

# **Great Seneca Creek**

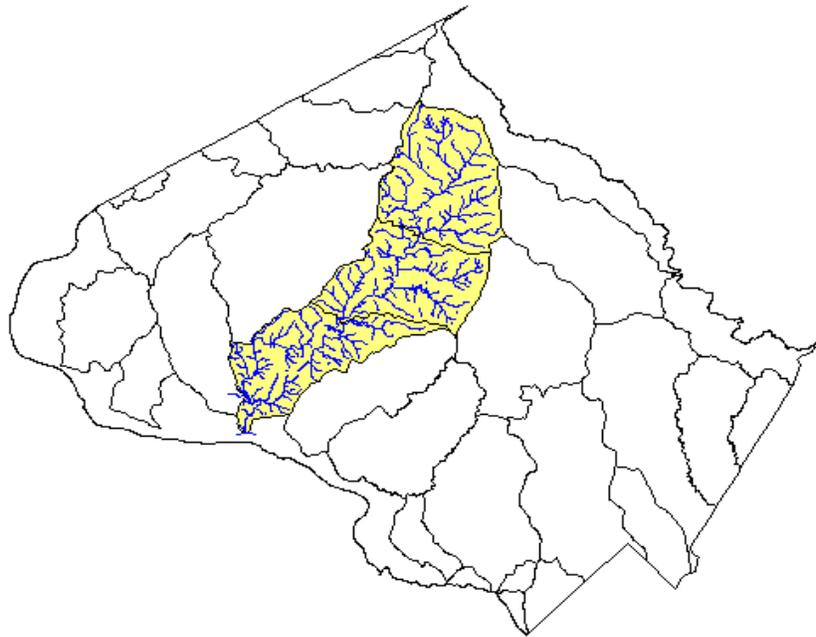
## **Watershed Study**

**Montgomery County**

**Department of Environmental Protection**

**Watershed Management Division**

**May 25, 1999**



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## Summary

The purpose of this report is to:

- assess the existing stream conditions of Great Seneca Creek,
- identify stream reaches with impairment from other than habitat stressors,
- identify stream reaches with unstable habitat features that, if left alone, could further degrade the biological community of the stream,
- provide recommendations for follow up actions concerning the identified areas of impaired stream reaches.

Upper Great Seneca, with the exception of Magruder Branch, is in good to excellent condition. Magruder Branch is in fair condition. Middle Great Seneca is almost entirely in a fair condition, the I-270 Tributary and a portion of Whetstone Run are in poor condition. The Lower Great Seneca returns to a good condition as it passes through less developed portions of the County.

Four stream reaches were identified as possibly having impairment from water quality stressors and are recommended to be investigated by a DEP team consisting of a biologist and an inspector. These reaches are in upper Magruder Branch, the I-270 Tributary, lower Whetstone Run, and upper Long Draught Branch. Where the drainage area contributing to the reach stream extends into a municipality, the inspection needs to be coordinated with that municipality. Priority should be to identify any possible illicit discharges occurring in these areas and correct them.

Six reaches and one stream area were identified as being impaired from having possible nutrient enrichment and will be monitored during the next synoptic nutrient sampling event. These reaches are upper Great Seneca Creek (above Creekview Drive), Magruder Branch (below Sweepstakes Road), Gunners Branch (between Allspice Drive and Stone Hollow Drive), Whetstone Run (near Docenia Drive), upper Long Draught Branch, the Dawsonville Tributary, and Great Seneca Creek main stem between Clopper Road and Route 118.

Stream reaches identified as having impairment from altered flows and related stressors will be submitted to the stream restoration staff for prioritization.

This report further recommends the addition of the Hooker Branch (currently within the Lower Great Seneca subwatershed) and the Quince Orchard (currently within the Lower Long Draught subwatershed) as new CSPA subwatersheds and new priority subwatersheds.

Hooker Branch should be placed in the Watershed Protection, (Special and Remedial Management) category. The Quince Orchard Tributary should be placed in the Watershed Restoration Management Category. Both should be considered for designation as priority subwatersheds.

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## *Great Seneca Creek Watershed*

### *Purpose of this Report*

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### *Introduction to the Watershed (excerpted from the Countywide Stream Protection Strategy)*

Great Seneca Creek is the largest watershed located entirely within Montgomery County. Great Seneca Creek watershed originates near Damascus in the northwest portion of the County, flowing in a southerly direction through Germantown and Gaithersburg, until it joins the Potomac River near the town of Seneca. Two large tributary systems flow into Great Seneca. These are Little Seneca Creek, and Dry Seneca. Almost every species of fish found in Montgomery County can be found in this watershed. Smallmouth bass have been found in the lower sections. Redbreast sunfish and central stonerollers are found throughout the middle section, and portions of the upper reaches support a cold water fish community.

Magruder Branch, a large tributary which begins in south Damascus, flows through county parkland and joins Great Seneca down river of Woodfield Rd. It then passes through commercial areas in Damascus and continues through low to medium density residential areas. Magruder Branch contains a system of vernal pools, built as mitigation for an adjoining hiker-biker trail system, that supports a diverse amphibian community. The Damascus Wastewater Treatment Plant (WWTP) is located in the Magruder Branch subwatershed.

Great Seneca Creek continues southwest of Laytonsville, rapidly increasing in size as other tributaries join it. Wildcat Branch, a naturally reproducing brown trout stream, and Goshen Branch join Great Seneca above Brink Road. Great Seneca Creek then flows through the Montgomery Village area, where land use densities increase considerably. Many of these areas were built before modern stormwater runoff controls were required by the State and, consequently, the quality of the stream channel has declined.

Below Route 355, Great Seneca picks up additional drainage from high density areas in Gaithersburg and Germantown. It then transitions back to low density residential with areas of agricultural land uses from approximately Riffle Ford Road in south Germantown down to the Potomac River. The quality of the stream channel has significantly degraded, with areas of active stream bank erosion and long reaches of deep runs with fewer riffle areas than observed

20 years ago. Above Riffle Ford Road is the Seneca WWTP. Ongoing studies will provide a baseline record of stream conditions before plant expansion is scheduled to come online. Some concerns have been raised about the increased nutrient load into Great Seneca resulting from this and the Magruder WWTP.

Major tributaries in this portion of Great Seneca include Whetstone Run, Gunners Branch, and Long Draught Branch. These three tributaries all originate in high density residential areas and each have instream impoundments: Lake Whetstone, Gunners Lake, and Clopper Lake. Whetstone Run is occasionally blue-tinted from light-filtering dyes intended to reduce algae and aquatic plant growth in the lake.

Below Riffle Ford Road, some tributary areas of Great Seneca are changing from agriculture to low and medium density residential. Great Seneca flows westward towards Dawsonville. It is joined by Little Seneca Creek, becoming Seneca Creek below the confluence. Flowing south towards the Potomac River, Seneca Creek is joined by Dry Seneca Creek before flowing into the Potomac River above the Seneca Breaks. Many people enjoy fishing, sailing, and paddling within the mouth of the creek, and out on the Potomac River.

### ***Methods***

All fieldwork, data reduction, and data analysis follow the stream monitoring protocols described in Van Ness et al 1997. The overall stream condition was determined by assessing the cumulative impacts that occurred in the watershed as indicated by the use of an interim Index of Biological Integrity (IBI) for freshwater fish and benthic macroinvertebrates. The stream condition was made by examining the trends expressed by the two IBI's. This is not the same as averaging the two scores. Seasonal trends were examined and a yearly stream condition has been established for the subwatersheds.

Assuming that water quality is constant throughout the study area, the relationship between habitat quality and biological condition can be predictable, (Barbour et al, 1998), and provide diagnostic information on stressors likely responsible for identified impairment to the existing stream area. Possible causes of impairment can be determined by examining the relationship between the IBI score/habitat score for each individual monitoring station (Figure 1). Percentage of the best attainable biological condition was calculated for each IBI score and compared against percentage of the best attainable instream physical habitat in order to assess relationships between habitat and biology and identify areas of stream impairment from other than physical stressors (Figure 1). The theoretical regression lines shown in Figure 1 describes the general relationship of biological condition to habitat quality in the absence of water quality effects. The highest possible IBI score for fish is 50 (100%), for benthic macroinvertebrates 40 (100%). Abiotic factors such as water temperature, water chemistry, and analysis of both qualitative and quantitative physical habitat attributes are also used to assess the types of stressors that may be affecting the system. Impaired sites are then targeted, and further investigations of the probable causes of impairment are scheduled.

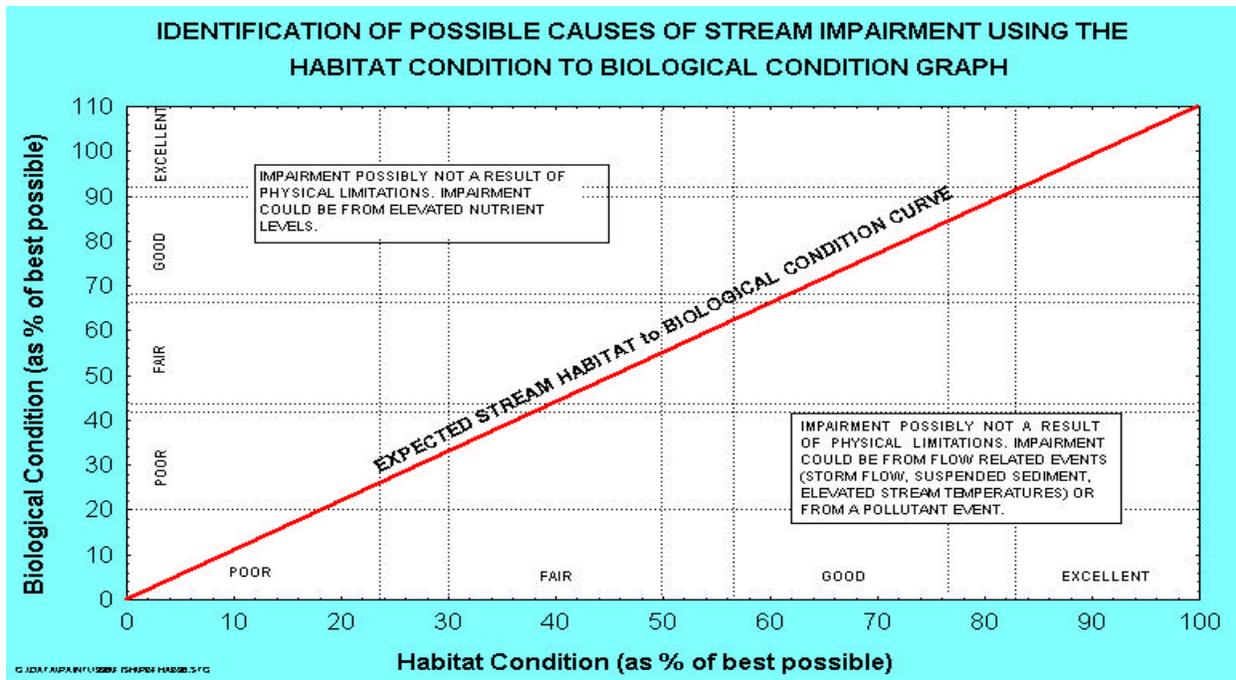


Figure 1. Conceptual Relationship between Habitat Condition and Biological Condition

## Results

The Great Seneca watershed is one of the largest watersheds in the County. It was divided into thirds to ensure adequate monitoring coverage. Upper Great Seneca contains the headwaters downstream to Brink Road. The Middle Great Seneca encompasses the drainages from the Gaithersburg area and some from the Germantown area. The Lower Great Seneca extends from the vicinity of the Great Seneca Highway to the limits of the wadeable area near the town of Seneca, Maryland. Results of the watershed monitoring will be organized by these three areas.

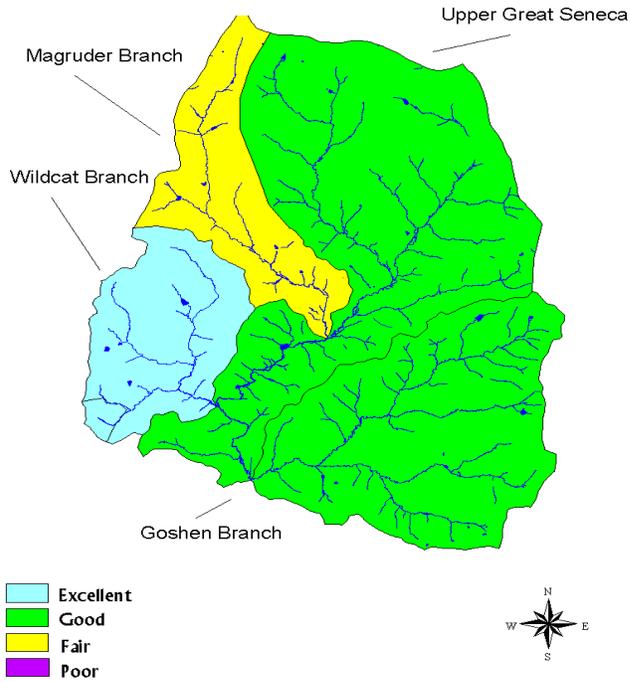
### Upper Great Seneca

#### *Analysis of the 1997 Stream Monitoring and Habitat Data*

##### Stream Condition

Stream conditions were evaluated and classified for 4 subwatersheds. Wildcat Branch subwatershed received an overall stream condition of *excellent*. Upper Great Seneca and Goshen Branch subwatersheds received an overall stream condition of *good*. The Magruder Branch subwatershed received an overall stream condition rating of *poor* (Figure 2).

### Examination of IBI/Habitat Relationships



Data from 15 monitoring stations were used in the assessment of the upper Great Seneca Creek. Benthic macroinvertebrates were collected in March-April 1997. Fish surveys were conducted during September 1997.

The benthic macroinvertebrate IBI scores were variable and ranged from *poor* to *excellent* (Figure 3 top graph). The majority of the fish IBI scores were in the *good* to *excellent* range (Figure 3 bottom graph). The data appears to indicate that stressors are impairing the benthic macroinvertebrate communities more so than the fish communities. The overall habitat rating for all stations was in the *good* range, Figure 2. Stream conditions of Upper Great Seneca Creek.

indicating that the habitat conditions alone are unlikely to be causing the impaired benthic communities. Likely causes of impairment include altered stormwater and baseflow patterns and or illicit discharges.

#### *Stream Areas of Concern*

Stations identified as areas of concern from the IBI /Habitat evaluation are listed in Table 1. These stations were identified because they plotted outside of the range of the expected habitat/biology relationship for both the fish and benthic macroinvertebrate communities.

GSGS313 is located on the mainstem of Upper Great Seneca Creek between the confluences of Magruder Branch and Wildcat Branch. Rapid habitat assessments conducted during the benthic and fish monitoring scored the overall habitat condition as *good* (150 and 138 respectively). GSMB102 is located in the Magruder Branch headwaters downstream from Bethesda Church Road. Rapid habitat assessments conducted during the benthic and fish monitoring for this station scored *good* for the overall habitat condition (131 and 130 respectively).

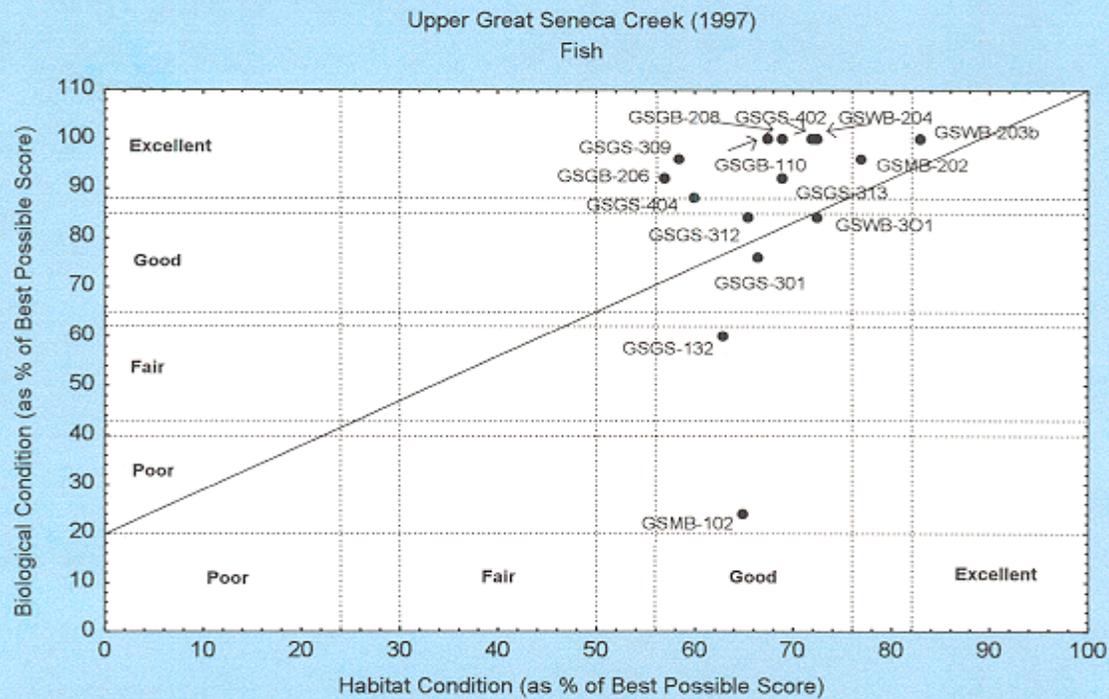
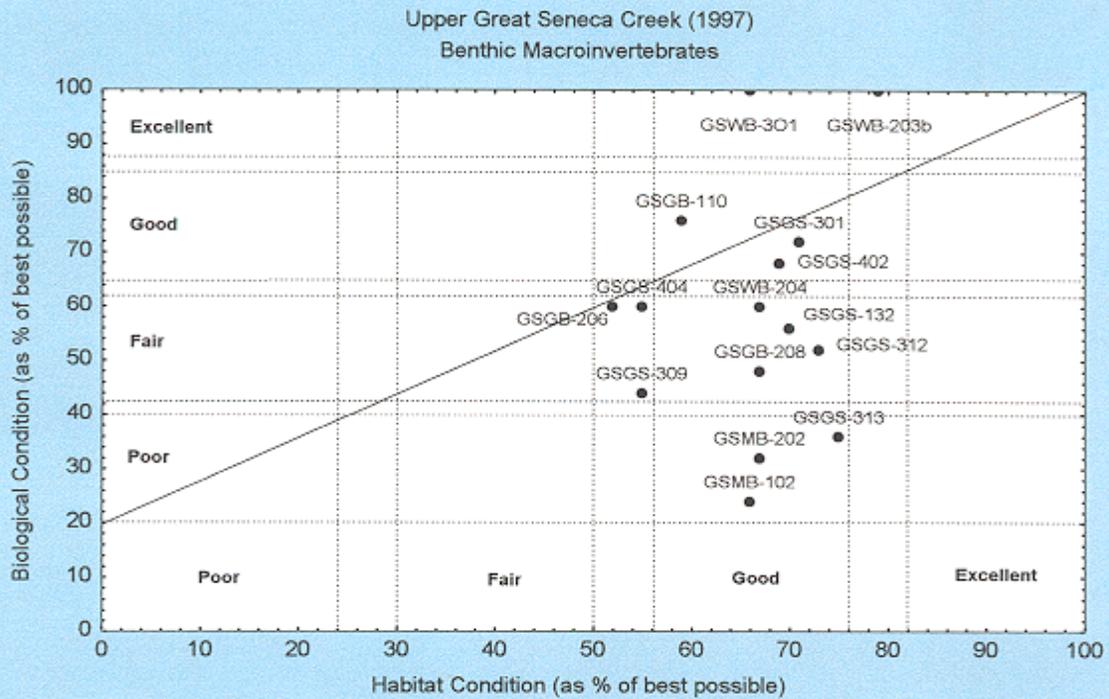


Figure 3. Biological relationships vs. habitat as a percentage of the best obtainable score in Upper Seneca Creek.

Table 1. Stations considered areas of concern.

Monitoring Station	Subwatershed	Location	Benthic IBI	Fish IBI	Recommended Action
GSGS313	Upper Great Seneca	Creekview Drive	Fair (18)	Excellent (46)	Examine Habitat Parameters
GSMB102	Magruder Branch	Bethesda Church Road	Poor (12)	Poor (12)	Examine Habitat Parameters
GSMB202	Magruder Branch	Watkins Road	Poor (16)	Excellent (48)	Examine Habitat Parameters

GSMB202 is located in Magruder Branch downstream from Watkins Road. Rapid habitat assessments conducted during the benthic and fish monitoring again scored the overall habitat condition as *good* (133 and 154 respectively).

Specific habitat parameters were further examined to see if individual parameters could explain some or all of the impairment observed in the fish and benthic community. Seven of the 10 parameters used in the rapid habitat assessment were analyzed (Table 2). These 7 parameters have scores that are good indicators of impairment from habitat stressors. Three of the parameters were excluded for the following reasons. Channel alteration (channelization or dredging) is usually absent or minimal in County streams. Bank vegetation protection scores usually follow those of bank stability (stable banks support a healthy vegetative cover). Finally, most riparian buffers in the County are 12 meters or greater. Scores for these 3 parameters are usually in the good to excellent range at all monitoring stations.

Table 2. Selected habitat parameters (Rapid Habitat Assessment) at areas of concern.

Monitoring Stations		Fish Cover	Benthic Substrate	Embeddedness	Sediment Deposition	Bank Stability	Flow Status	Riffle Freq.
GSGS313	Spring 3/17	Fair	Fair	Good	Excellent	Good	Excellent	Excellent
	Summer 7/9	Good	Good	Fair	Fair	Good	Good	Excellent
	Fall 10/30	Good	Good	Fair	Fair	Good/Excellent	Excellent	Good
GSMB102	Spring 3/17	Fair	Excellent	Good	Fair	Good	Fair	Excellent
	Summer 7/10	Good	Excellent	Fair	Fair	Good	Fair	Excellent
	Fall 10/7	Good	Good	Good	Good	Good/Fair	Fair	Good
GSMB202	Spring 4/1	Good	Good	Fair	Good	Good	Excellent	Excellent
	Summer 6/9	Good	Excellent	Excellent	Good	Good/Excellent	Excellent	Good
	Fall 9/30	Good	Excellent	Good	Excellent	Good	Excellent	Excellent

The rapid habitat assessment at station GSGS313 during the spring period indicated *fair* fish cover and benthic substrate. All the other parameters were rated in the *good* to *excellent* range for this period. The fish cover and benthic substrate parameters were subsequently rated as good during the summer and fall periods. Embeddedness and sediment deposition ratings decreased to *fair* during the summer and fall periods. The lack of benthic substrate during the spring period is the only parameter that seemed to be limiting the macroinvertebrate community when the sample was collected. The fish community was rated excellent despite the apparent increase in deposition. Analysis of water quality and /or quantified habitat parameters may provide more information about what may be limiting the benthic community at this station.

Flow status and sediment deposition appears to be limiting factors at station GSMB101. Moderate deposition affecting 30 - 50 % of the stream bottom was occurring during the summer and fall periods. The channel flow was consistently low covering only 25 - 75% of the channel. Although the deposition in pools and runs is moderate, riffle embeddedness does not appear to be a limiting factor. This may be due to the fact that the riffles may be for the most part exposed during baseflow.

The rapid habitat assessments conducted at station GSMB202 do not indicate any parameters that may be limiting the *poor* benthic community assessed during the spring period. Analysis of water quality and /or quantified habitat parameters may provide more information about what may be limiting the benthic community at this station.

### Water Quality

Physicochemical parameters measured during the monitoring year at these stations were examined for any indication of impairment from water quality stressors (Table 3).

There were no readings at GSGS-313 that were of concern.

Conductivity readings at GSMS-102 were high during the spring, summer, and fall monitoring periods with a measurement of 620  $\mu\text{mhos}$  on 3/17/98, 577  $\mu\text{mhos}$  on 7/10/98 and 673  $\mu\text{mhos}$  on 10/7/98. All other parameters were within a range found in other County streams.

The pH readings at station GSMB202 were consistently high and ranged from 7.7 - 9.0. All other parameters appear to be at levels found in systems throughout the county. There is an abundance of filamentous algae in the stream. An abundance of algae may be elevating the pH in this section of Magruder Branch. The Damascus Waste Water Treatment Plant (WWTP) is located upstream from this station.

Table 3. Physicochemical parameters measured during the monitoring year at areas of concern.

Monitoring Stations		Water Temperature (°C)	Dissolved Oxygen (ppm)	pH	Conductivity (µmhos)
GSGS313	Spring 3/17	5.7	13.31	7.2	150
	Summer 7/9	21.3	8.60	7.6	178
	Fall 10/30	7.3	11.56	7.1	237
GSMB102	Spring 3/17	8.4	12.21	7.4	620
	Summer 7/10	17.6	6.00	7.2	577
	Fall 10/7	15.8	8.45	6.9	673
GSMB202	Spring 4/1	12.3	12.01	9.0	220
	Summer 6/9	14.8	9.76	7.7	293
	Fall 9/30	16.8	11.71	8.2	N/A

Quantitative Habitat Analysis

Quantitative habitat was surveyed during the fall of 1997. Analysis of these measurements can provide further information as to whether or not a habitat limitation, physical impairment, or water quality impairment is potentially influencing the fish and benthic macroinvertebrate communities. In addition, habitat data was examined to see if any areas of accelerated habitat instability were observed. Entrenchment and bankfull width-depth ratio calculations and interpretation follows Rosgen (1996).

Surveys conducted on the mainstem indicate that the level of entrenchment in Upper Great Seneca Creek is variable and ranges from areas that are moderately entrenched (Figure 4.) to areas of slight entrenchment where the flood prone area was too wide to measure in the field (Figure 5). The "entrenchment ratio" is the ratio of the width of the flood-prone area to the surface width of the bankfull channel, and expresses how incised a stream is relative to its flood prone area (Rosgen, 1996). The flood prone area is defined as the active floodplain.

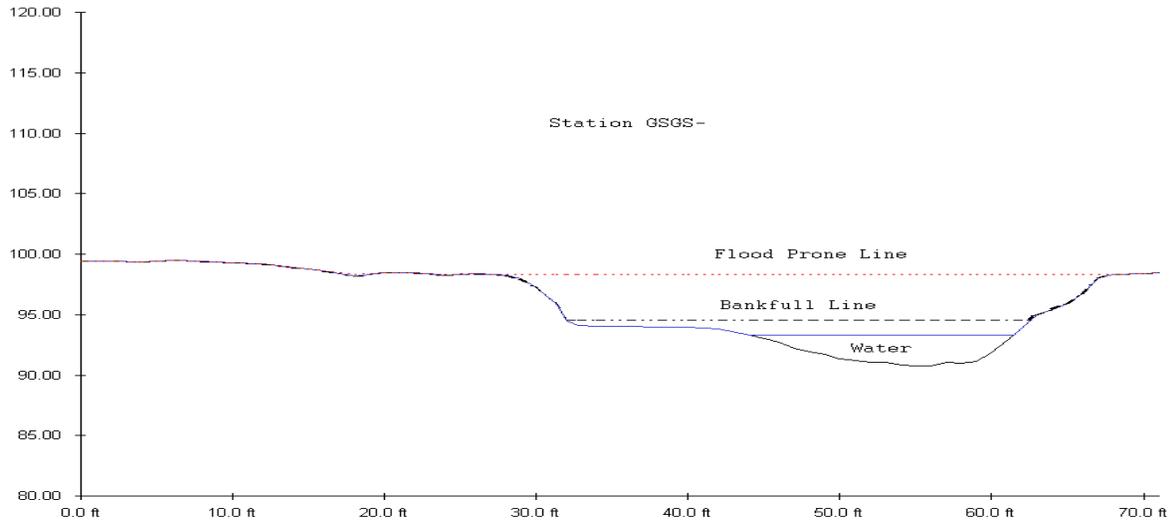


Figure 4. Moderately entrenched section of Upper Great Seneca Creek main stem.

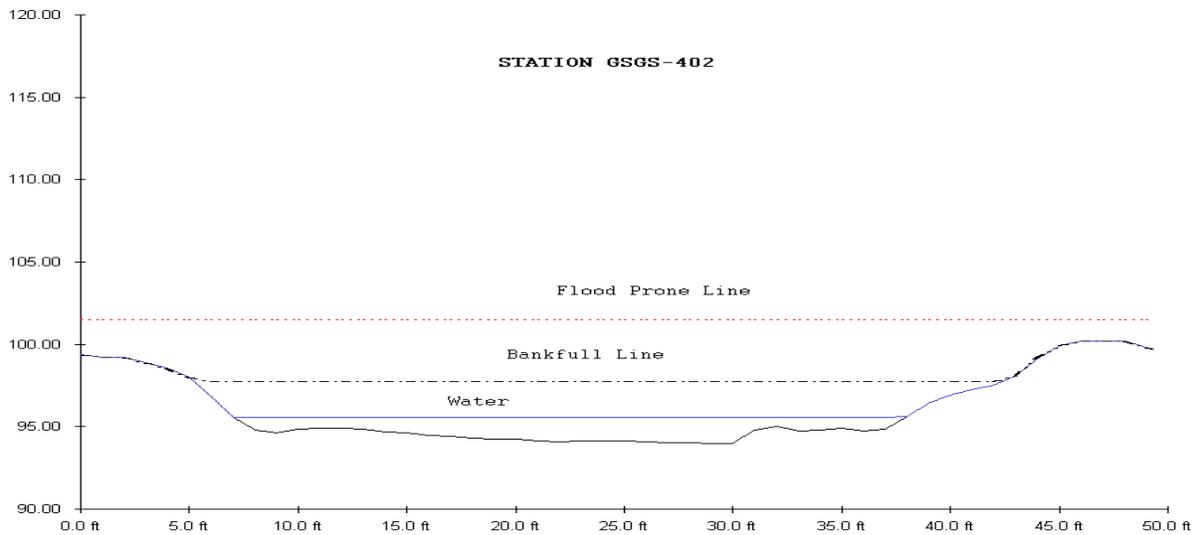


Figure 5. Slightly entrenched section of Upper Great Seneca Creek main stem.

Bankfull width to depth ratio is another important indicator of trends in channel stability and overall stream habitat condition. Stream reaches with high bankfull width/depth ratios tend to have in-stream hydraulic stress placed in close proximity to the stream banks. As width/depth ratios increase, the stress against the stream banks also increases. Bank erosion is further accelerated. Increased sediment supply to the stream channel develops. By virtue of becoming over widened, the channel gradually loses its capability to transport the increased sediment loads. Sediment deposition occurs in the channel and further accelerates bank erosion.

Width/depth ratios in the mainstem indicate that Upper Great Seneca Creek is slightly to moderately wide. Ratios ranged from 13.7 in the headwaters to 25.8 in the middle of the watershed. The area between Woodfield Road and Brink Road is experiencing accelerated bank erosion and sedimentation problems.

The Magruder Branch tributary is moderately entrenched in the headwaters (GSMB102) and slightly entrenched at the lower end of the tributary (GSMB202) with ratios of 1.3 and 2.1 respectively. The width/depth ratios for these two stations indicate a widened channel in the headwaters and to a much lesser degree in the lower part of the tributary. The headwaters of this tributary are located in a suburbanizing area of Damascus and the morphology of the channel may be the result of this land use.

Two tributaries in Wildcat Branch are moderately entrenched with ratios of 1.3 and 1.6 at GSWB203b and GSWB204 respectively. However neither of the tributaries have large width/depth ratios indicating a narrow channel width. This may indicate that impacts to these channels are relatively recent as measured by the degree of entrenchment present and that subsequent widening may occur. Further down in the watershed at GSWB301 the channel is severely entrenched and over-widened with ratios of 1.0 and 20.2 respectively.

The Goshen Branch tributary is entrenched to moderately entrenched with ratios ranging from 1.2 - 2.4. The channel does not appear, however to be overly widened with width/depth ratios ranging from 7.7 - 12.9. Again this may indicate that impacts to these channels are relatively recent and that subsequent widening may occur (Figure 6).

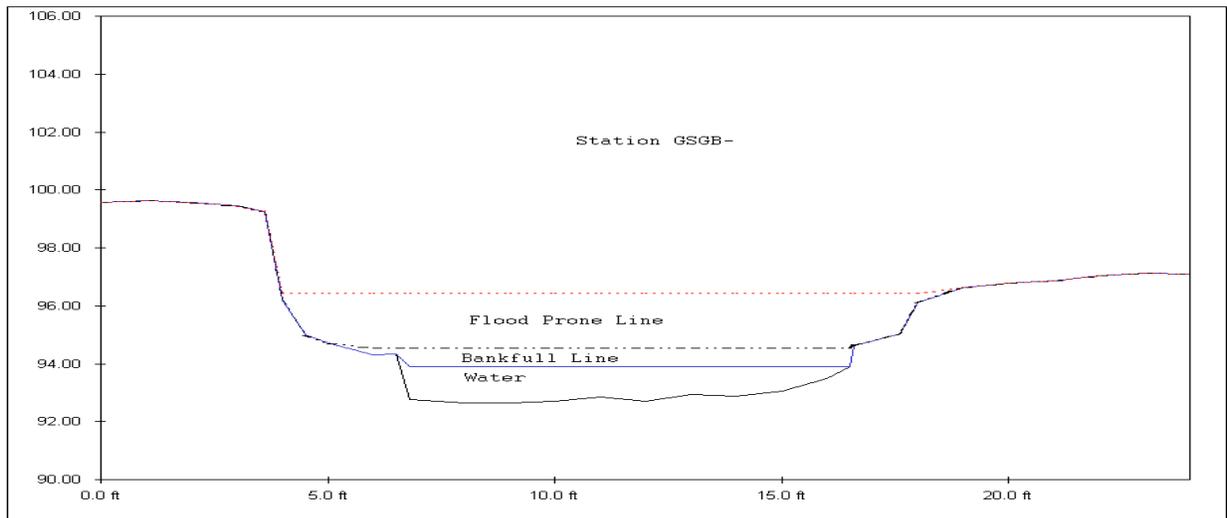


Figure 6. Channel Cross-Section in Goshen Branch.

Riffle substrates were evaluated by conducting pebble counts at all stations. Substrate analysis can determine whether or not particle size may be limiting benthic macroinvertebrate communities. The median (D<sup>50</sup>) particle distribution was in the cobble range for GSGB206 and GSWB203b. All other stations contained particle distributions with a D<sup>50</sup> coarse gravel range . The coarse gravel range is not ideal for benthic communities and may explain why the benthic macroinvertebrate IBI scores are generally lower than the fish IBI scores throughout the watershed.

Water Temperature Monitoring

Four continually recording temperature meters were placed in Upper Great Seneca Creek from June through September (Table 4, Figure 7).

Table 4. Temperatures recorded in Upper Great Seneca Creek from June 1, 1998 to September 30, 1998.

Stations	N	Mean	Median	Minimum	Maximum	Std. Dev.
GSGS309	2929	66.5	70.0	54.4	76.0	4.23
GSGS404	2929	66.6	66.7	54.2	77.9	4.78
GSMB202	2929	65.6	66.1	55.3	74.8	3.86
GSWB301	2929	62.8	63.2	51.7	72.6	3.96

Temperatures recorded in the mainstem and Magruder Branch were within the State of Maryland's use classification standard for a Class I stream (<90°F). Wildcat Branch (Figure 7.) however exceeded the State of Maryland's use classification standard for a Class III stream (<68°F). A stream temperature around 75°F can support a cool water fish community. Many streams in the County support such a fish community. Streams with water temperatures around 75°F should, all other factors being equal, support a cool water fish community.

Temperature meters placed in the upper and lower reaches of the Upper Great Seneca (Figure 7 top left and right graph respectively, table 4) had similar daily temperature patterns, with the lower temperature meter recording slightly elevated temperatures than the upper reach (Figure 7). Temperatures were sufficient to support a cool water fish community comparable to the better streams in the County. The temperature meter in Magruder Branch (Figure 7, bottom left graph) also recorded water temperatures sufficient to support a cool water fish community comparable to the better streams in the County. Water temperatures in Wildcat Branch exceeded the water temperature limit for Class III naturally reproducing trout waters during all or part of 26 days (24 hour periods). The frequent elevated water temperatures could place stress on the trout population, especially the young-of-year and one to two year old fish.

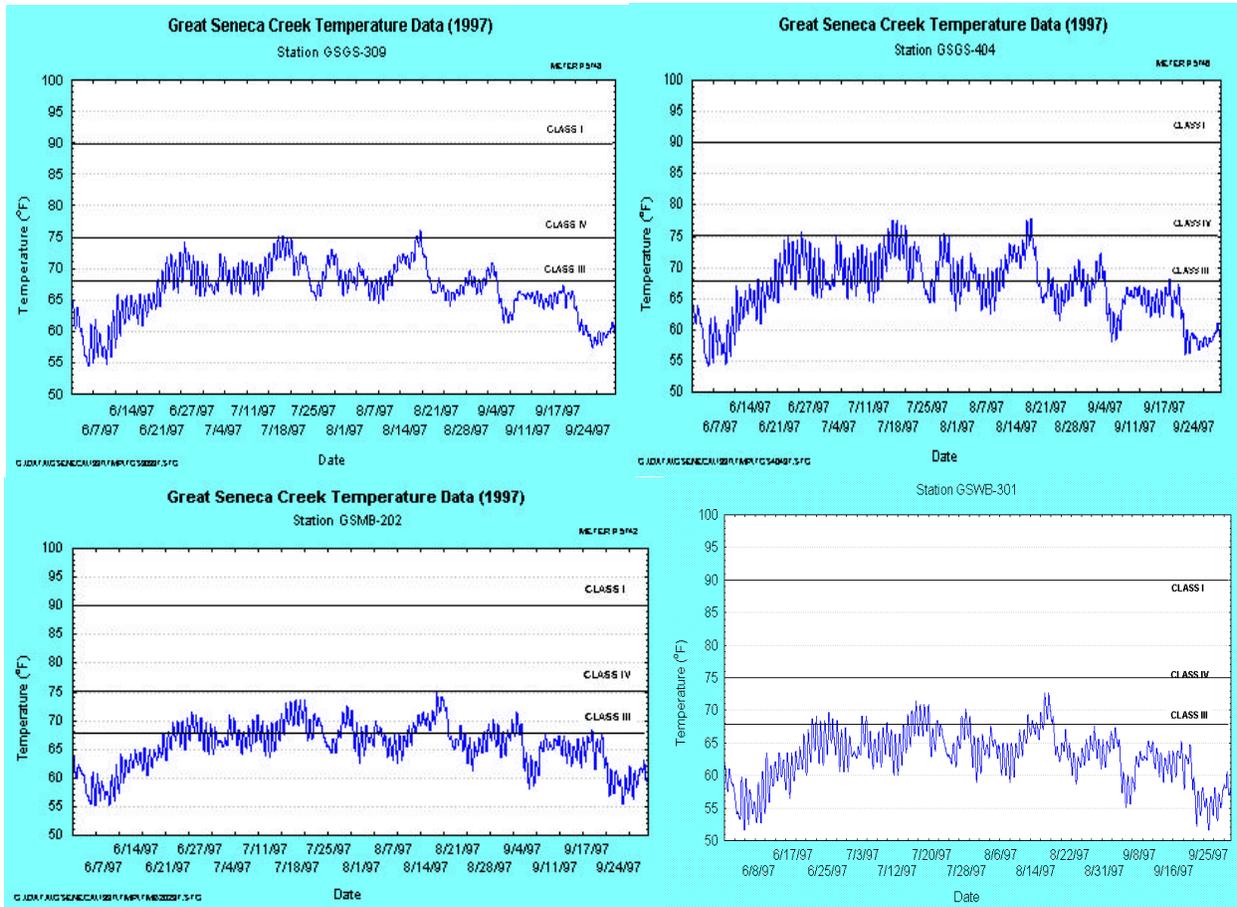


Figure 7. Stream Temperatures in Upper Great Seneca Creek (upper graphs), Magruder Branch (bottom left graph), and Wildcat Branch (bottom right graph).

### Middle Great Seneca

#### Analysis of the 1997 Stream Monitoring and Habitat Data

##### Stream Condition

Seasonal trends were examined and a yearly stream condition was established for the Middle Great Seneca Creek subwatersheds (Figure 8). Stream conditions were evaluated for 5 subwatersheds. No subwatershed received an overall stream condition of *excellent* or *good*. Gunners Branch, Cabin Branch, Whetstone Run, and the Middle Great Seneca Creek mainstem subwatersheds received an overall stream condition rating of *fair*. The Upper Whetstone Run and the Route 270 Tributary subwatersheds received an overall stream condition rating of *poor*. Subwatersheds in or draining the more impervious suburban areas had a *poor* to *fair* stream

Middle Great Seneca Creek Watershed  
Stream Condition by Subwatershed  
Based on 1998 Monitoring Data.

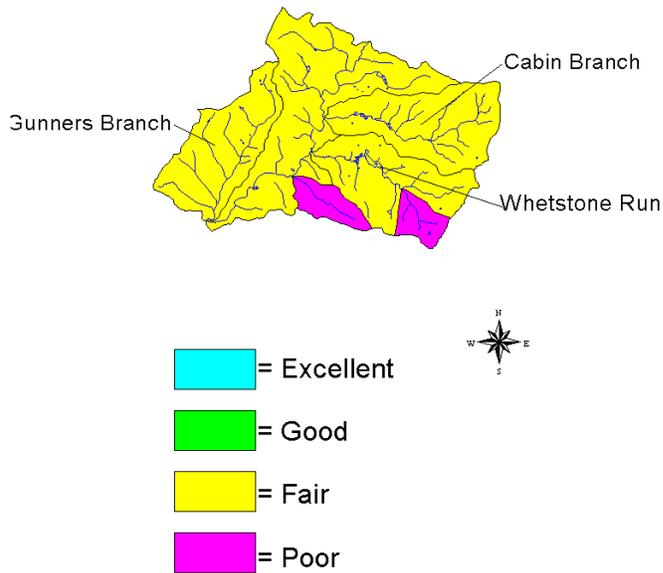


Figure 8. Stream Conditions of Middle Great Seneca Creek.

The low numbers may indicate possible impairment from altered storm flows. The overall habitat rating within the monitoring reaches was in the good range, indicating that habitat conditions alone (as measured by the rapid habitat assessment procedure) are unlikely to be causing the observed impaired biological community.

Stream areas with IBI's indicative of cumulative impacts of concern

Stream areas identified as areas of concern from the IBI/habitat evaluation are described in Table 5.

GSMS -112 is located above the end of Metropolitan Grove Road, with the upper end of the station just below the I-270 culvert. Rapid habitat assessments taken during the benthic and fish monitoring scored the overall habitat condition as *good* (135 and 107 respectively).

condition rating. Subwatersheds within commercial areas or along the interstate had a *poor* stream condition rating.

Examination of IBI/Qualitative Habitat Relationships

Data from 15 monitoring stations were used in the assessment of the Middle Great Seneca. Benthic macroinvertebrates were collected in the spring of 1998. Fish surveys were conducted during the summer/fall of 1998.

Thirteen of the fifteen monitoring stations benthic macroinvertebrate IBI scores were in the *fair to poor* range indicating a relatively impaired biological community (Figure 9). Five of the monitoring stations fish IBI scores were also in the *fair to poor* range. Seven of the monitoring stations fish IBI scores ranged in the *good to excellent* range.

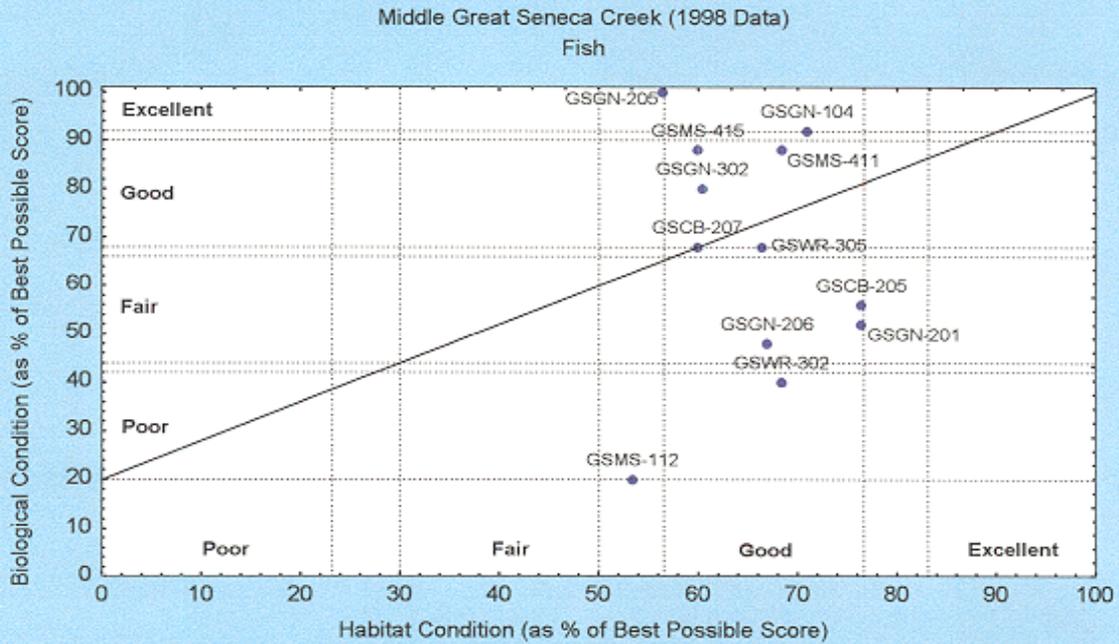
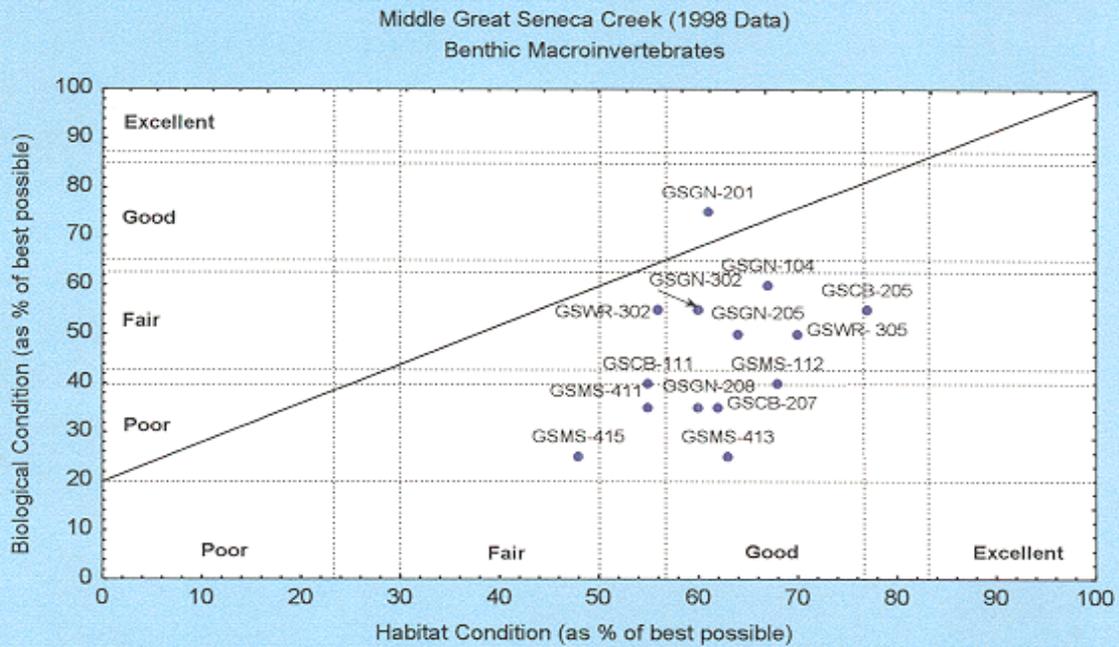
The overall number of fish within main stem stations was low compared to other stations with similar stream order.

Table 5. Stream areas with identified measures of cumulative impacts.

Monitoring Station	CSPS Subwatershed	Location	benthic IBI	Fish IBI	Recommended Action
GSMS-112	I-270 Tributary	vicinity of Metropolitan Grove Road	poor (16)	poor (10)	Field investigation
GSGN-205	Gunners Branch	vicinity of Allspice Drive	fair (20)	excellent (50)	Field investigation
GSGN-208	Gunners Branch-	vicinity of Stone Hollow Drive	poor (14)	fair (24)	Field investigation
GSCB-205	Cabin Branch	vicinity of the Green Farm	fair (22)	fair (28)	Field investigation
GSWR-302	Whetstone Run	vicinity of Docenia Drive	fair (22)	poor (20)	Field investigation

GSGN-205 is located off of Allspice Drive. Rapid habitat assessments taken during the benthic and fish monitoring also scored the overall habitat condition for this 75 meter station reach as *good* (127 and 113 respectively). GSGN-208 is located just upstream of the end of Stone Hollow Drive. Rapid habitat assessments taken during the benthic and fish monitoring scored the overall habitat condition for this 75 meter station reach as *good* (120 and 134 respectively). GSCB-205 is located within the Green Farm Conservation Park east of Snouffer Schoolhouse Road. Rapid habitat assessments taken during the benthic and fish monitoring scored the overall habitat condition for this 75 meter station reach as *good* (154 and 153 respectively). GSWR-302 is located upstream from the end of Docenia Drive. Rapid habitat assessments taken during the benthic and fish monitoring also scored the overall habitat condition for this 75 meter station reach as *good* (120 and 137 respectively). Overall, habitat conditions were sufficient to support a better quality biological community than was found all other factors being equal.

Specific habitat parameters were further examined to see if individual parameters could explain some or all of the impairment observed in the fish and benthic community (Table 6).



**Figure 9. Relationship between habitat condition and biological condition in Middle Great Seneca Creek.**

Table 6. Selected habitat parameters (from Rapid Habitat Assessment) at stream areas with identified measures of cumulative impacts

Monitoring Stations		Fish Covr	Benthic Substrate	Embedd	Sediment Deposit.	Bank Stability	Flow Status	Riffle Freq.
GSMS-112	spring 4/13/98	excell.	good	good	good	fair	fair	excell.
	summer 6/26/98	good	fair	fair	fair	good	fair	good
	fall 12/18/98	good	fair	good	fair	fair	fair	fair
GSGN-205	spring 4/6/98	good	fair	good	fair	good	good	good
	summer 6/26/98	good	good	good	fair	good	good	good
GSGN-208	spring 4/6/98	good	excell.	fair	fair	fair	excellent	excell.
	summer 7/2/98	good	excell.	excell.	good	fair (LB) good (RB)	fair	excell.
GSCB-205	spring 4/14/98	excell.	excell.	good	good	good	excellent	excell.
	summer 6/16/98	excell.	excell.	good	good	good	good	good
GSRW-302	spring 4/6/98	good	fair	good	good	fair (LB) good (RB)	good	good
	summer 6/18/98	good	good	good	good	good	good	good

Many habitat parameters scored in the good to excellent range throughout the monitoring year (Table 6). No habitat parameter received a score of poor during the monitoring period, however a number of observations were made in the fair range (Table 6) and these will be discussed next to determine if they could have contributed to the stream impairment.

Despite signs of habitat impairment at station GSMS-112, (located above Metropolitan Road), overall habitat conditions should have provided support to a healthier biological community, all other water quality factors being equal. During the spring monitoring period,

riffle substrate was good, however, stream banks were moderately unstable with up to 60% of banks in the reach having areas of erosion, and base flow filled no more than 75% of the available channel and/or riffle substrates were exposed. During the summer monitoring period, fish cover provided adequate habitat for maintenance of fish populations with 30 to 50% mix of stable habitat, however sediment problems were observed in both the embeddedness as well as the sediment deposition parameters. Channel flow was also fair with 25 to 75% of the available channel exposed. During the fall/winter period, all but 2 parameters (fish cover and embeddedness) were rated as fair indicating some measure of habitat impairment.

The riffles within the GSGN-205 station reach (Gunnery Branch, near Allspice Drive) were observed to be short and with a width shorter than the stream width. There was also moderate deposition of new gravel and coarse sand on old and new bars with moderate deposition of sediment in the pools during the spring and summer periods. Sediment deposition may have been a factor in the impairment observed in the benthic and fish communities.

Benthic substrate was excellent during the spring monitoring period at station GSGN-208 (Gunnery Branch, near Stone Hollow Drive). Riffles were well developed with riffles being as wide as the stream and riffle length extending 2 times the width of the stream. Cobble substrate was also abundant in the riffles. Sediment problems were observed in both the embeddedness and sediment deposition parameters during the spring monitoring period. Sediment deposition may have been a factor in the impairment observed in the benthic community. During the summer, sediment deposition and embeddedness were observed to be in the excellent to good range. However left bank stability (looking downstream) and flow status were fair. Banks were judged to be moderately unstable and the flows filled no more than 75% of the available channel. Despite these signs of habitat impairment, the overall condition of the habitat, all other water quality factors being constant, should have provided support to a healthier biological community.

There was no observed habitat impairment at station GSCB- 205. This station is located in Cabin Branch in the vicinity of the Green Farm Conservation Park.

This station is located in Whetstone Run in the vicinity of Docenia Drive. The condition of the riffle substrate and the presence of algae could have contributed to the impacted condition of the benthic macroinvertebrate community. Benthic macroinvertebrate riffle substrate was fair during the benthic monitoring period. Riffles were not as wide as the stream and were not well developed. gravels predominated in the riffle. The field crew also observed large amounts of blue-green algae in the stream during this time which may also be indicative of nutrient enrichment. There was no observed habitat impairment at this stream reach during the summer monitoring period.

Physicochemical parameters measured during the monitoring year at these stations were

examined for any indication of impairment from water quality stressors (Table 7). Readings at stations GSMS-112 and GSWR-302 may indicate impairment from other than habitat stressors. Relatively high readings for total dissolved solids at these stations also may indicate impairment from other than habitat stressors. Readings at stations GSGN- 205, GSGN- 208, and GSCB- 205 were not indicative of impairment from other than habitat stressors. Station GSMS-112 had very high conductivity measurements when the station was visited during the spring and summer monitoring period (748 umhos and 604 umhos respectively). During the summer, dissolved oxygen was measured just above the 5.0 mg/l criterion limit for State Water Use Class I waters (5.10 mg/l, 55.7% saturation). As the station is just below I-270, runoff from the Interstate could be responsible for the observed impairment. Station GSWR-302 had an elevated pH reading of 8.25 during the spring period. The reading was taken around 2:00 p.m.. Abundant blue green algae was observed in the stream during this time. Photosynthesis by the algae could have raised the pH from a neutral level to the 8.25 reading.

Table 7. Physicochemical parameters at stream areas with identified measures of cumulative impacts.

Monitoring Station		dissolved oxygen mg/l (% Saturation)	pH	TDS g/l	Conductivity umhos
GSMS-112	spring 4/13/98	12.02 (116.5%)	6.58	0.478	748
	summer 6/26/98	5.10 (55.7%)	6.42	0.387	604
	fall 12/18/98	12.35 (99.2%)	6.61	n/a	247
GSGN-205	spring 4/6/98	11.71 (108.1%)	7.51	n/a	237
	summer 6/26/98	6.27 (73.5%)	7.07	0.162	257
	fall 12/9/98	9.96 (88.8%)	7.49	0.181	284
GSGN-208	spring 4/6/98	12.77 (109.9%)	7.85	n/a	187
	summer 7/2/98	8.60 (86.9%)	7.18	n/a	223
	fall 12/9/98	10.73 (94.3%)	7.32	0.111	173
GSCB-205	spring 4/14/98	10.77 (98.7%)	7.15	0.0844	132
	summer 6/16/98	7.74 (83.9%)	6.95	0.0616	96
	fall 1/28/99	11.38 (98.0%))	7.27	n/a	233
GSWR-302	spring 4/6/98	13.06 (124%)	8.25	n/a	268
	summer 6/18/98	7.81 (n/a)	7.18	n/a	284
	fall 1/7/99	15.16 (109.9%)	7.50	0.328	283

With an examination of the habitat parameters and physicochemical parameters yielding possible causes of impairment at several of the stations, further field investigations by a biologist/investigator team is recommended. Stream reaches will need to be walked to identify any possible causes of impairment.

### Quantitative Habitat Analysis

Quantitative habitat was surveyed during the fall/winter of 1998. Analysis of these measurements can provide further information to aid in deciding whether or not a habitat limitation, physical impairment, or water quality impairment is potentially influencing the fish and benthic macroinvertebrate communities. In addition, quantitative habitat data was examined to see if any areas of accelerated habitat instability were observed.

### *Middle Great Seneca Creek Mainstem*

Surveys conducted on the main stem (Figures 10, 11) indicate that the Middle Great Seneca main stem begins as a slight to moderate entrenched stream (Figure 10) but transitions to an entrenched stream channel (Figures 11). Much of this main stem stream system currently has access to flood prone areas associated with relatively frequent storm events. This means that frequent floods spill out into the flood prone area, dissipating erosive energy and depositing excess sediment. Bank erosion and sedimentation rates should be relatively low (Rosgen, 1996).

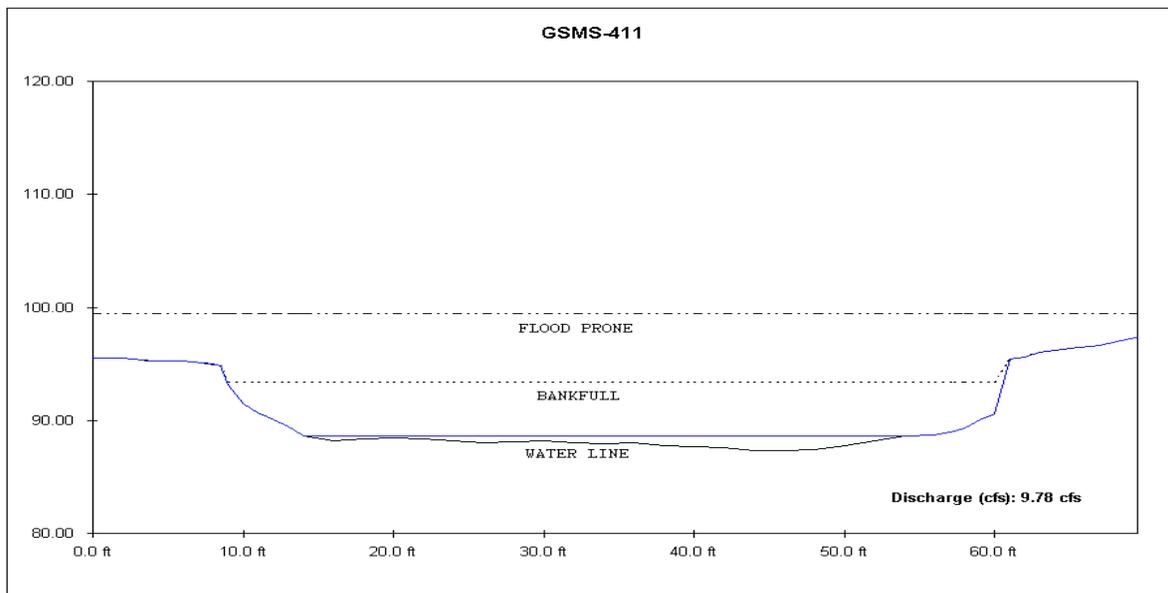


Figure 10. Slightly entrenched cross section of Middle Great Seneca Creek. Stream areas with similar cross sections provide access to the flood prone area during frequent storms.

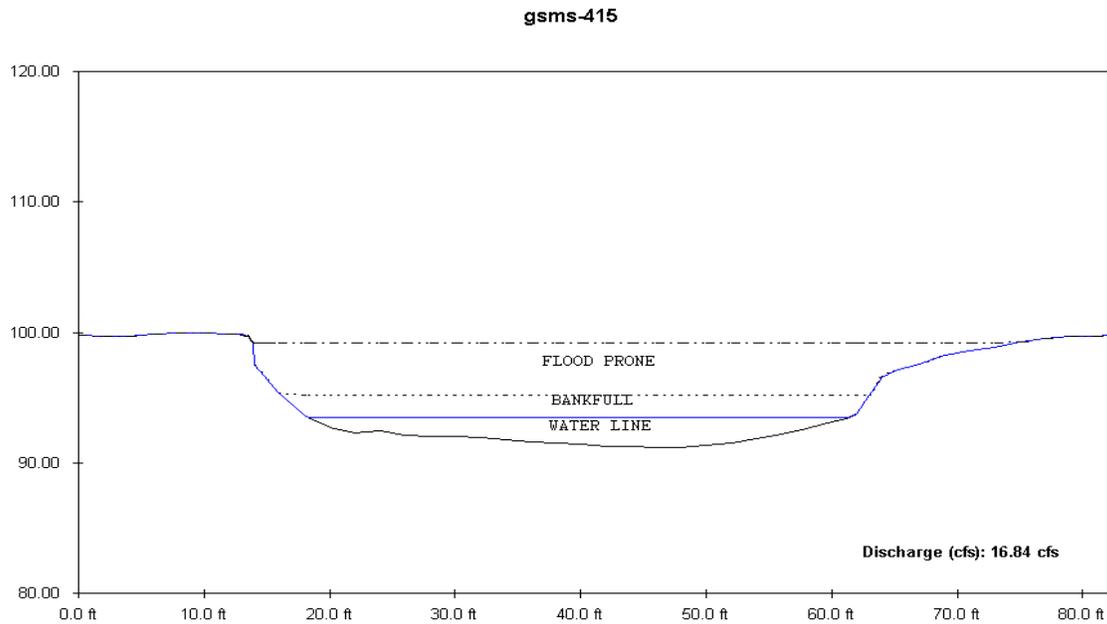
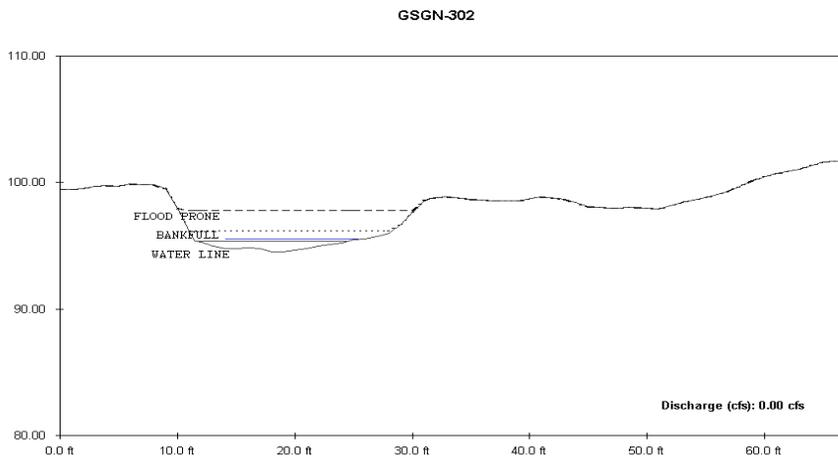


Figure 11. Moderately entrenched cross section of Middle Great Seneca Creek.

Width/depth ratios in the middle main stem indicate the Great Seneca is not overly widened.

*Gunners Branch*



Gunners Branch headwater areas appear to be moderately entrenched to entrenched. Middle stations are slightly to moderately entrenched. The lowermost station was entrenched (Figure 12). Width/depth ratios do not indicate a overly widened channel. The entrenched condition in portions of the subwatershed confines

Figure 12. Entrenched cross section in the lower Gunners Branch.

the stream flow during relatively frequent storms, keeping erosive velocities and sediment in the active channel

### *Cabin Branch*

The Cabin Branch headwater station appears to be moderately entrenched. The middle station was also moderately entrenched. The lowermost station was only slightly entrenched. Width/depth ratios do not indicate a overly widened channel. Stream morphology may not be a significant stressor here (Figure 13).

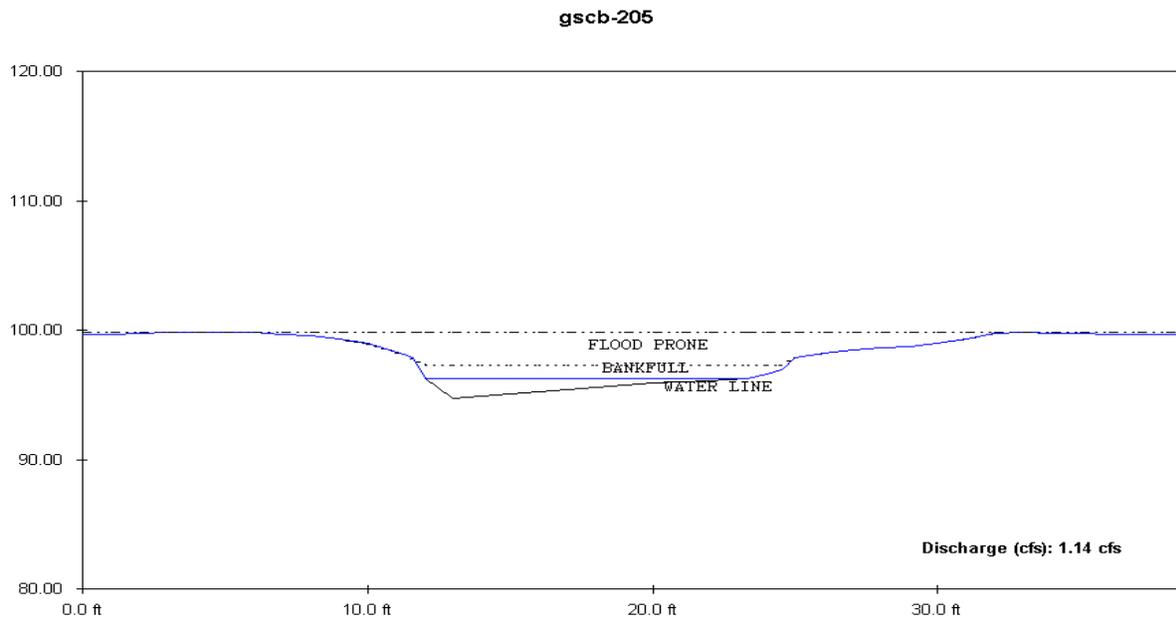


Figure 13. Moderately entrenched cross section in the middle portion of Cabin Branch.

### *Whetstone Run*

Whetstone Run above the lake appears to be slightly entrenched. Below the lake, Whetstone Run appears to be moderately entrenched to entrenched (Figure 14). Width/depth ratios do not indicate a overly widened channel. Stream morphology may be a sign of altered storm flows and an indication of increasing entrenchment.

### *Riffle Substrate*

Pebble counts taken from the Great Seneca main stem found that the dominant pebble

size class in the riffles became smaller as one moved downstream. The dominant pebble size classes were at or below very coarse gravel (around 2 to 2 ½"). Pebble counts taken from Gunners Branch found that the dominant pebble size class in the riffles ranged from coarse to very coarse gravels throughout the subwatershed. Pebble counts taken from Cabin Branch found that the dominant pebble size classes in the riffles ranged from coarse to very coarse gravels. Pebble counts taken from Whetstone Run found that the dominant pebble size class in the riffles above the lake was in the very coarse gravel range while the dominant pebble size class in the riffles below the lake was in the coarse gravel range. In almost every station, much of the riffle substrate was below very coarse gravel (around 2 to 2 ½"). This small material may not provide quality habitat for the benthic community found here, and may be indicative of increased stormwater velocities.

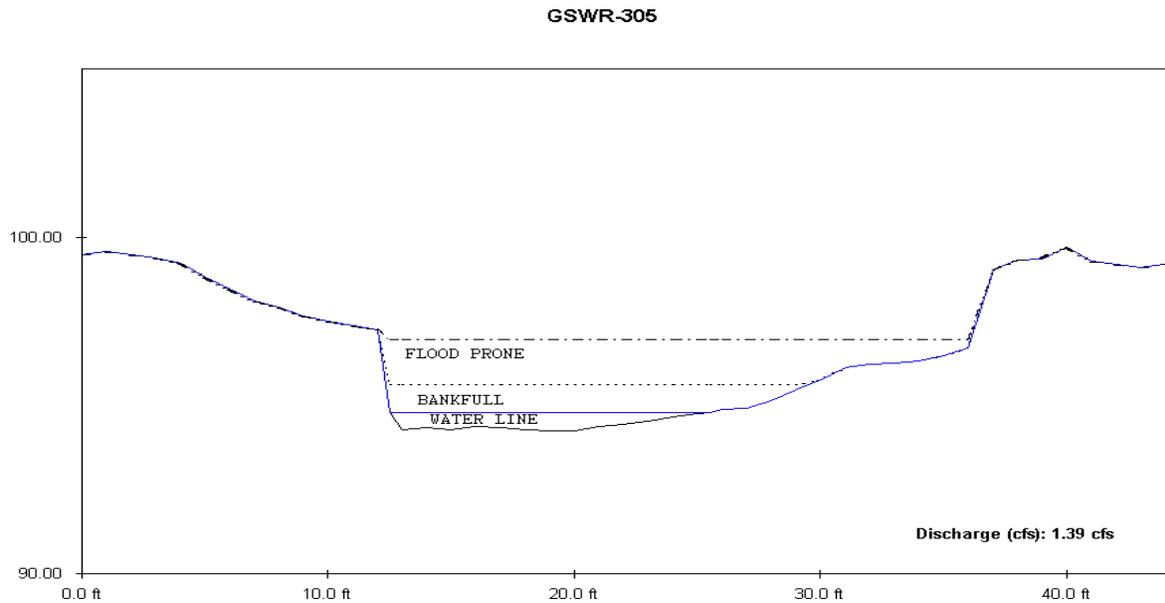


Figure 14. Moderate to entrenched stream cross section in Whetstone Run.

Water Temperature Monitoring

Three continually recording temperature meters were placed in the Middle Great Seneca watershed. While this portion of Great Seneca Creek is classified as a Use I stream, the Department of Natural Resources (DNR) stocks rainbow and brown trout in the stream for put and take fishing similar to Class IV streams in the rest of the County. In addition, the DNR manages portions of the Middle Great Seneca and the Lower Great Seneca as a small mouth bass stream. Through stream monitoring, DEP has found a fish community consistent with a cool

water stream. For these reasons, it is of interest to examine how closely stream temperatures fluctuated around 75° F during the diurnal temperature cycle.

Temperature meters were distributed in the main stem at station GSMS-413 (on the main stem between Interstate I-270 and Route 355), station GSWR-302 (Whetstone Run above the impoundment), and on the Gunners Branch at station GSGN-302 (upstream of the confluence of Gunners Branch and Great Seneca Creek). The temperature meter at GSWR-302 was lost. The main stem station exhibited temperatures that largely were below the State of Maryland's Use classification standard for Class IV streams (Figure 15 (75° F) ). Figure 15 shows the diurnal temperature trends from June through September 1998. Temperatures briefly exceeded the Use IV temperature criterion 4 times during this period, briefly reaching 76° to 77° F and then returning below 75° F during the rest of the same 24 hour period. On August 28, temperatures climbed above this criterion reaching a maximum of 77 and remained above the limit for most of the day.

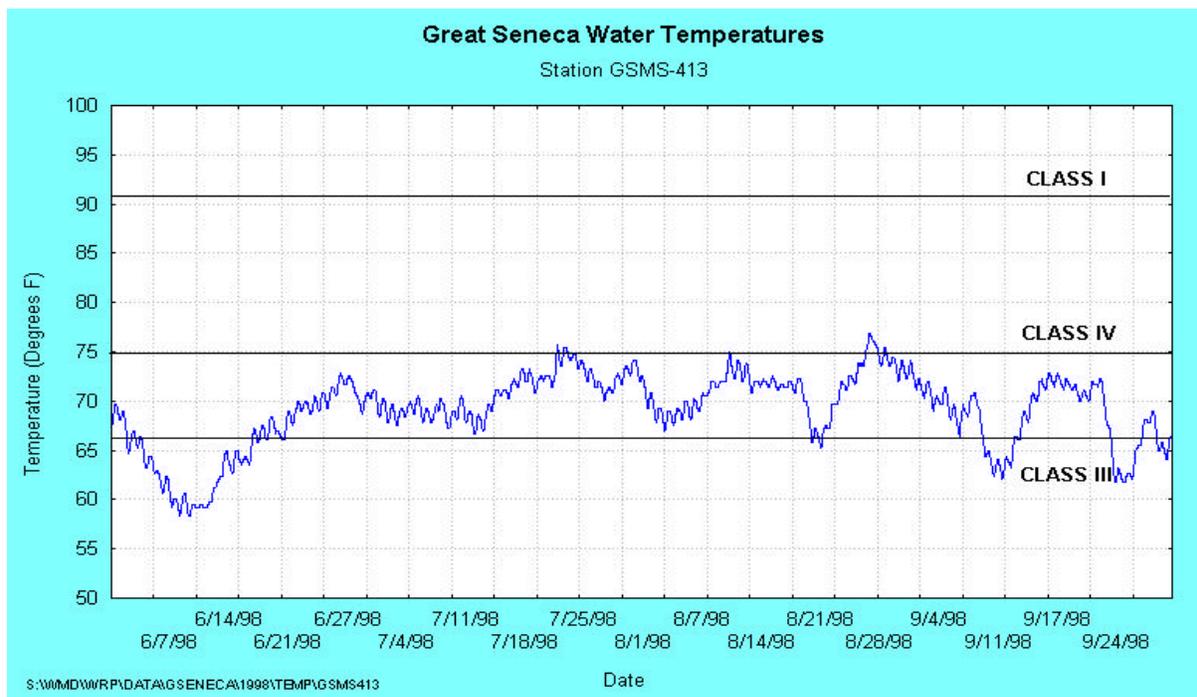


Figure 15. Water temperatures in Middle Great Seneca Creek main stem, June through September 1998.

The temperature meter at Gunners Branch also recorded hourly diurnal temperatures during June through September 1998. Water temperature trends were noticeably different in this tributary than in the main stem station (Figure 16). Temperatures regularly exceeded the Class IV temperature limit for a total of 42 times during this period. Although many exceedances were

for brief periods during the day, during late July and mid-August, temperatures exceeded or nearly reached 80 degrees F. Daily temperature ranges were greater than the main stem station, and temperatures reached higher levels quicker than in the main stem station and dropped to lower temperatures quicker. These temperature fluctuations and elevated water temperatures account for some of the stressors impacting the biological communities in Gunners Branch.

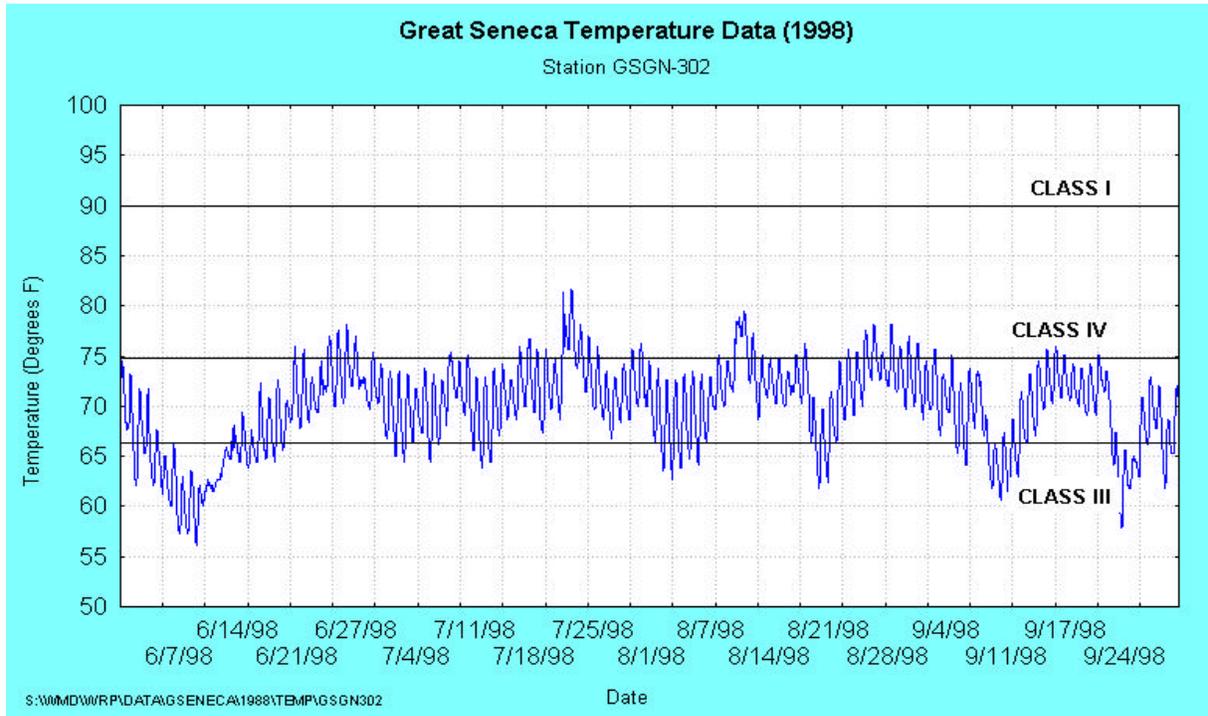


Figure 16. Water temperatures in lower Gunners Branch, June through September 1998.

### **Lower Great Seneca Creek**

#### **Stream Condition**

Seasonal trends were examined and a yearly stream condition was established for the Lower Great Seneca Creek subwatersheds (Figure 17). Stream conditions were evaluated for 5 subwatersheds. At this time, the Dawsonville Tributary subwatershed received an overall stream condition of *fair*. The stream is an intermittent stream, the benthic macroinvertebrate community IBI score was *excellent*, however there may be a nutrient enrichment problem in this tributary that is artificially elevating the IBI. South Germantown and Lower Great Seneca subwatersheds received an overall stream condition rating of *good*, this rating was warranted from both the biological conditions in the tributaries that were monitored as well as the conditions found in the main stem stations. The Lower Long Draught subwatershed received an overall rating of *fair* largely based on the stream conditions observed in the three tributary stations that were

monitored in this subwatershed. Upper Long Draught subwatershed received an overall rating of *poor*.

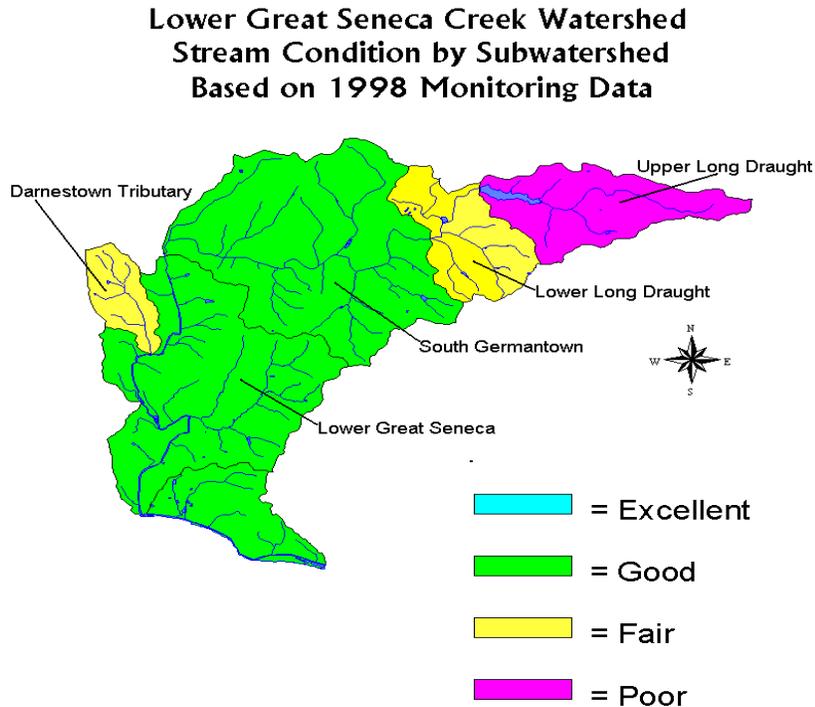


Figure 17. Stream Conditions in Lower Great Seneca Watershed.

#### Examination of IBI/Qualitative Habitat Relationships

Data from 22 monitoring stations were used in the assessment of the Lower Great Seneca. Five of the stations are being done in cooperation with the Washington Suburban Sanitary Commission (WSSC) to develop a baseline of the stream conditions above and below the Seneca Waste Water Treatment Plant (WWTP). Two stations were done by the M-NCPPC. The Benthic macroinvertebrates were collected in the spring of 1998. Fish surveys were conducted during the summer/fall of 1998.

Twelve of the 22 monitoring stations benthic macroinvertebrate IBI scores were in the *fair to poor* range indicating a relatively impaired biological community in these areas (Figure 18). Three of the monitoring stations fish IBI scores were also in the *fair to poor* range. Sixteen of the monitoring stations fish IBI scores ranged in the *good to excellent* range, however,

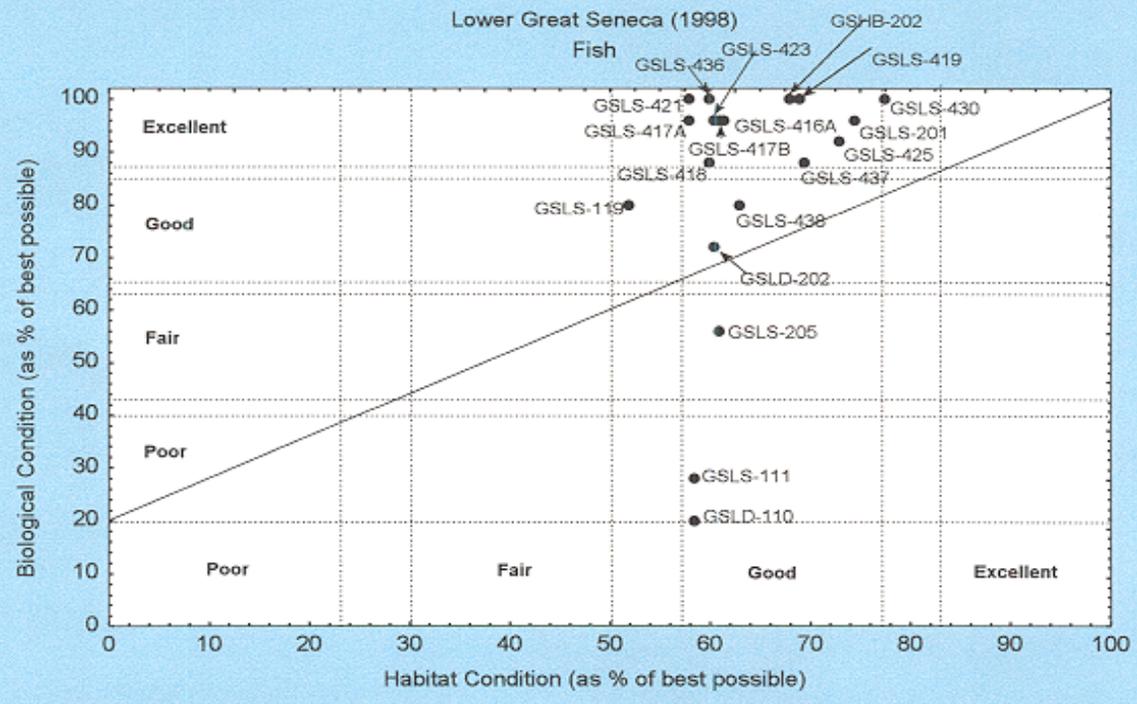
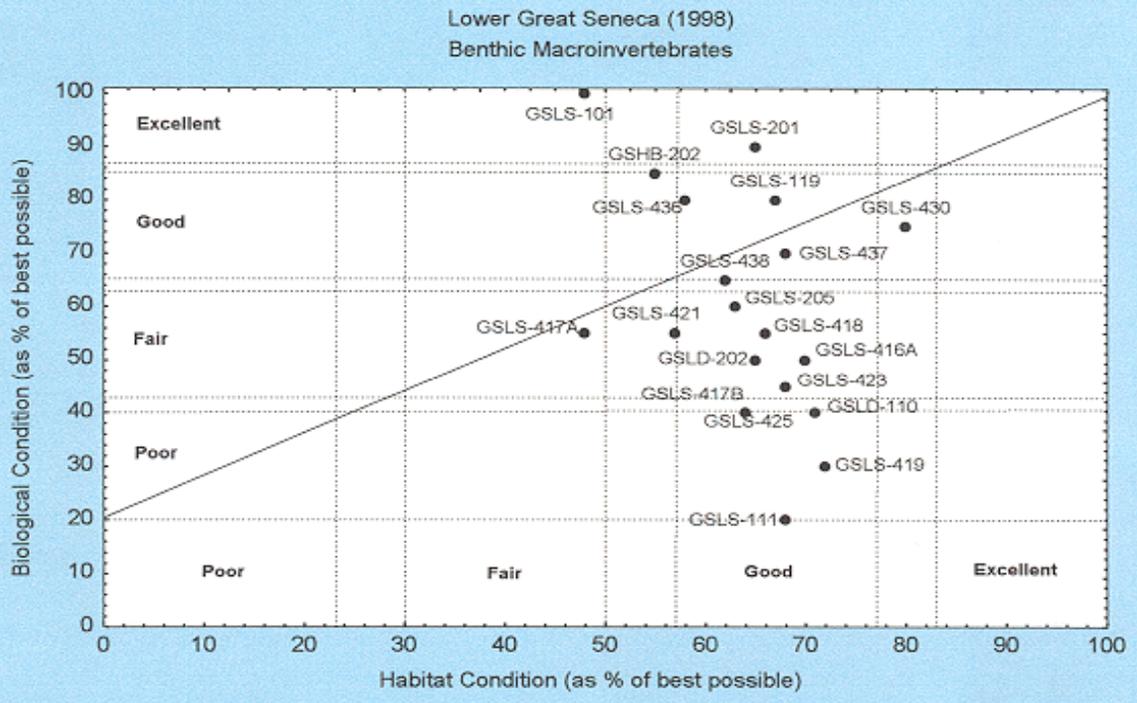


Figure 18. Relationship between habitat condition and biological condition at Lower Great Seneca Creek.

the overall number of fish within the main stem stations was low. The low numbers may indicate possible impairment from altered stormwater flows. The data also suggests that stressors are impairing the benthic macroinvertebrate communities more so than the fish communities. The overall habitat rating within the monitoring reaches was largely in the good range, indicating that habitat conditions alone (as measured by the rapid habitat assessment procedure) are unlikely to be causing an impaired biological community. No station had habitat assessment ratings in the fair range during both the benthic macroinvertebrate and fish monitoring periods.

*Stream areas with IBI's indicative of cumulative impacts of concern*

Stations identified as areas of concern from the IBI/habitat evaluation are described in Table 7. These stations plotted outside of the range of expected IBI/habitat values for both the fish and benthic macroinvertebrate communities (Figure 18).

Table 7. Stream areas with identified measures of cumulative impacts.

Monitoring Station	CSPS Subwatershed	Location	benthic IBI	Fish IBI	Recommended Action
GSLs-111	Lower Long Draught	vicinity of Suffolk Terrace	poor (8)	poor (14)	Field investigation
GSLD-110	Upper Long Draught	vicinity of Rabbit Road	poor (16)	poor (10)	Field investigation
GSLs-205	Lower Long Draught	Above Riffle Ford Road	fair (24)	fair (28)	Field investigation
GSLs-101	Dawsonville Tributary	vicinity of Berryville Road	Excell. (40)	intermitt. stream	Field investigation
GSLs-416A	Middle Great Seneca	vicinity of Clopper Road	fair (20)	excell. (48)	Field investigation
GSLs-417B	Lower Long Draught	vicinity of Riffle Ford (above outfall)	poor (16)	excell. (48)	Field investigation
GSLs-418	Lower Long Draught	vicinity of Riffle Ford (below outfall)	fair (22)	good (44)	Field investigation
GSLs-419	Lower Long Draught	vicinity of Riffle Ford (below outfall)	poor (12)	excell. (50)	Field investigation

GSL-421	South Germantown	vicinity of Riffle Ford (below road)	fair (22)	Excell. (50)	Field investigation
GSL-423	South Germantown	vicinity of Brandon Way	fair (18)	Excell. (48)	Field investigation
GSL-425	South Germantown	vicinity of Darnestown-Germantown Road (Route 118)	poor (16)	Excell. (46)	Field investigation

Relationship between Stream Condition and Qualitative Habitat Assessments

Specific habitat parameters were further examined to see if any single parameter could explain some or all of the impairment observed in the fish and benthic community (Table 8). Seven of the 10 parameters used in the rapid habitat assessment are presented in Table 8. The reasons for excluding the other 3 has been previously described. Many habitat parameters scored in the good to excellent range throughout the monitoring year (Table 8). A number of observations were made in the fair and poor ranges and these will be discussed next to determine if they could have contributed to the stream impairment.

Table 8. Selected habitat parameters (from Rapid Habitat Assessment) at stream areas with identified measures of cumulative impacts.

Monitoring Station		Fish Cover	Benthic Substrate	Embedd.	Sediment Deposition	Bank Stability	Flow Status	Riffle Freq.
GSL-111	4/15/98	fair	excell.	good	good	good	excell.	excell.
	8/11/98	poor	good	good	good	good	fair	excell.
GSLD-110	4/15/98	fair	excell.	good	good	good <sup>7</sup>	excell.	excell.
	8/4/98	fair	good	fair	good	good	good	good
GSL-205	4/15/98	good	good	good	fair	fair	fair	excell.
	8/11/98	good	good	fair	fair	fair	good	good
GSL-101	4/22/98	poor	good	poor	poor	good	good	good
	8/12/98	poor	poor	poor	poor	fair	poor	poor
GSL-416A	4/24/98	good	good	good	good	fair	good	good
	10/14/98	good	good	good	good	fair	good	good
GSL-417B	4/24/98	good	fair	good	fair	good	excell.	fair
	10/13/98	good	fair	good	good	fair	good	fair

GSLS-418	4/24/98	good	good	excell.	good	good	excell.	good
	10/07/98	fair	fair	fair	fair	good	excell.	fair
GSLS-419	4/28/98	good	good	good	good	good	excell.	good
	10/07/98	good	fair	good	good	good	excell.	fair
GSLS-421	4/22/98	excell.	fair	fair	fair	fair	excell.	fair
	8/6/98	excell.	fair	fair	fair	fair	excell.	fair
GSLS-423	4/28/98	good	good	excell.	good	good	fair	fair
	10/15/98	good	good	good	fair	fair	good	fair
GSLS-425	4/21/98	excell.	fair	fair	fair	good	excell.	fair
	7/28/98	excell.	good	good	fair	good	good	good

Station GSLS-111 is located off of Suffolk Terrace, near the northwest corner of the intersection of Route 28 and Quince Orchard Road. It is within the Quince Orchard subwatershed. In 1998, both the benthic macroinvertebrate community and fish community IBI scores were *poor*. This headwater tributary has habitat conditions present to support a better benthic macroinvertebrate community. The small drainage area could account for the poor fish community. Benthic habitat was rated as *excellent*, with well developed riffles and runs. Fish habitat was rated as *poor*, with less than 10% mix of stable habitat. Stream flow as rated as *fair* during the fish monitoring period, with 25% to 75% of the available channel being filled. All other habitat parameters were rated as either *excellent* or *good*. Physicochemical measurements taken when the benthic macroinvertebrate and fish monitoring was conducted showed dissolved oxygen and pH within acceptable ranges. Conductivity was elevated with 350  $\mu$ mhos recorded in the spring and 398  $\mu$ mhos recorded during the fish monitoring period.

Station GSLS-205 is located in the lower most section of the same stream that GSLS-111 is in. This stream is near the northwest corner of the intersection of Route 28 and Quince Orchard Road and is within the Quince Orchard subwatershed. Land cover appears to be primarily residential single family homes. Both the benthic macroinvertebrate community and fish community IBI scores were *fair*. The amount of fine sediment deposition in the stream may be impacting this stream reach and account for some of the observed impacts to the resident biological community. The stream bed gravels, cobbles, and small boulder particles were 50 to 75% surrounded by fine sediment during the summer. There was moderate deposition of new gravel and coarse sand on old and new bars with 30 to 50% of the stream bottom affected and moderate sediment deposition in the pools throughout the monitoring period. In addition, both left and right banks were moderately unstable with up to 60% of the banks within the reach having areas of erosion throughout the monitoring period. Physicochemical measurements taken when the benthic macroinvertebrate and fish monitoring was conducted showed dissolved oxygen and conductivity within acceptable ranges. pH was elevated during the spring with a pH

of 8.94. However, a pH of 7.39 was recorded during the fish monitoring period.

Station GSLD-110 is located upstream of Long Draught Road in the vicinity of Rabbit Road. It is within the Upper Long Draught subwatershed. Both the benthic macroinvertebrate community and fish community IBI scores were *poor*. This headwater tributary has habitat conditions present to support a better benthic macroinvertebrate community. The poor fish community could be a result of Clopper Lake serving as an effective barrier to fish migration from downstream below the lake. Fish cover and embeddedness were rated as *fair* during the fish monitoring period, with 10 to 30% mix of stable habitat present and gravel, cobble, and boulder particles are 50 to 75% surrounded by fine sediment. All other parameters were in the excellent to good range throughout both monitoring periods. Physicochemical measurements taken when the benthic macroinvertebrate and fish monitoring was conducted showed dissolved oxygen to be within acceptable ranges. Conductivity was elevated with 514  $\mu$ mhos recorded in the spring and 384  $\mu$ mhos recorded during the fish monitoring period. The pH was slightly elevated in the spring with a pH of 7.63.

Station GSLS-101 is in the Dawsonville Tributary subwatershed. This tributary is located upstream of where Seneca Creek passes under Route 28, on the west bank. It was an intermittent stream in 1998, drying up after the spring benthic monitoring period. The spring benthic macroinvertebrate IBI score was excellent. However, embeddedness, and sediment deposition were rated as *poor* throughout the year, with stream bed gravel, cobble, and boulder particles being more than 75% surrounded by fine sediment and heavy deposits of fine material almost filling the existing pools. The amount of fine sediment deposition should be greatly impacting the benthic macroinvertebrate community. The spring benthic macroinvertebrate community IBI score of *excellent* may be a result of nutrient enrichment elevating the ability of the stream to support a diverse benthic community. Toxic impacts are not indicated. Physicochemical measurements taken when the benthic macroinvertebrate monitoring was conducted showed all parameters to be within acceptable ranges.

The rest of the stations that are identified as having a degree of impairment that warrants follow up investigation are main stem 4<sup>th</sup> order stations that start downstream of Clopper Road and end upstream of Route 118 (Darnestown- Germantown Road). These stations are located in the Lower Long Draught/Quince Orchard and South Germantown subwatersheds. All seven stations have *fair* to *poor* benthic macroinvertebrate IBI scores and *excellent* to *good* fish scores. Through the monitoring work being performed to document base line stream conditions around the Seneca WWTP, DEP has documented that riffle habitat is limiting in this stream area, with the number of available riffles being low and riffle spacing being irregular. Impacts to the stream habitat from increased stormwater runoff is observed at all stations. While the fish IBI scores are within the *excellent* to *good* range, numbers of fish are lower than expected. Often a species is represented by only one or two individuals. Nutrient enrichment can not be ruled out in this area and should be investigated further. Physicochemical measurements taken when the benthic macroinvertebrate and fish monitoring was conducted showed most parameters to be within acceptable ranges. No outlier values were observed consistently throughout all seven stations.

Conductivity measurements of 362, 354, and 315  $\mu$ mhos were recorded during the fish monitoring period at GSLS- 418, GSLS-419, and GSLS-423 respectively.

Table 9. Physicochemical parameters at stream areas with identified cumulative impacts.

Monitoring Station		Water Temperature (°C)	Dissolved Oxygen (ppm)	pH	TDS (g/l)	Conductivity ( $\mu$ mhos)
GSLS-111	4/15/98	14.2	11.14 (107.9)	7.26	0.224	350
	8/11/98	19.7	7.55 (n/a)	7.1	n/a	398
GSLD-110	4/15/98	13.28	12.22 (117.3)	7.63	0.329	514
	8/4/98	18.2	8.66 (92)	6.92	n/a	384
GSLS-205	4/15/98	17.25	11.81 (122.1)	8.94	0.117	184
	8/11/98	21.9	7.77 (88.6)	7.39	n/a	122
GSLS-101	4/22/98	n/a	10.7	7.29	.0867	135
	8/12/98				n/a	
GSLS-416A	4/24/98	13.23	10.85 (105.1)	7.51	n/a	174
	10/14/98	14.37	8.94 (86.4)	7.49	n/a	191
GSLS-417B	4/24/98	14.77	8.8 (85.7)	7.36	n/a	192
	10/13/98	14.77	14.83 (114.9)	8.25	n/a	179
GSLS-418	4/24/98	15.05	12.18 (120.1)	8.2	n/a	190
	10/07/98	17.9	8.85 (91.4)	7.57	n/a	362
GSLS-419	4/28/98	13.25	8.62 (81.8)	7.36	n/a	203
	10/07/98	17.44	7.83 (80.3)	7.51	n/a	354
GSLS-421	4/22/98	15	9.23 (91.3)	7.78	n/a	143
	8/06/98	20	7.37 (82.5)	n/a	n/a	265
GSLS-423	4/28/98	13.54	10.5 (98.8)	7.46	n/a	205
	10/15/98	13.97	8.31 (79.4)	7.4	n/a	315
GSLS-425	4/21/98	14.25	10.31 (99.8)	7.4	n/a	188
	7/28/98	21.84	7.3 (89.61)	7.42	n/a	281

Quantitative Habitat Analysis

Quantitative habitat was surveyed during the fall/winter of 1998.

*Upper Long Draught*

A survey was conducted within station GSLD-110 on December 14, 1998. This section of Upper Long Draught is moderately entrenched. Access to flood prone areas associated with relatively frequent storm events is limited (Figure 19). The stream section was composed of 44% riffles, 34.7% runs, and 11.3% other habitat types. Banks were mostly vegetated and canopy cover over the stream was 32%. Fifty per cent of the riffle stream bed particles were very coarse gravel or smaller.

Width/depth ratios indicate the stream is not overly widened.

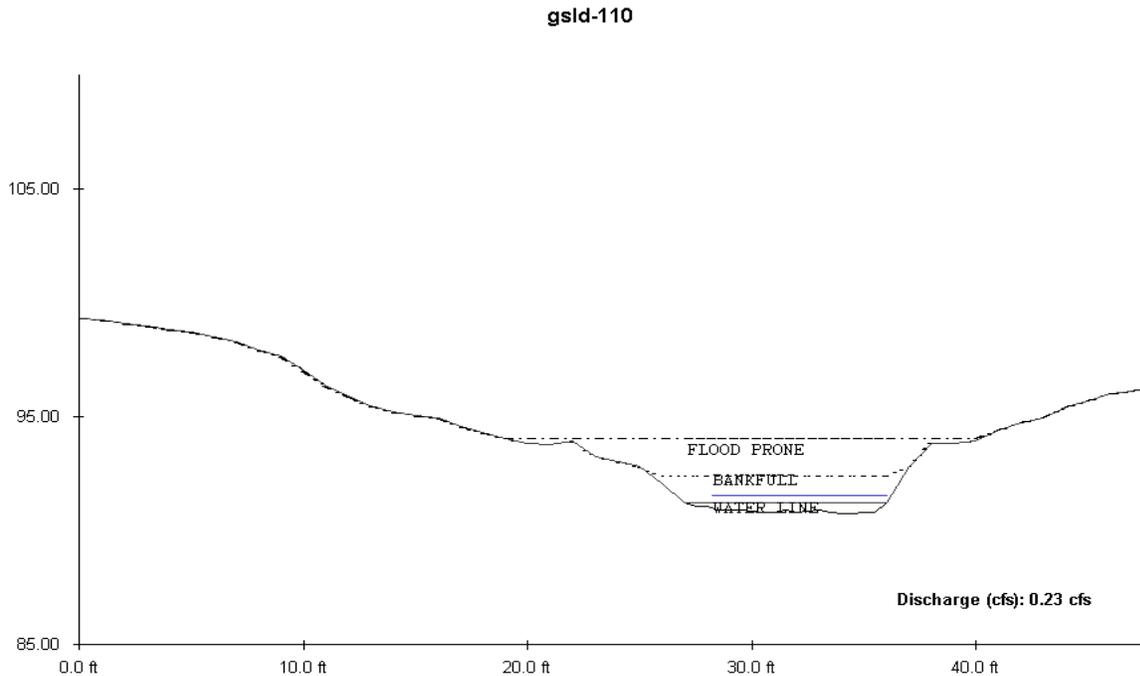


Figure 19. Entrenched stream channel in Upper Long Draught Branch.

*Lower Long Draught/Quince Orchard*

Five surveys were conducted within this subwatershed. One survey was completed

within Lower Long Draught (GSLD-202), two within the Quince Orchard Tributary (GSLs-111, GSLs-205), and two in the main stem (GSLs-417a, GSLs-418)).

Lower Long Draught Tributary is entrenched. Access to flood prone areas associated with relatively frequent storm events is severely limited (Figure 20). The stream section was composed of 20.7% riffles, 33.2% runs, and 30.2% pool habitat which is a balanced mix. Banks were two thirds vegetated and canopy cover over the stream was 70%. Fifty per cent of the riffle stream bed particles were very coarse gravel or smaller. About 30% of the particles were in the small cobble to large cobble size range. Width/depth ratios indicate the stream is overly widened.

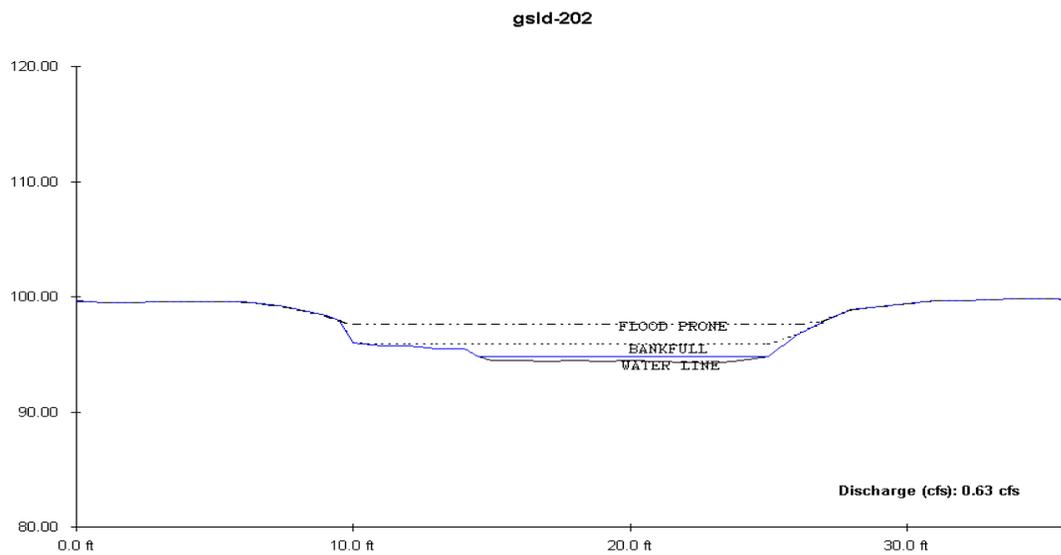


Figure 20. Entrenched and over widened stream section in Lower Long Draught Branch.

The Upper Quince Orchard Tributary is also entrenched (Figure 21). The stream section was composed of 25.5% riffles, 41.5% runs, and 8.9% pool habitat. Pools are somewhat lacking. Banks were not well vegetated, with the right bank having 63% cover, and the left bank having 25% cover. Canopy cover over the stream was 92%. Fifty per cent of the riffle stream bed particles were small cobble or smaller. About 35% of the particles were in the medium cobble to very large cobble size range. Width/depth ratios indicate the stream is not overly widened.

The lower Quince Orchard Tributary is entrenched (Figure 22). The stream section was composed of 22.9% riffles, 10.0% runs, and 48.4% pool habitat. Runs are somewhat lacking. Banks were well vegetated, with both banks having about 83 - 85% cover. Canopy cover over the stream was 63%. Fifty per cent of the riffle stream bed particles were medium to coarse gravel or smaller. Forty per cent of the particles were coarse gravel. About 35% of the particles

were in the medium cobble to very large cobble size range. Width/depth ratios indicate the stream is extremely overly widened, and may indeed be forming a new flood prone area within the old channel.

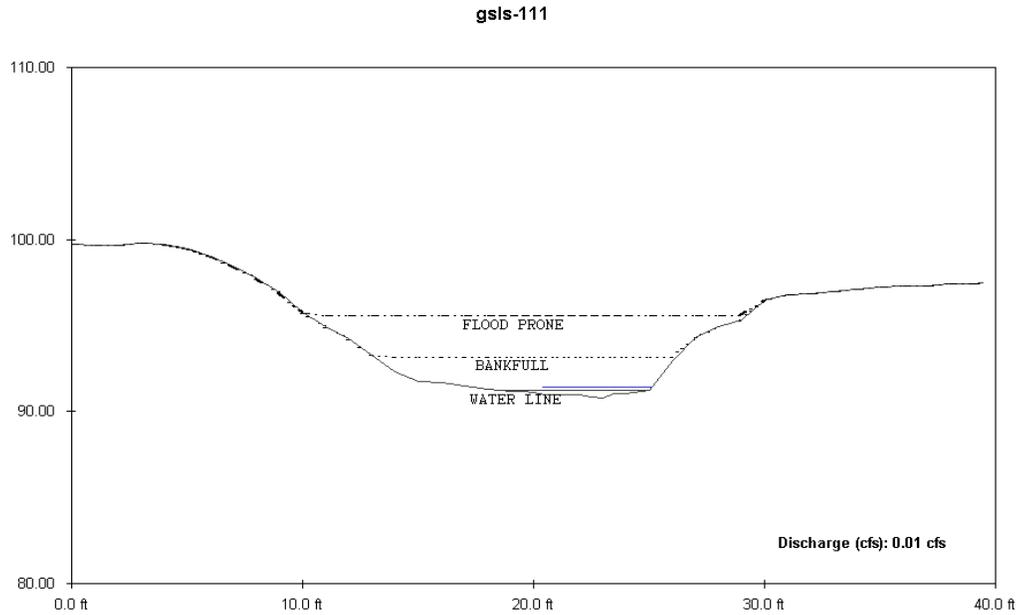


Figure 21. Stream cross section from the Upper Quince Orchard Subwatershed.

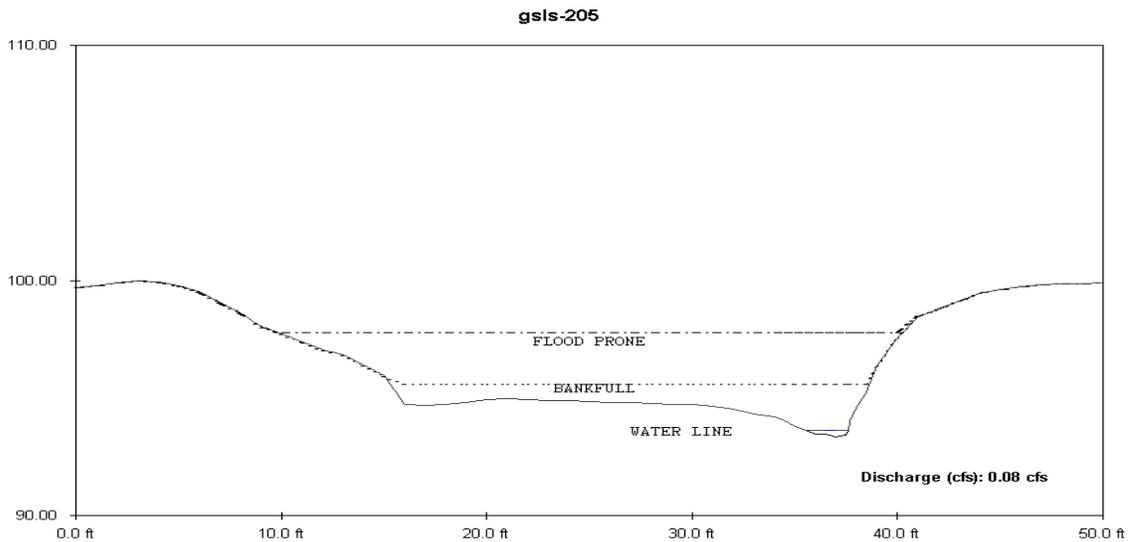


Figure 22. Stream cross section in the Lower Quince Orchard Subwatershed showing an overly wide and entrenched channel.

The main stem is moderately entrenched to entrenched. The main stem stream sections average 0% riffles, 73.6% runs, and 13.85% pool habitat. Riffles are lacking, and pool habitat is also not optimal. Banks were not well vegetated, with an average of 54.5% cover. Canopy cover over the stream averaged 56%. Fifty per cent of the riffle stream bed particles were medium to coarse gravel or smaller. About 55% of the particles were in the coarse to very coarse gravel size range. Width/depth ratios indicate the stream is not overly widened.

### *South Germantown*

Five surveys were conducted within this subwatershed. One survey was completed within an unnamed tributary east of route 118 (GSLs-119), one within an unnamed tributary downstream of Black Rock Road, (GSLs-201), and three in the main stem (GSLs-421, GSLs-425, and GSLs-430).

The unnamed tributary east of route 118 is entrenched (Figure 23). The stream section was composed of 34.3% riffles, 49.9% runs, and 15.9% pool habitat. Pools are somewhat lacking. The left banks was 29% vegetated, and the right bank was 75% vegetated. Canopy cover over the stream was 80%. Fifty per cent of the riffle stream bed particles were coarse gravel or smaller. Forty per cent of the particles were coarse to very coarse gravel size range. Width/depth ratios indicate the stream is extremely overly widened.

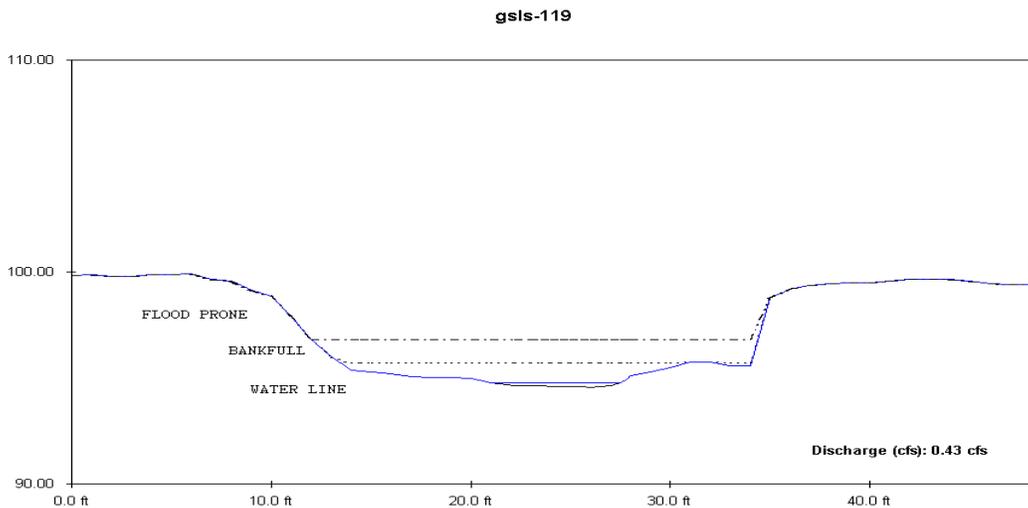


Figure 23. Entrenched and overly widened channel in the Unnamed Tributary east of Route 118.

The unnamed tributary downstream of Black Rock Road is moderately entrenched (Figure 24). The stream section averaged 12.4% riffles, 46.0% runs, and 3.3% pool habitat. Pools are somewhat lacking. The left banks was 64% vegetated, and the right bank was 34%

vegetated. Canopy cover over the stream was 97%. Fifty per cent of the riffle stream bed particles were medium gravel or smaller. Forty five per cent of the particles were coarse to very coarse gravel size range. Width/depth ratios indicate the stream is extremely overly widened.

gsls-201

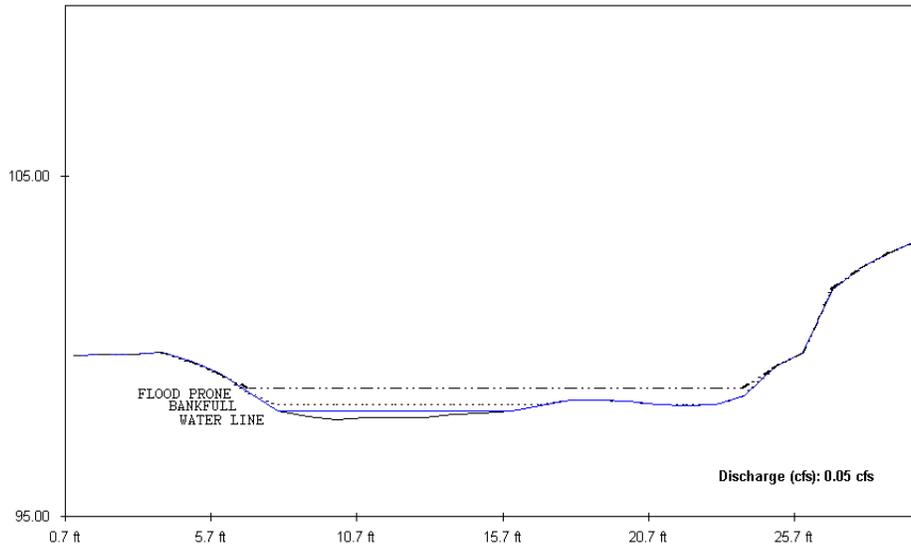


Figure 24. Stream cross section in Unnamed Tributary downstream of Black Rock Road.

The main stem in this subwatershed is moderately entrenched to entrenched. The stream section was composed of 1.6% riffles, 73.7% runs, and 7.2% pool habitat. Pool and riffle habitat are lacking. Banks averaged 62.5% vegetated. Canopy cover over the stream averaged 83.3%. Fifty per cent of the riffle stream bed particles averaged coarse to very coarse gravel or smaller. Particle sizes appeared skewed towards smaller sizes (< very coarse gravel) Width/depth ratios indicate the stream is moderately overly widened and may be forming a new flood prone area in portions of the main stem.

#### Dawsonville Tributary

The Dawsonville Tributary is entrenched (Figure 25). The stream section averaged 0.0% riffles, 74.1% runs, and 11.9% pool habitat. Riffles are entirely lacking, and pools are somewhat lacking. The left banks was 48% vegetated, and the right bank was 34% vegetated. Canopy cover over the stream was 73%. Fifty per cent of the riffle stream bed particles were smaller than coarse gravel. Width/depth ratios indicate the stream is moderately widened.

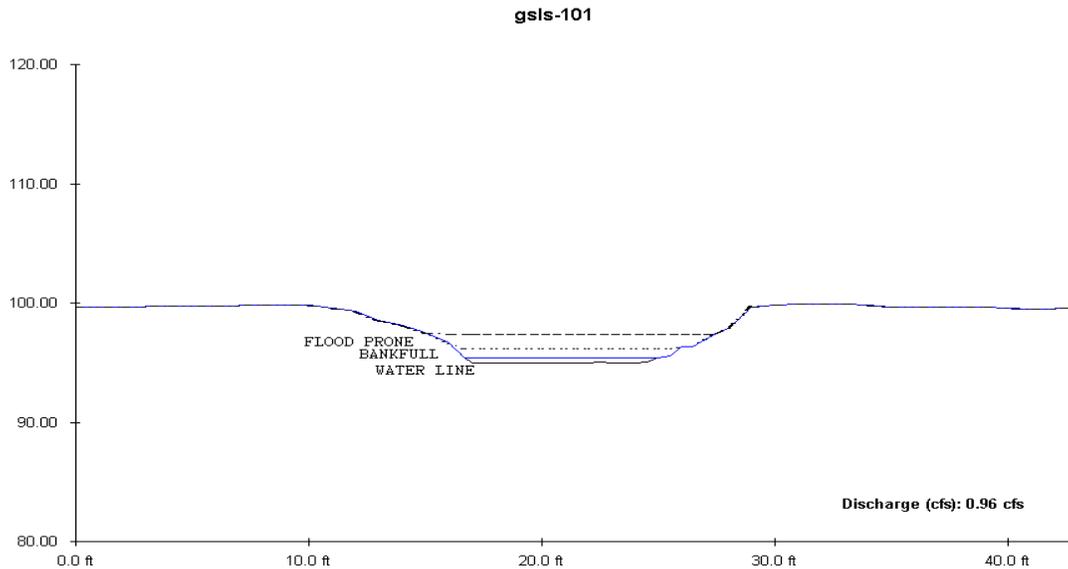


Figure 25. Channel cross section in the Dawsonville Tributary. Channel is entrenched.

### Lower Great Seneca

Three surveys were conducted within this subwatershed. One survey was completed within Hooker Branch (GSHB-202), and two within the main stem (GSLs-436, and GSLs-437).

The Hooker Branch is entrenched (Figure 26.). The stream section averaged 34.8% riffles, 0.0% runs, and 9.3% pool habitat. Runs are entirely lacking, and pools are somewhat lacking. The left bank was 72% vegetated, and the right bank was 50% vegetated. Canopy cover over the stream was 43%. Fifty per cent of the riffle stream bed particles were medium gravel or smaller. Width/depth ratios indicate the stream is over widened.

The main stem in this subwatershed is moderately entrenched to entrenched. The stream section averaged 14.9% riffles, 67.9% runs, and 18.4% pool habitat. Pool and riffle habitat are somewhat lacking. Banks averaged 55.25% vegetated. Canopy cover over the stream averaged 37%. Fifty per cent of the riffle stream bed particles averaged coarse to very coarse gravel or smaller. Particle sizes appeared skewed towards smaller sizes (< very coarse gravel) Width/depth ratios indicate the stream is overly widened and may be forming a new flood prone area.

### Water Temperature Monitoring

Four continually recording temperature meters were placed in the Lower Great Seneca watershed. Temperature meters were distributed in the main stem at station GSLs- 430 (above Black Rock Road), and station GSLs-437 (above Seneca Road). Two temperature meters were also distributed among the Lower Long Draught Branch and Hookers Branch.

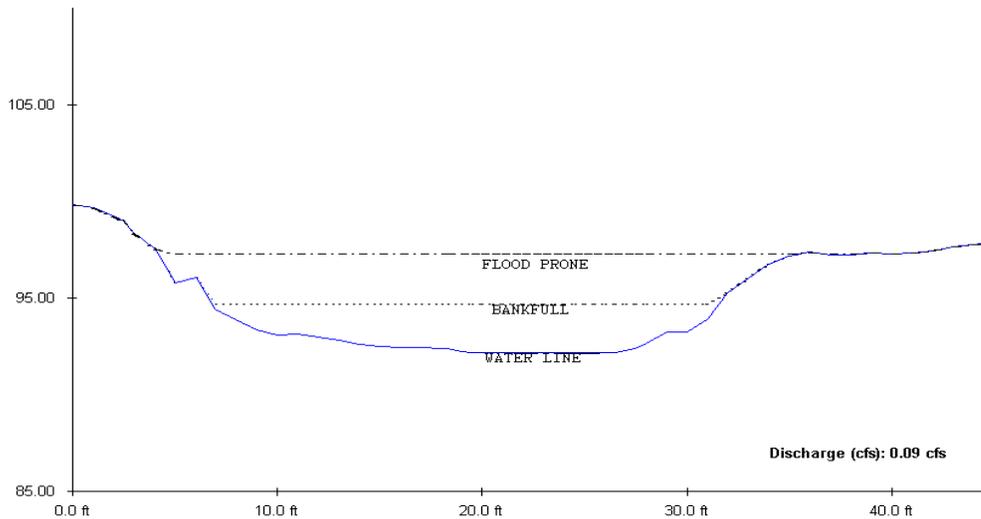


Figure 26. Cross section in Hooker Branch.

The main stem stations exhibited temperatures that largely were below the State of Maryland's Use classification standard for Class IV streams (75° F). Diurnal temperature trends were recorded on a hourly basis from June through September 1998. Temperatures briefly exceeded the Use IV temperature criterion 4 times during this period at station GSLS-430, briefly passing slightly above the 75 ° F limit and then returning below it during the same 24 hour period (Figure 27). The temperatures at the lowermost station (GSLS-437) remained below Class IV limits throughout the monitoring period (Figure 28).

The temperature meter at Hookers Branch also recorded hourly diurnal temperatures during June through September 1998. Water temperature trends remained below Class IV limits throughout the monitoring period (Figure 29).

The temperature meter on Lower Long Draught recorded water temperature trends that were noticeably different than elsewhere in the Lower Seneca Creek watershed (Figure 30). Temperatures did not exhibit a regular diurnal pattern. Temperature exceeded the Class IV temperature limit during 4 distinct periods for a total of 16 separate events. Many exceedances were over 24 hours in duration, beginning with an event that began in late June that lasted 5 days, followed by an event in late July that lasted 3 days, and ending with an event in late August that lasted 2 days. Temperatures approached 80 degrees F during these periods. These spikes could be the result of releases from the upstream lake as they are all followed by a rapid drop in diurnal stream temperature followed by a rapid recovery. These temperature fluctuations and elevated water temperatures could account for some of the stressors impacting the biological communities in Long Draught Branch.

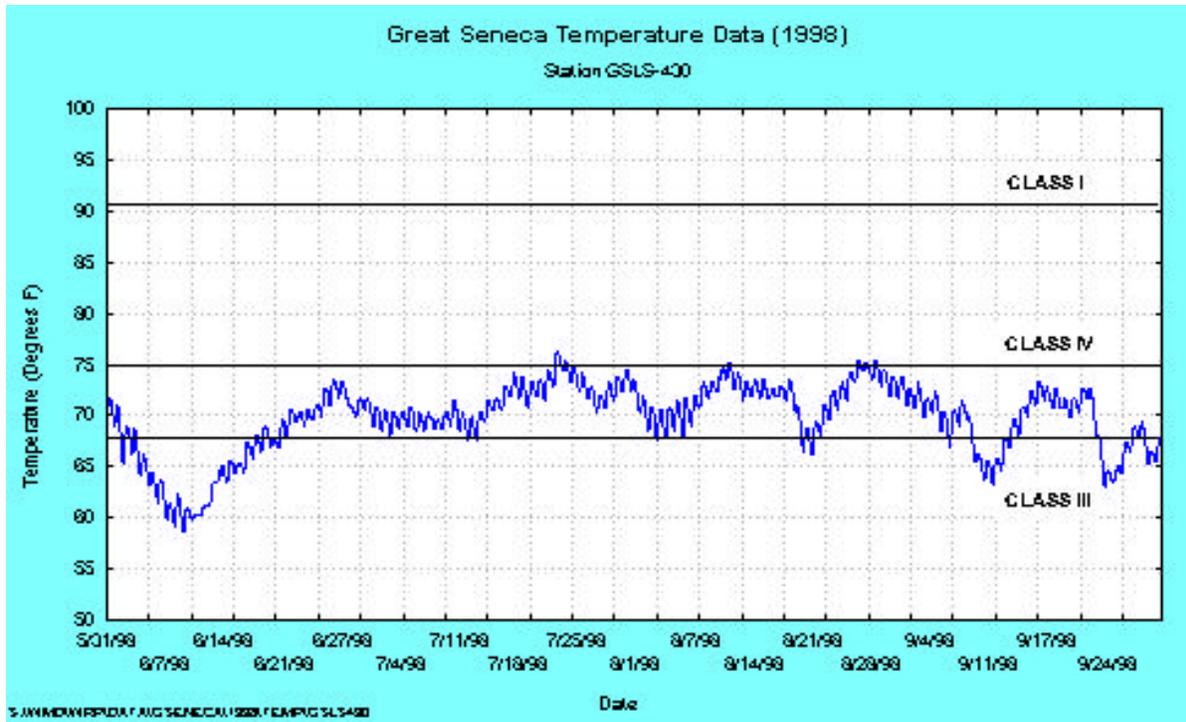


Figure 27. Water temperatures in the Lower Great Seneca main stem, near Black Rock Road.

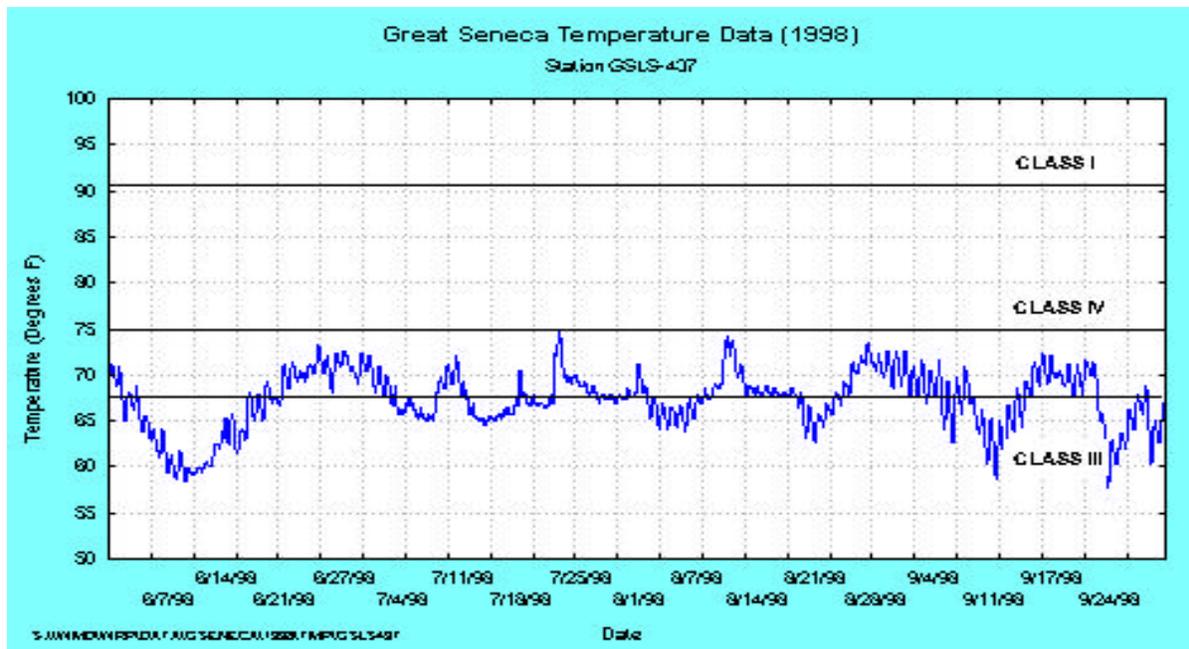


Figure 28. Water temperatures in Lower Great Seneca Creek, upstream of Seneca.

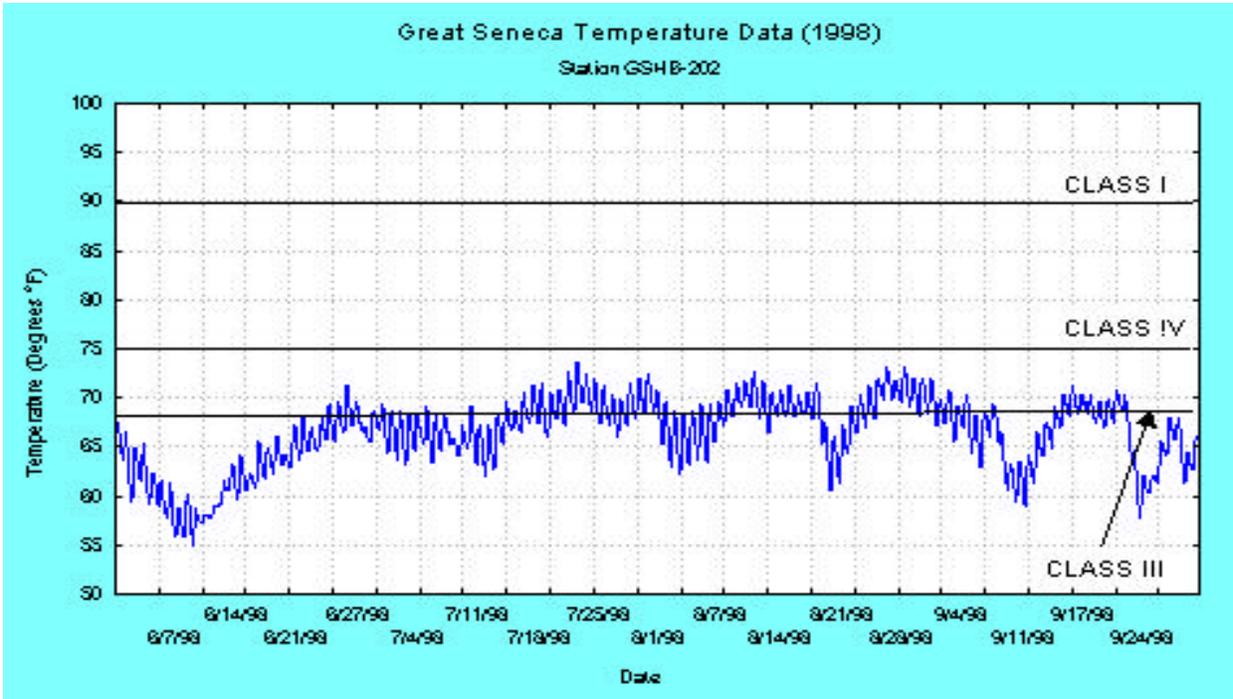


Figure 29. Water temperatures in Hooker Branch, June through September 1998.

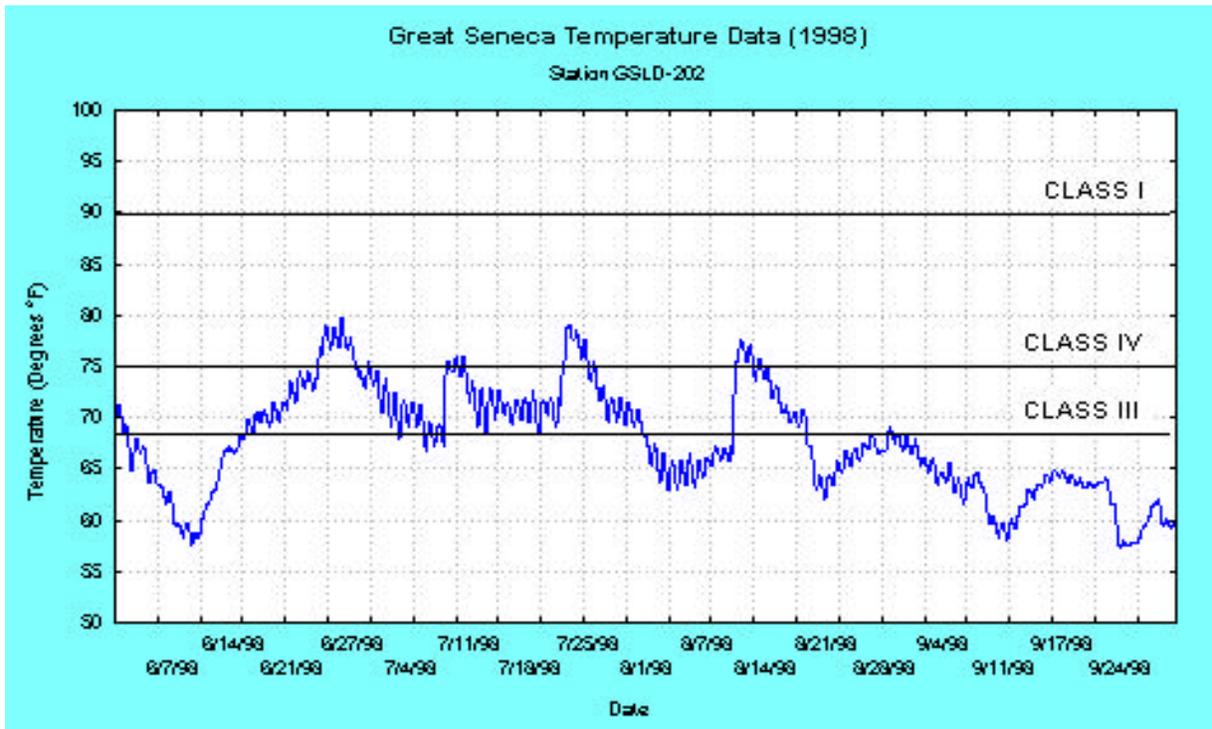


Figure 30. Water temperatures in Lower Long Draught, June through September 1998.

*Discussion*

*Existing stream conditions of Great Seneca Creek*

The overall stream conditions of the Great Seneca watershed is shown in Figure 31. The

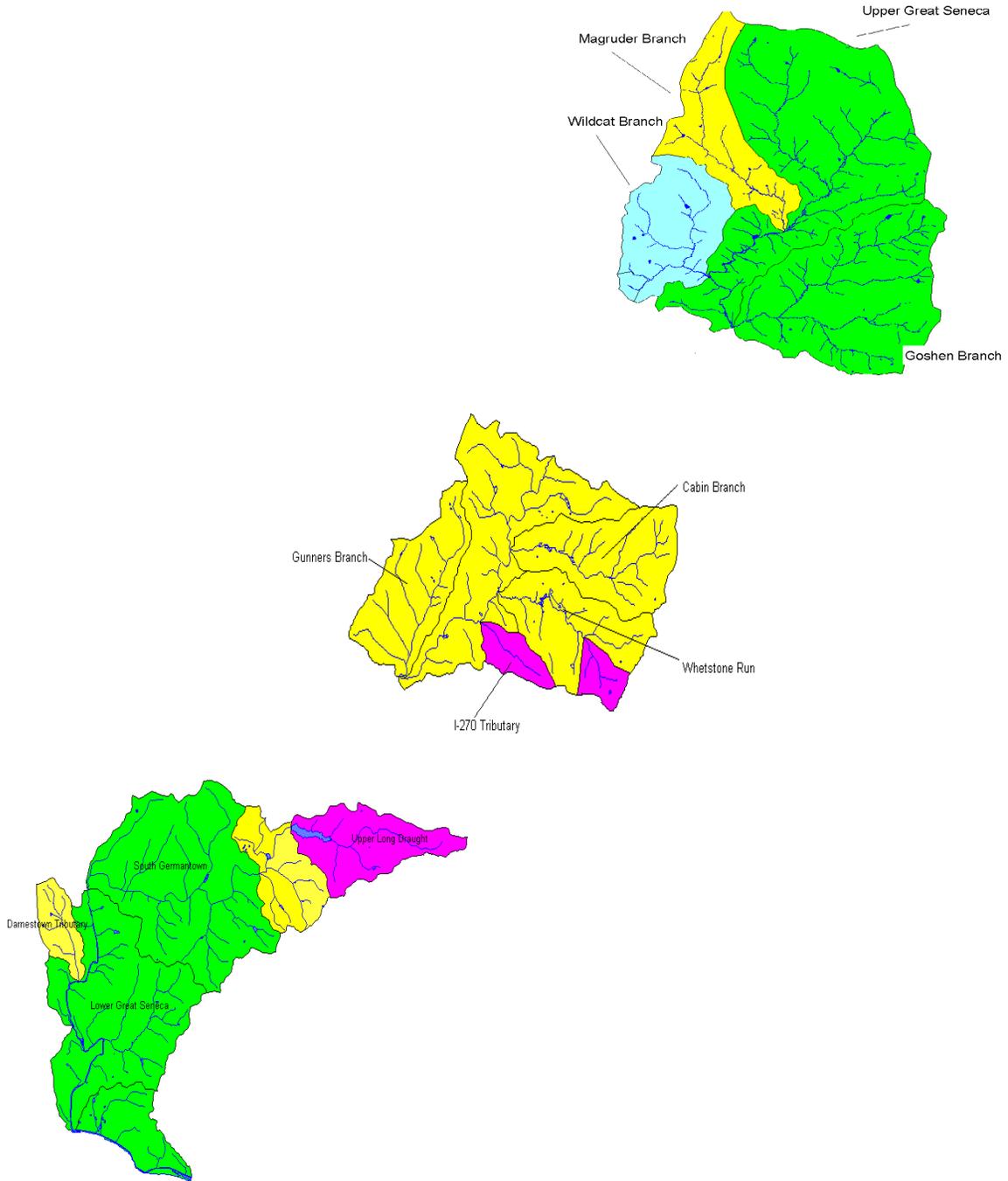


Figure 31. Overall Stream Conditions of Great Seneca Creek Watershed.

upper portion of the watershed contains areas of excellent and good stream conditions as well as an area of fair stream conditions. Wildcat Branch subwatershed received an overall stream condition of excellent. Upper Great Seneca and Goshen Branch subwatersheds received an overall stream condition of good. The Magruder Branch subwatershed received an overall stream condition rating of poor.

The middle portion of the watershed was almost entirely rated as having a fair stream condition. Gunners Branch, Cabin Branch, Whetstone Run, and the Middle Great Seneca Creek mainstem subwatersheds received an overall stream condition rating of fair. The Upper Whetstone Run and the Route 270 Tributary subwatersheds received an overall stream condition rating of poor.

Stream conditions returned to a good rating in the lower portion of the watershed as the stream left the more developed areas of the County. The Dawsonville Tributary subwatershed received an overall stream condition of excellent. The stream is an intermittent stream, so the stream condition is entirely based on the condition of the benthic macroinvertebrate community, however there may be a nutrient enrichment problem in this tributary that is artificially elevating the IBI. South Germantown and Lower Great Seneca subwatersheds received an overall stream condition rating of good, this rating was warranted from both the biological conditions in the tributaries that were monitored as well as the conditions found in the main stem stations. The Lower Long Draught subwatershed received an overall rating of fair largely based on the stream conditions observed in the three tributary stations that were monitored in this subwatershed. Upper Long Draught subwatershed received an overall rating of poor.

***Stream reaches with impairment from other than habitat stressors***

This assessment identified reaches with impairment from other than habitat stressors. Twelve stream reaches and one stream area have been identified for follow up investigation. Altered stormwater and base flows and stressors associated with altered flow regimes were identified in in all 12 reaches and the one stream area..Four reaches were identified where the primary stressors appear to be chemical (ie, illicit discharges). Seven reaches and one stream area were identified where nutrient enrichment may be occurring, however nutrient enrichment was not found in the absence of other flow related stressors. Follow up investigations are recommended in all these reaches to further determine the nature of the stressor(s) present and to make recommendations for the correction of the impairment.

Table 10. Stream reaches identified as having possible impairment from other than habitat related stressors. These areas are recommended for follow-up investigations during 1999.

Monitoring Station	CSPS Subwatershed	Location	Possible Primary Stressors			Recommended Course of Action
			Flow	WQ	Nutrients	

GSGS313	Upper Great Seneca	Creekview Drive	✓		✓	Field investigation
GSMB102	Magruder Branch	Bethesda Church Road	✓	✓		Case assignment
GSMB202	Magruder Branch	Watkins Road	✓		✓	Field investigation
GSMS-112	I-270 Tributary	vicinity of Metropolitan Grove Road	✓	✓		Case assignment & coord. with municipality
GSGN-205	Gunners Branch	vicinity of Allspice Drive	✓		✓	Field investigation
GSGN-208	Gunners Branch-	vicinity of Stone Hollow Drive	✓			Field investigation
GSCB-205	Cabin Branch	vicinity of the Green Farm	✓			Field investigation
GSWR-302	Whetstone Run	vicinity of Docenia Drive	✓	✓	✓	Case assignment & coord. with municipality
GSLs-111	Lower Long Draught	vicinity of Suffolk Terrace	✓			Field investigation
GSLD-110	Upper Long Draught	vicinity of Rabbit Road	✓	✓	✓	Case assignment & coord. with municipality
GSLs-205	Lower Long Draught	Above Riffle Ford Road	✓			Field investigation
GSLs-101	Dawsonville Tributary	vicinity of Berryville Road	✓		✓	Field investigation
Great Seneca Creek Main Stem		From Clopper Road downstream to Route 118	✓		✓	Field investigation

In addition, results of DEP's pilot synoptic nutrient sampling effort also indicates that portions of this watershed have elevated nutrient levels. A synoptic nutrient survey was conducted by DEP in the spring of 1998 to evaluate baseflow nutrient levels throughout the county. The watershed had elevated nitrate/nitrite levels as compared to other County watersheds ( $\text{NO}_3/\text{NO}_2$ - Figure 32). The highest orthophosphate concentrations were recorded in Magruder Branch ( $\text{PO}_4$ - Figure 33). In addition, the lower portion of Magruder Branch exhibited consistently high pH levels.

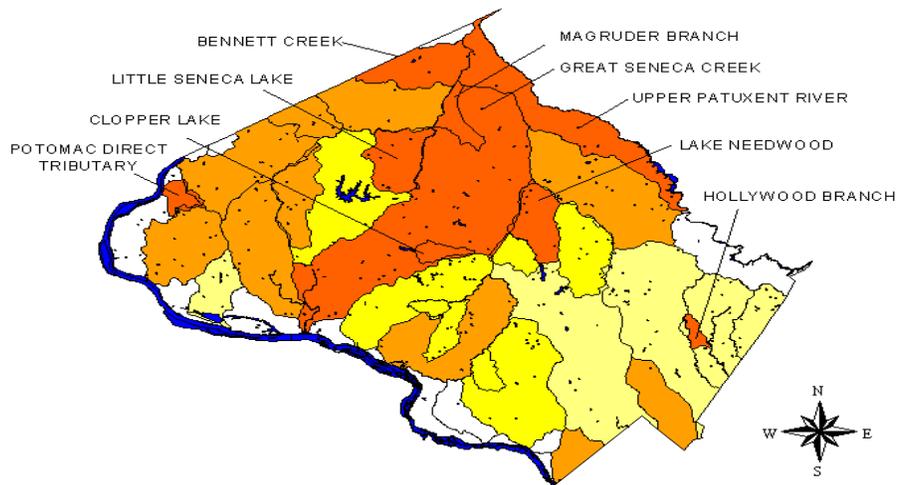
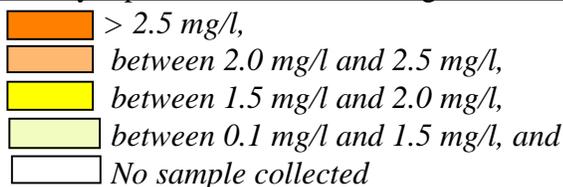


Figure 32. Results of 1998 Synoptic Nutrient Monitoring . Nitrate/Nitrite concentrations in County watersheds.



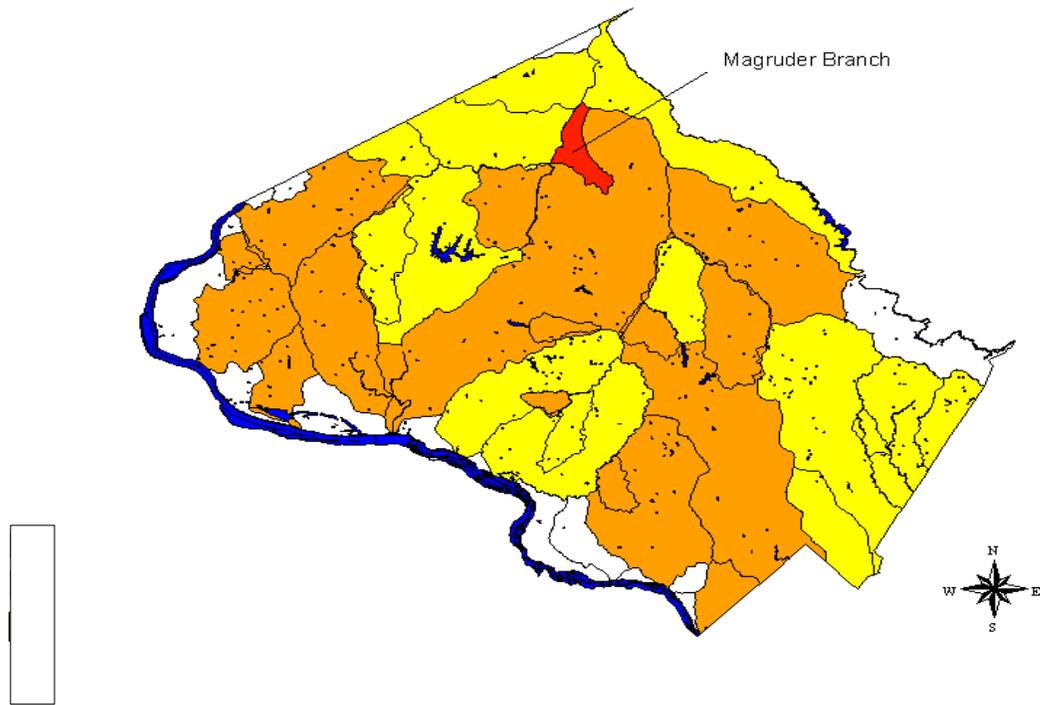


Figure 33. Results of 1998 Synoptic Nutrient Monitoring. Orthophosphate concentrations in County watersheds.

- $PO_4 > 0.12 \text{ mg/l}$
- $PO_4 \text{ between } 0.02 \text{ mg/l and } 0.12 \text{ mg/l}$
- $PO_4 \text{ below the detection limit (} 0.02 \text{ mg/l)}$
- $\text{No sample collected}$

***Stream reaches with unstable habitat features that, if left alone, could further degrade the biological community of the stream***

The following Great Seneca Creek subwatersheds have been listed as priority subwatersheds by the Countywide Stream Protection Strategy;

- Magruder Branch- Priority Watershed Restoration Area
- Wildcat Branch- Priority Watershed Protection Area- Special Level
- Goshen Branch- Priority Watershed Protection Area- Remedial Level

Channel instability was identified in these subwatersheds that, if not addressed promptly, could cause further degradation to stream habitat and supportable biological resources. These findings are consistent with the observations made during this current monitoring study. All three subwatersheds are in the Upper Great Seneca Creek watershed.

This report recommends the addition of the Hooker Branch (currently within the Lower Great Seneca subwatershed) and the Quince Orchard (currently within the Lower Long Draught subwatershed) as new CSPA subwatersheds and new priority subwatershed.

Monitoring data from Hooker Branch demonstrates that, in 1998, both the benthic macroinvertebrate and fish communities were among the highest quality communities in the Great Seneca watershed. However, examination of the visual habitat assessment performed at the Hooker Branch station indicates that bank stability, bank vegetation cover, and riparian buffer are marginal and indicate areas of channel instability. Quantitative habitat measurements also support these observations with the channel at station GSHB-202 being entrenched and beginning to be over widened. This subwatershed should be placed in the Watershed Protection, (Special and Remedial Management) category.

In contrast, the Quince Orchard Tributary had a benthic macroinvertebrate and fish community that received a fair IBI score. The channel is entrenched with unstable habitat features. Both stations within this tributary (GSL-111 and GSL-205) are recommended for followup field investigations for observed flow related impacts. This subwatershed should be placed in the Watershed Restoration Management Category and considered for designation as a priority subwatershed.

***Recommendations for follow up actions concerning the identified areas of impaired stream reaches.***

The four stream reaches identified as possibly having impairment from water quality stressors are recommended to be investigated by a DEP team consisting of a biologist and an inspector. Where the drainage area contributing to the reach stream extends into a municipality, the inspection needs to be coordinated with that municipality. Priority should be to identify any possible illicit discharges occurring in these areas and correct them.

The six reaches and one stream area identified as being impaired from having possible nutrient enrichment will be monitored during the next synoptic nutrient sampling event.

Those stream reaches identified as having impairment from altered flows and related stressors will be submitted to the stream restoration staff for prioritization.

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