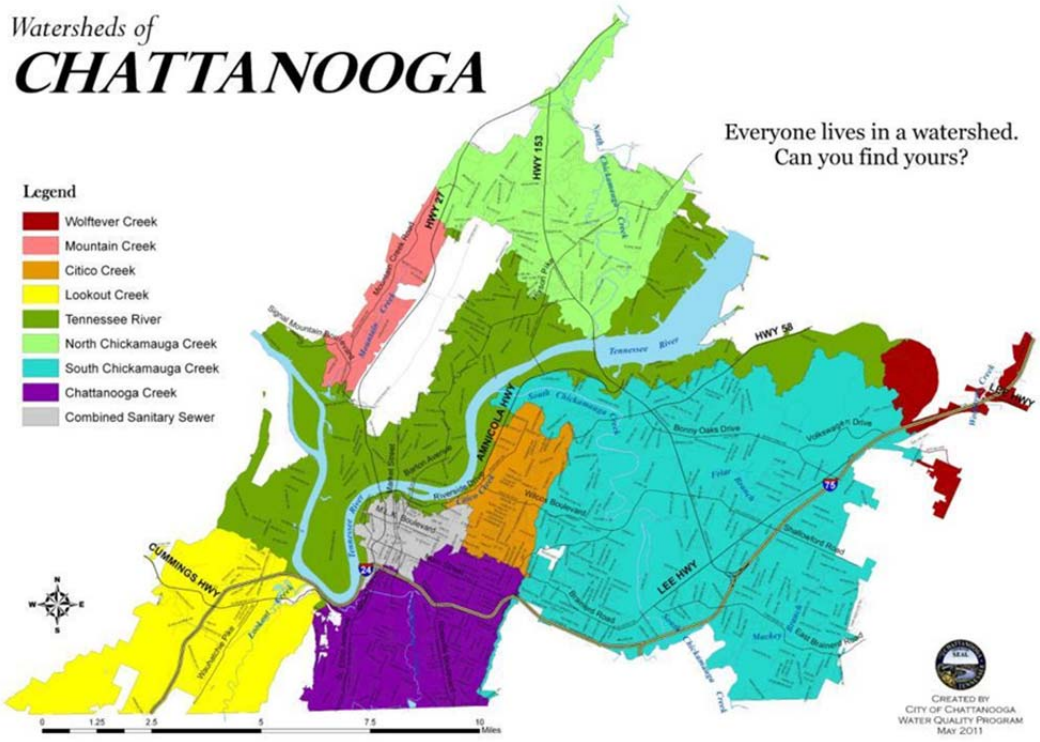
Name of Project: Watershed Based Plan for Mountain Creek Watershed

Lead Organization: TenneSEA (Student Environmental Alliance)

Watershed Identification

This project is located within the Nickajack Lake Upper Watershed (HUC 06020001 1202), a sub watershed of the Lower Tennessee River Watershed. It is focused particularly on Mountain Creek (HUC 062001426-1000). Mountain Creek is located in Hamilton County, TN. It is almost entirely in the City of Chattanooga, but small portions of the watershed are in the City of Red Bank while the upper reaches of the watershed on Walden's Ridge are in the Town of Walden and the Town of Signal Mountain. Mountain Creek Watershed is approximately 2583 acres which is about 13 miles of stream, 4.67 of which are listed as impacted. It joins with Stringer's Branch on the campus of Baylor School just before emptying into the Tennessee River/ Nickajack Reservoir just downstream of downtown Chattanooga. Population density in the watershed ranges from very low (approximately 34 ppl/sq mile) to very high (over 10,000 ppl/sq mile) in the areas dominated by apartment complexes.

In Phase 1 of this project, we instituted a watershed education plan at schools and constructed two model BMP's in this watershed. For Phase 2, we propose to install at least 50 BMP's in the watershed, upstream of Runyan Drive. For Phase 3, we plan to install another 40 BMP's in the watershed downstream of Runyan Drive to the Tennessee River.



Causes and Sources of Nonpoint Source Pollution in the Watershed

The following indicates the impairments according to the current Draft 303(d).

Waterbody ID TN06020001	Impacted Waterbody	Watershed area (acres)	Miles Impaired	Cause of impairment
426-1000	Mountain Creek	2,583	4.67	Physical Substrate Habitat Alterations *Escherichia coli*

This watershed based plan addresses sediment and pathogens within the watershed. Our goal with full implementation of this plan is to remove Mountain Creek from the 303 d list of impaired streams.

Mountain Creek watershed is situated in a narrow valley, bounded on one side by Walden's Ridge (Signal Mountain) and on the other by the ridge on which Highway 27 is built. • Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f) form a heterogeneous region composed predominantly of limestone and cherty dolomite. Landforms are mostly low rolling ridges and valleys, and the soils vary in their productivity. Land cover includes intensive agriculture, urban and industrial uses, as well as areas of thick forest. White oak forest, bottomland oak forest, and sycamore-ash-elm riparian forests are the common forest types. The upper valley is still dotted with hobby farms with acreage and lower density residential dwellings, while further downstream it becomes congested with high density residential comprised of many apartment complexes. There are also many housing developments, the newest of which is Horse Creek Farms, completed in the last few years and the oldest is Spring Valley which is over 50 years old. Older homes are still in the valley, but increasingly that land is being converted to high density

residential and businesses. The newest development that has been approved by the planning commission is high density apartment homes across Mountain Creek Road from Red Bank Elementary School. The site developer is ASA Engineering, which has pledged to assist the school with Green Infrastructure and other projects. One tributary begins on Signal Mountain and flows through oak hickory forest before joining with the main creek down below. This tributary is still highly diverse and scores healthy on the biotic index.

It is a relatively small watershed, therefore our positive actions can make significant impact on the water quality in the stream. Yet still, an inch of rain would cause over 70 million gallons of water to discharge into the Tennessee River. The runoff, particularly increased by urbanization, causes rapid increases in stream flow which severely erode the stream banks and increase sediment loading. Runoff also causes issues with the MS4 and sewer systems, increasing pathogen concentrations. Restoration should focus on reducing runoff, stream bank repair, pathogen reduction practices, and public education about watershed pollution.

Sediment Loading

Some of the sediment loading to Mountain Creek are from MS4s during storm events, but for the most part it originates from development and stream bank erosion. According to the TMDL,

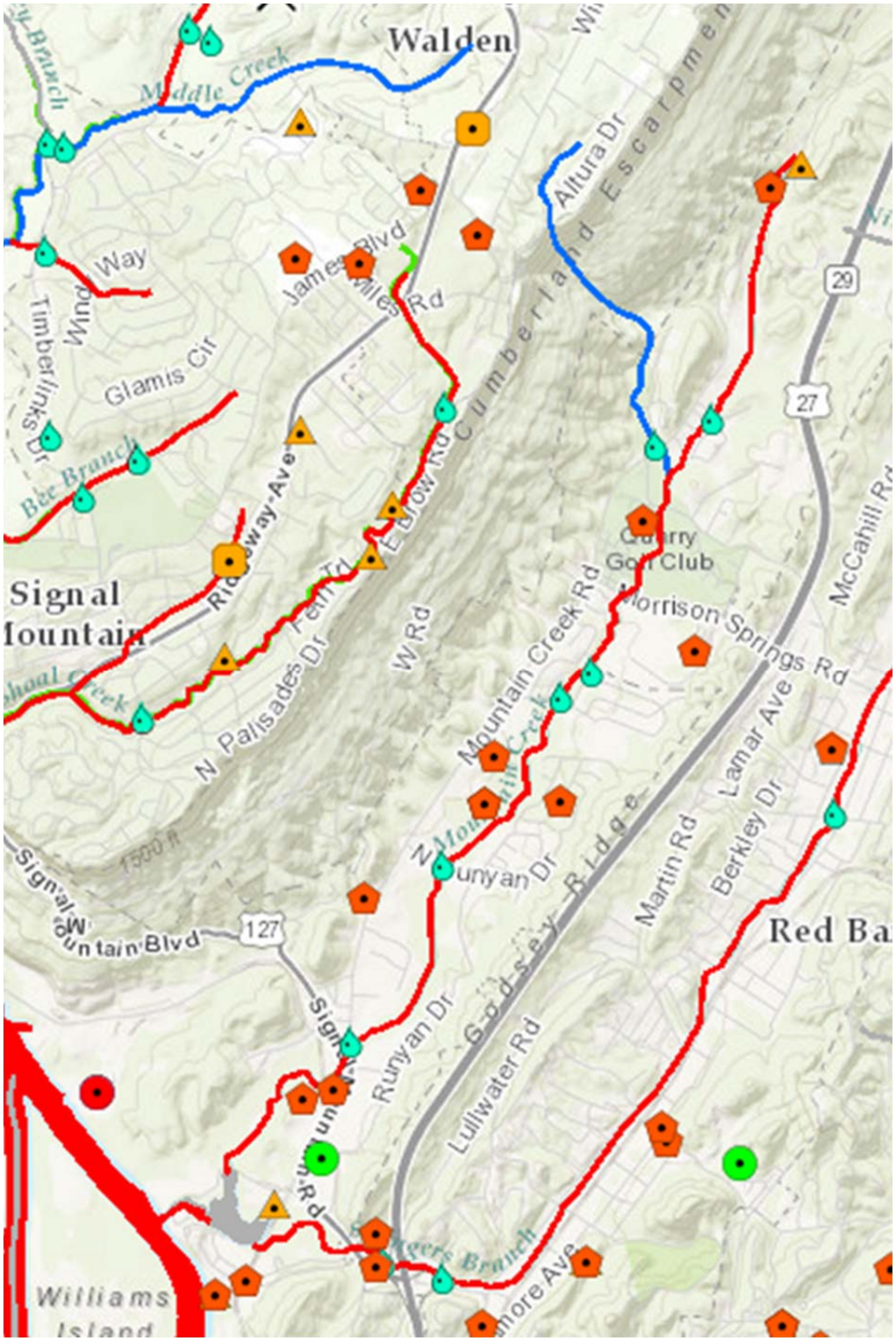
“Reductions of sediment loading from nonpoint sources (NPS) will be achieved using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired waters. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources.”

(Source: Siltation/Habitat Alteration TMDL Lower Tennessee River Watershed (HUC 06020001) (9/25/06 - Final))

Pathogen loading

MS4s are point sources of E. coli which happens during storm events. Nonpoint sources of pathogens are much more difficult to pinpoint and therefore treat. Frequently, they wash off of land during storm events. The source of these could be pet and wildlife wastes or agricultural wastes. Deer density in Tennessee is very high, and have been seen frequently in the Mountain Creek Watershed. In addition, poorly functioning septic systems are also sources of pathogen. Since urban streams are dominated by impervious surfaces, runoff is transported to streams rapidly, without natural treatment by soils and plants. The TMDL for E. coli for Mountain Creek is 2.3 x 10,000,000,000 x Q (streamflow) cfu/day. For most streamflow events, reduction required to meet the TMDL would be between 25 and 45%.

(Source: E. coli TMDL Lower Tennessee River Watershed (HUC 06020001) 9/15/10 – Final)



Estimate of Load Reductions

According to the TMDL, although stormwater mitigation installations do no specifically reduce pathogens, sediment reduction will reduce pathogen concentrations since pathogens are attached to sediments. The TMDL also suggests many types of low impact development/ green infrastructure BMP's to be used to decrease the stormwater runoff and therefore the pathogen loading. *E coli* numbers collected by our staff and interns show a very close relationship with rainfall, more rain fall equals higher *E coli* numbers. Highest numbers are in the 3800 range and lowest numbers are less than 100. As predictable, higher in the watershed, the numbers drastically decrease. Not so predictable is that our lowest sampling site typically has lower numbers as well. We attribute this to the intact bottomland forest which would beneficially treat pathogens in high flow events. The TMDL calculates that the average load reductions should be approximately 20 per cent for mid-range and moist conditions and 46 per cent for high flows. The increased loading with high flows again points to a need to reduce the flashy nature of the stream as well as control the MS4 and sewer system failures. We predict that 100 acres of BMPs will reduce pathogen laden sediments as well as reduce sewer system overflows. Pathogen concentrations will be monitored at high, medium, and low flow events to see if this number needs to be adjusted. Additionally, if we could restore some additional bottomland riparian forest downstream or amid the highest developed areas, the E. coli load at the mouth of the creek will be significantly reduced. That will be one of our goals for Phase 3 of this project. Pet waste also adds to pathogen loading so encouraging pet owners to properly dispose of pet waste is important in reducing these pathogens

According to the TMDL for Mountain Creek, non-point sources would require a load reduction of 67.2% for siltation. Since the implementation of the TMDL in 2006, much of the construction caused siltation has been eliminated. However, increased impervious surfaces due to development have only continued to increase. Recent turbidity data shows that runoff/ stream bank erosion is still causing extremely high turbidity readings. In 2006, the sediment load was 1,156 lbs/ac/yr. The target load is 399.7 lbs/ac/yr which would be a 67.2 % reduction in sediment, which would be more than accomplished as we meet all of the goals of this watershed based plan, even as construction continues.

BMP Name		**Quantity**	**Sediment reduction per unit**	**Tons of sediment reduction/yr**
Riparian Forest Buffer		20 acres	3 tons/acre/yr	60
Native Species Filter Strip		1 acres	32.9 tons/ac/yr	32.9
Roof Runoff Structures storage tank		100 (50 gallon)	Na	
Stream Bank Protection	Vegetative	5000 sq ft	.047 per ft	23.5

Stream bank stabilization projects	2	4.224 tons per year	8.448
Bottomland Forest Restoration	20 acres	3 tons/acre/year	60
Rain Gardens/ bioswales/ pervious pavement/ other green infrastructure	60 units estimating 3 acres (130680 sq ft)	.006 tons/sq/yr	784
Green infrastructure retrofit with pavement removal and recycling	2 units ½ acre 21780sqft	.006 tons/sqft/yr	131
Pet Waste Dispensers	10	na	
Total Reduction			1099

BMP List, Educational Activities and Budget

BMP Name		Quantity	Cost/Unit	Budget Estimate
Riparian Forest Buffer		20 acres	1042	20,840
Native Species Filter Strip		1 acres	122	122
Roof Runoff Structures storage tank		100 (50 gallon)	1.44	7,200
Stream Bank Protection	Vegetative	5000 sq ft	.74	3,700
Stream bank stabilization projects		2	100,000	200,000
Bottomland Forest Restoration		10 acres	Est 2000 with land movement	Est 20,000
Rain Gardens/ bioswales/ pervious pavement/ other green infrastructure		60 units	Not able to assign a	Est 60,000

		simple cost since it changes with location	
Green infrastructure retrofit with pavement removal and recycling	2 units	Costs will vary	Est. 100,000
Pet Waste Dispensers	10	800	8000

Educational Event	**Quantity**	**Cost/Unit**	**Budget Estimate**
Green Infrastructure tour for professionals	4	1000	4000
Water festival for watershed residents and others at elementary school.	4	6000	24000
Watershed Awards Development and marketing	1	5000	5000
Watershed award inception and celebration	5	3000	15000
Watershed non-point source reduction BMP virtual tour	1	4000	4000
Video Contest at Schools	2	4000	4000
Educational Activities at Schools	16	500	8000

Total Budget for Project:	**$486,862**

This watershed based plan intends to reduce sediment and E coli in the impaired segments of Mountain Creek by installing the BMP's listed above. These are the potential BMP's we may use, but they may change as conservation plans are developed with landowners. We also will engage residents and business owners in the watershed through development of incentive Watershed Award system which will include a collaboration of watershed citizens in the development. The students at the schools will also be engaged through activities and a video contest about How to Save Their Creek. Water Festivals will be held in the watershed to

highlight activities to protect the creek and a BMP Tour will be mapped and a video created to make virtual tour of BMP's installed in watershed. Tours for professionals and the public will be given in order to increase awareness.

Timeline, Tasks, and Assessment of Progress

This watershed based plan is envisioned as a comprehensive 6 year plan building on our initial five years, to be completed by 2023. The plan is divided into 2 additional 3 year periods with Phase one being the initial education and outreach with BMP's. Phase 2 will address the upper watershed upstream of Runyan Drive. Phase 3 will address the lower watershed, from Runyan Drive to the Tennessee River.

Within the first six months, watershed residents will be engaged to help develop the award program and conservation planning in watershed will begin with the assistance of NRCS. All BMPs will be designed and installed according to NRCS Field Office Technical Guide or Urban Green Infrastructure and accepted engineering standards. Educational events will occur throughout the process. Stream bank restoration at the elementary school will begin within the first six months. Progress toward milestones will be measures on a monthly basic and adjustments will be made when needed to keep projects on track to be completed by due dates. We anticipate this to take up to six years, with the lower more urban section of the watershed in the latter part of the process. Primary tasks in first three year process are in table below:

Task or Event	Year		
	1	2	3
Contact Landowners, churches, schools	Q1		
Develop award with watershed based steering committee	Q1-2		
Watershed Conservation planning and mapping with NRCS	Q2-4		
BMP installation (10 in Year 1, 20 each in years 2 and 3)	Q3-4	Q1-4	Q1-3
Streambank Stabilization	Q2-4	Q1-3	
Awards Piloted	Q4	Q4	
Educational workshops and activities	Q2-4	Q1-3	Q1-3
BMP virtual tour			Q2-3
Water festivals	Q4	Q4	Q4
Professionals and public BMP tours			Q2-3

Criteria to Assess Achievement of Load Reduction Goals

Turbidity measurements will be taken during wet and dry times where runoff from BMP sites enter the river. E coli samples will be taken as well. Samples will be taken before and after BMP installations to determine sediment and E coli reduction.

Monitoring and Documenting Success

BMP installation records, photographs, and field measurements will document the success of the project. The conservation plan will also be included. Criteria will be developed in cooperation with the Chattanooga TDEC Field Office to determine whether substantial progress is being made toward attaining water quality standards and whether modifications will be necessary along the way for this watershed based plan. Criteria will include measurements for sediment (total suspended solids), nutrients including Nitrate+nitrate, Ammonia and orthophosphate, and E coli.