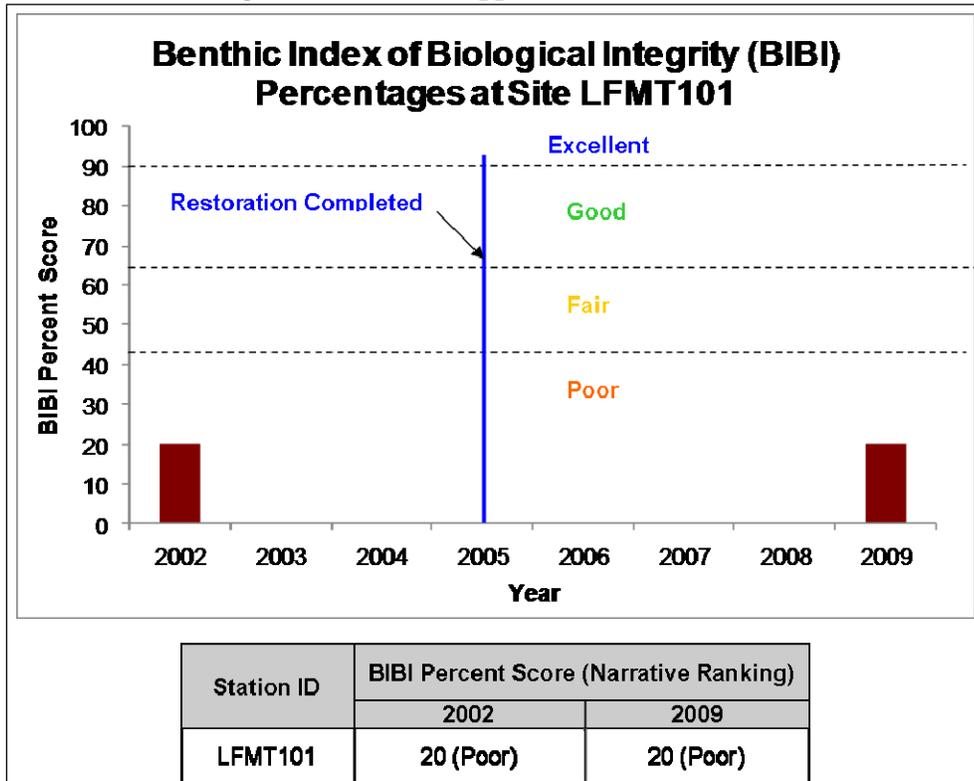


Figure 3.18.6 – Pre- and Post-Restoration Benthic Index of Biological Integrity (BIBI) Percentages at LFMT101

Dominant Taxa

Both pre- and post-restoration communities of benthic macroinvertebrates at LFMT101 were dominated by Chironomidae (non-biting midges), which comprised 82 percent of the community prior to restoration and 92 percent after restoration. *Gammarus* sp. (scuds) was the second most dominant taxon prior to restoration, representing 14 percent of individuals collected. Following restoration, the second most dominant taxa collected was Tubificidae (a family of aquatic worms), making up three percent of the community. Overall, the percentage of dominance of the top two taxa was similar between the pre- and post-restoration periods, comprising 96 and 95 percent of the community, respectively.

Tolerance Values

Site LFMT101 was dominated by tolerant taxa (83 percent) prior to restoration, with the remaining 14 percent represented by taxa intermediate in sensitivity (*Figures 3.18.7 and 3.18.8*). Following restoration, the site experienced an increase in the proportion of tolerant benthic macroinvertebrate taxa to 98 percent, and a decrease in the proportion of taxa intermediate in sensitivity to two percent.

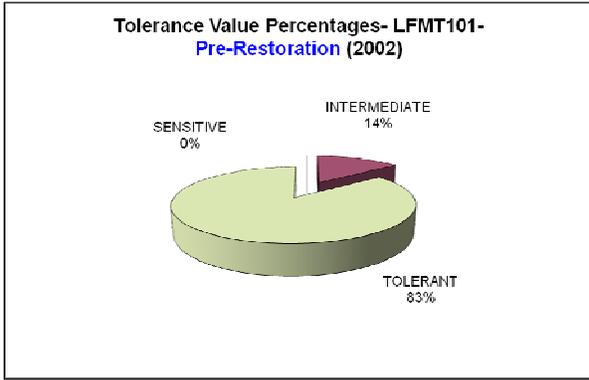


Figure 3.18.7 – Benthic Macroinvertebrate Tolerance Composition at LFMT101 Prior to Restoration

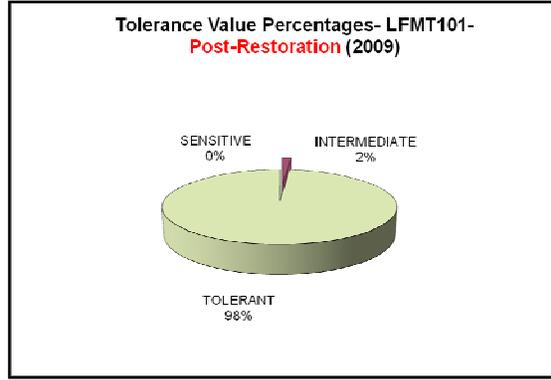


Figure 3.18.8– Benthic Macroinvertebrate Tolerance Composition at LFMT101 After Restoration

Functional Feeding Groups

Collectors were the most dominant functional feeding group at LFMT101 both before and after restoration. Prior to restoration, the community was comprised of 93 percent collectors and three percent scrapers (*Figures 3.18.9 and 3.18.10*). After restoration the percentage of collectors decreased from 93 percent to 84 percent. The remainder of the community was represented by predators (16 percent) and filterers (0.8 percent). More specialized feeders such as scrapers and shredders that require less degraded stream conditions or specific habitat features were absent from the benthic macroinvertebrate community following restoration.

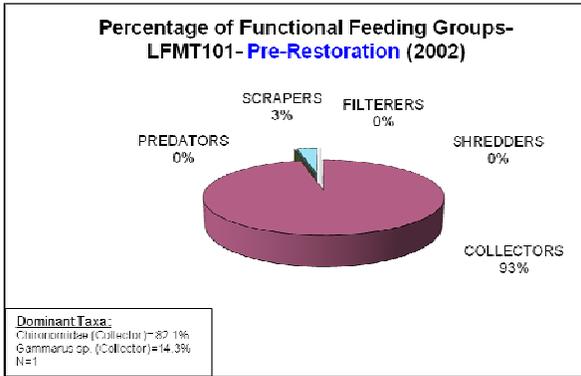


Figure 3.18.9 – Benthic Macroinvertebrate Functional Feeding Group Composition and Dominant Species at LFMT101 Prior to Restoration

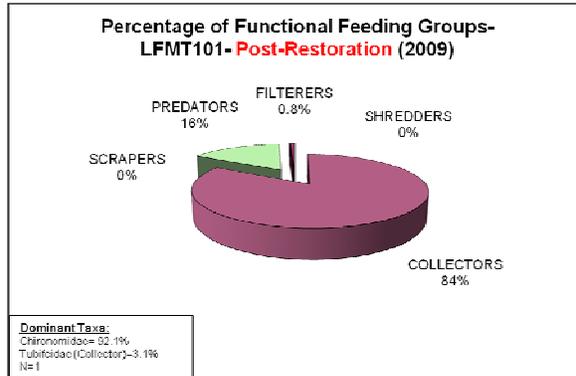


Figure 3.18.10– Benthic Macroinvertebrate Functional Feeding Group Composition and Dominant Species at LFMT101 After to Restoration

Fish

Fish data were not available for the pre-restoration period at this site. The post-restoration fish community was sampled at LFMT101 in 2009. However, no fish were documented during the survey, thus a Fish Index of Biotic Integrity (FIBI) score could not be calculated. The absence of fish in 2009 is likely due to the size of the stream, as the stream is small and possibly dry during parts of the year, which suggests that fish are not a good indicator for stream condition at this site.

Qualitative Habitat

Pre-restoration aquatic habitat was evaluated at LFMT101 in the spring and summer in 2002. During this period, percentages were in the Fair range with scores of 45.5 and 44.0, respectively (*Figure 3.18.11*). Following restoration, aquatic habitat was evaluated in the spring and summer of 2009. During 2009, aquatic habitat percentages were lower than they were in the pre-restoration period but still within the Fair range, with scores of 36.5 and 39.0, respectively. The lower aquatic habitat percentages observed following restoration were due to a decrease in instream cover for fish, higher embeddedness, and an increase in sediment deposition. Field data sheets for this task are located in *Appendix D*.

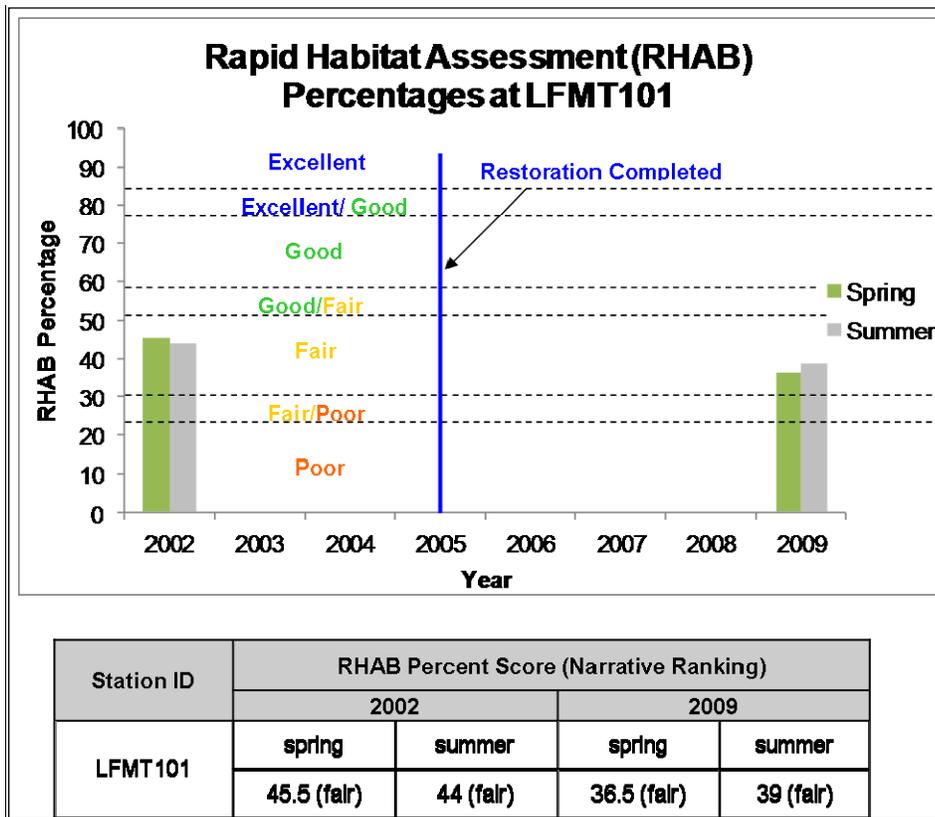


Figure 3.18.11 – Pre- and Post-Restoration Rapid Habitat Assessment (RHAB) Percentages at LFMT101

Quantitative Habitat

Quantitative monitoring was scheduled to occur at LFMT101 in 2009, but was delayed due to problems locating the benchmarks. Data were collected in 2011 and will be presented in the 2011 report.

Water Chemistry

All in-situ water quality parameters were in compliance with COMAR standards for Use I-P streams during both pre- and post-restoration periods (**Table 3.18.2**). However, dissolved oxygen was relatively low (5.42 mg/L) in the summer of 2002.

Table 3.18.2– Pre- and Post-restoration in-situ Water Chemistry Data at LFMT101

Water Quality Parameter	2002		2009	
	spring	summer	spring	summer
Dissolved oxygen (mg/L)	6.64	5.42	-	6.17
Dissolved oxygen (% saturation)	69	64	-	63
pH	6.67	6.74	6.85	6.61
Conductivity (µmhos)	567	644	1022	908
Water temperature (°F)	66.2	75.6	72.1	62.4

Botanical Reforestation

This site was planted in 2005 with 78 trees representing five species *Platanus occidentalis* (American sycamore), *Acer rubrum* (red maple), *Pinus strobus* (white pine), and *Ilex opaca* (American holly), *Liriodendron tulipifera* (tuliptree). In 2009, all five species of planted tree were observed in addition to two species of volunteer trees *Carpinus caroliniana* (American hornbeam) and *Cercis canadensis* (eastern red bud). Overall, the success rate of planted trees in this botanical zone was 71 percent (**Table 3.18.3**). When including the volunteers found at this site the success rate increases to 79 percent. White pine and red maple had the two best survival rates and American holly had the lowest survival rate. Of the trees observed in 2009, 59 percent appeared healthy. A small number of individuals were experiencing tip dieback and rubbing by deer. Only two stems were dead at the time of the vegetation survey and included one red maple and one American sycamore. The tree species that grew the most since being planted in 2005 were white pine and American sycamore. The species that seemed to grow the least were American holly and red maple.

In 2005, 169 shrubs representing four species were planted including *Viburnum prunifolium* (blackhaw), *Lindera benzoin* (northern spicebush), *Cephalanthus occidentalis* (buttonbush), and *Sambucus nigra canadensis* (American black elderberry). All four shrub species were observed in 2009 and two volunteer species were found including *Cornus amomum* (silky dogwood) and *Hamamelis virginiana* (American witchhazel). Overall, the success rate of shrubs was lower than trees at this site, with 29 percent of the individuals surviving from 2005 to 2009, when including the volunteers in the success rate increased to 41 percent. All shrub species survived similarly, with buttonbush having the highest survival rate (44 percent) and elderberry having the lowest (25 percent) (**Table 3.18.4**). Fifty four stems were counted in the botanical zone, 86 percent of which appeared healthy. Most individuals appeared to be either affected by deer or invasive plants. Only two shrubs appeared dead at the time of the survey, one silky dogwood and one blackhaw. Blackhaw individuals grew the most since being planted in 2005. The

average height of the planted elderberry was smaller than what was planted; these individuals were resprouting after being browsed by deer. Several species of invasive plants were observed, some of which were rather abundant across the site. Those observed included *Rubus phoenicolasius* (wineberry), *Celastrus orbiculatus* (Oriental bittersweet), *Alliaria petiolata* (garlic mustard), *Lonicera japonica* (Japanese honeysuckle), *Wisteria sinensis* (Chinese wisteria), *Microstegium vimineum* (Nepalese browntop), and *Rosa multiflora* (multiflora rose). **Figure 3.18.12** shows the area of reforestation following restoration in 2009.

Table 3.18.3 – Botanical Reforestation Tree Data for Site LFMT101

Scientific Name	Common Name	Number Planted (2005)	Number Observed (2009)	Success Rate (%)	Caliper Range (2009) ¹
<i>Platanus occidentalis</i>	American sycamore	15	10	67	1.75-2.5
<i>Acer rubrum</i>	red maple	24	17	71	1.25-1.5
<i>Liriodendron tulipifera</i>	tulip poplar	17	11	65	1.5-2.5
<i>Pinus strobus</i>	white pine	12	12	100	2.75-3.5
<i>Ilex opaca</i>	American holly	10	5	50	1-1.75
Total		78	55	71	

¹ All trees ranged from 1 to 1.5 inch caliper when planted in 2005

Table 3.18.4 – Botanical Reforestation Shrub Data for Site LFMT101

Scientific Name	Common Name	Number Planted (2005)	Number Observed (2009)	Success Rate (%)	Average Height (ft) ¹
<i>Lindera benzoin</i>	spicebush	76	20	26	3
<i>Viburnum prunifolium</i>	blackhaw	76	23	30	5.5
<i>Sambucus canadensis</i>	elderberry	8	2	25	1.5
<i>Cephalanthus occidentalis</i>	buttonbush	9	4	44	4
Total		169	49	29	

¹The height of all planted shrubs was approximately three to four feet in 2005



Figure 3.18.12 – Botanical Zone at LFMT101 along the Little Falls III Mall Tributary (2009)

3.18.5 Discussion

Table 3.18.3 below provides a summary of project goals, the results of post-restoration monitoring, and whether each project goal has been met by the restoration actions as assessed by the third year of post-restoration monitoring. Based on the results, one of the project goals was partially met by the restoration actions, one restoration goal was successfully met, and one project goal could not be evaluated in 2009.

Table 3.17.3 – Summary of Project Goal Results

Goal	Result
<ul style="list-style-type: none"> • Improve aquatic habitat conditions • Improve quality and density of aquatic communities 	Partially successful – pre-restoration fish data were not available for this site, thus no before/after comparisons can be made. However, fish were absent from the site in 2009; therefore, no improvement to the community could have occurred. Qualitative habitat did not improve after restoration. Benthic macroinvertebrate data shows no improvement in health, but a greater density was observed following restoration.
Reduce stream erosion and erosive stream flows	Unable to determine – physical data from 2010 will suggest if these goals have been met.
Reforest riparian zone	Successful – most tree plantings appeared healthy; however, several of the shrub plantings have died and invasive species were prevalent.

Partially Successful – Improve Aquatic Habitat Conditions and Quality and Density of Aquatic Communities in the Little Falls Branch

Based on the results of the third year of monitoring, the goal of improving aquatic habitat conditions and aquatic community quality and density in the Little Falls III Mall Tributary was partially met in 2009. Although aquatic habitat conditions did not improve following restoration, the benthic macroinvertebrate community showed greater density. Because fish were not observed in 2009, the goal of helping establish a fish community was not met in 2009. The absence of fish in 2009 is likely due to the size of Little Falls III Mall Tributary, which may have been dry during the year, suggesting that this site may not be a suitable candidate for establishing a viable fish population.

Unable to Determine – Reduce Stream Erosion and Erosive Stream Flow in the Little Falls Branch

Because quantitative monitoring was delayed in 2009, the goal of reducing stream erosion and erosive stream flows was unable to be determined. Data were collected in 2011 and will be presented in the 2011 report.

Successful – Reforest Riparian Zone

The current year's monitoring indicated reforestation efforts within LFMT101 have been successful. Overall, the success rate of the planted vegetation, including volunteers was 71 for trees and 41 for shrubs. The health of persisting planted vegetation was good, with approximately 59 percent of trees and 86 percent of shrubs appearing healthy at the time of the monitoring visit. An abundance of planted Christmas ferns were also found along the upstream portion of the project. However, several species of invasive plants were observed, some of which were rather abundant across the site. Invasive control measures are recommended for species that could potentially suppress the health of the riparian plantings such as porcelainberry, Oriental bittersweet, and multiflora rose. Additionally deer appeared to affect many of the planted shrubs and some of the planted trees.

3.18.6 Conclusions

The project goals of improving aquatic habitat and reforesting the riparian zone in the Little Falls III Mall Tributary were partially met in 2009. This is the third year of monitoring for this site; a fifth year of monitoring is required to determine whether the Little Falls III Mall Tributary Stream Restoration project has met its project goals. However, because the watershed in which the Little Falls III Mall Tributary flows is highly urbanized, it may not be able to assimilate impacts from impervious surface runoff or treat all of the contaminated stormwater without implementation of watershed-wide stormwater management improvements. As a result, future monitoring may not show improvement in the aquatic community following restoration.