Management Unit 1

Greene County - Town of Hunter

NYS DEC Forest Preserve to Notch Inn Bridge

Management Unit Description

This management unit begins on NYS DEC forest preserve land, approximately one mile downstream from Notch Lake, and continues approximately 2,197 ft. to the bridge at Notch Inn. The drainage area ranges from 1.9 mi^2 at the top of the management unit to 2.2 mi^2 at the bottom of the unit. The valley slope is fairly steep at 2.9% and stream water surface slope is 3.2%.

Generally, stream conditions in this management unit are fairly stable and healthy, particularly in the upper reaches. *Incision* is not a significant concern in this unit due to bedrock and bridge sill grade control in the unit. *Lateral stability* is fairly good throughout the unit due to healthy *riparian* vegetation and *revetment*. Management efforts here should focus on preserving the integrity of these reaches. Isolated incidences of erosion can be addressed with vegetated bank treatments, and possibly riparian zone plantings. Replacement or maintenance of bridges in the unit should be designed to accommodate the *morphological* and sediment transport requirements of the unit. GCSWCD will provide technical assistance for bridge replacement and maintenance in the unit. Habitat quality is generally very good, although segmented by migration barriers.

Summary of Recommendations Management Unit 1	
Intervention Level	Preservation/Assisted Self-Recovery
Stream Morphology	Bioengineered treatment of erosion behind garage upstream of bridge Bioengineered treatment of eroding banks at Notch Inn Breach berm
Riparian Vegetation	Riparian plantings of treated banks at Notch Inn
Infrastructure	Geomorphically appropriate bridge replacement design Low-disturbance bridge and road maintenance Repair of road embankment at top of unit
Aquatic Habitat	Preservation of healthy riparian vegetation and canopy cover
Flood Related Threats	None
Water Quality	None
Further Assessment	Ongoing monitoring of bank erosion monitoring site #1

Historic Conditions

In this section of the Stony Clove, the stream parallels State Route 214 very closely through the narrow valley. Colonel Edwards built a road through the Stony Clove notch for hauling hemlock bark to his tannery in Hunter sometime between 1846[i] and 1856, and bark supply roads ran up the western flank of Plateau and the eastern flank of Hunter Mountains. Bark peeling probably dominated the landuse on these hillsides during the middle half of the nineteenth century. In 1893, a forest fire, probably ignited by a cinder thrown by a train, burned approximately 3,000 acres of the northwestern slope of Plateau Mountain. The Fenwick and Slawson lumber companies logged the adjacent hillslopes between 1903 and 1917.

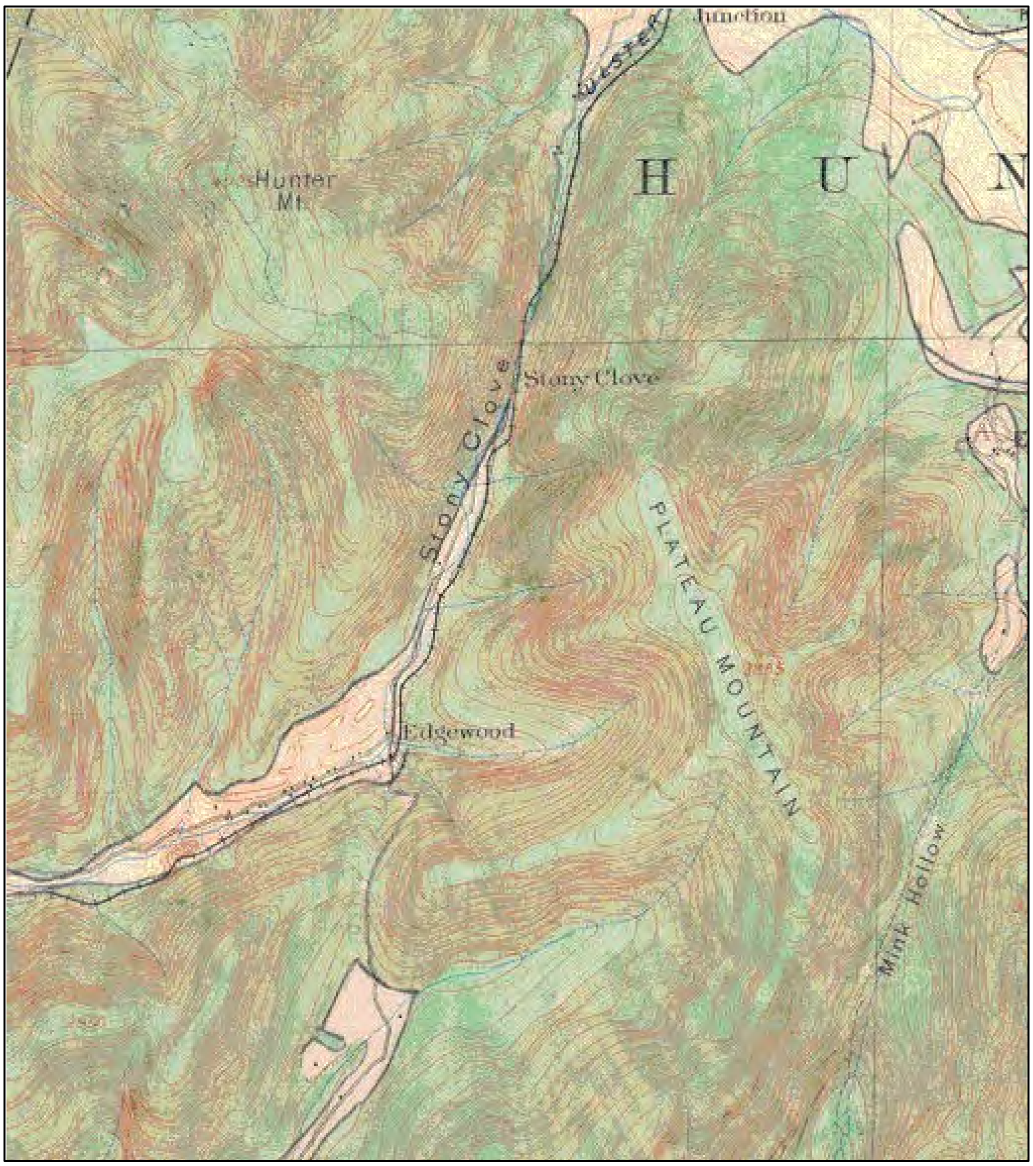


Figure 2 Excerpt of 1903 USGS topographic map

Erosion likely followed the fire, and in addition to erosion from logging operations, delivered a heavy sediment load to the Stony Clove from gullied out tributaries coming off the steep barren slopes. Pasturing on the hillslopes was likely minimal in this area, and confined primarily to the floodplain and road corridor (Kudish 2000).

Colonel Edwards' bark hauling road was improved into the Stony Clove Turnpike in 1873, and the Stony Clove and Catskill Mountain branch of the Ulster and Delaware railroad was completed in 1883. The railroad was upgraded from narrow to standard gauge in 1899, and continued operation until the late 1930s. The Notch Inn was built at the Edgewood station, accommodating tourists and recreational use of local natural resources.

The photograph of the highway somewhere in the vicinity of Edgewood would suggest that maintenance of NYS Route 214 (and perhaps of the railroad bed as well in places) would have involved a recurrent struggle with erosion of the toe of the embankments by the stream during floods, as it still does (Fig. 4). The absence of large trees illustrates the extent of deforestation in the valley. Stacked rock walls were frequently used for bridge abutments and stream bank revetment (Fig. 3).

Historical stream channel alignments are not available for this management unit. This management unit is located at the top of the watershed where the stream is smaller and covered by tree canopy, making the channel difficult to distinguish on aerial photographs. According to available NYS DEC records there have been no stream disturbance permits issued in this management unit.

Figure 3 (above) The Notch Inn, ca. 1920s
Note that NYS Route 214 runs between the inn and the creek. This roadbed is still discernible behind the inn.

Figure 4 (right) NYS Route 214, near Edgewood

Both images courtesy of the Gale Collection.

Stream Channel and Floodplain Current Conditions

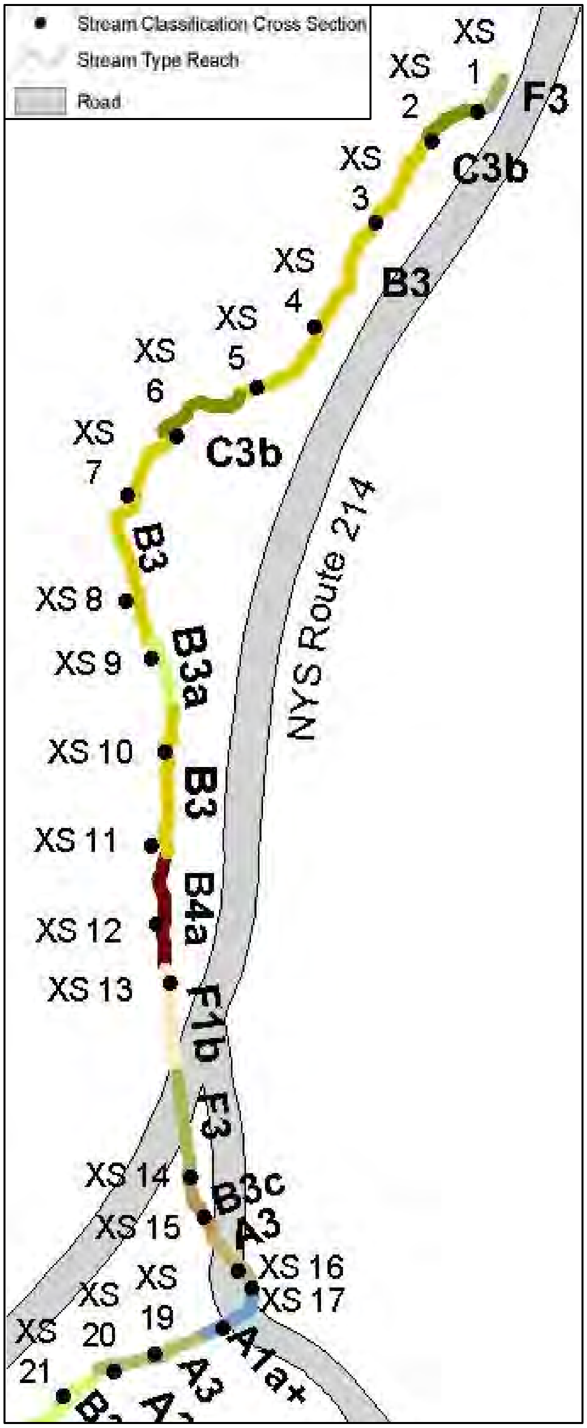


Figure 5 Cross-sections and Rosgen stream types in Management Unit 1

Revetment, Berms and Erosion

The 2001 stream feature inventory revealed that 2% (71ft.) of the stream banks exhibited signs of active erosion along 2,197 ft. of total channel length (Fig. 1). Revetment has been installed on 1% (60 ft.) of the stream banks. A berm is present on 3% (146 ft.) of the stream banks.

Stream Morphology

The following description of stream morphology references insets in foldout Figure 16. “Left” and “right” references are oriented looking downstream, photos are also oriented looking downstream unless otherwise noted. Italicized terms are defined in the glossary. This characterization is the result of a survey conducted in 2001.

Stream morphology, or shape (i.e., slope, width and depth) changes frequently in this unit (Fig. 5), creating small reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.1 for stream type descriptions).

The grade of the stream through this unit is controlled by the sill under the NYS Route 214 bridge and bedrock beds just downstream. The unit is laterally controlled for much of its length by the base of Hunter Mountain to the west and the highway to the east. Reaches upstream of the NYS Route 214 crossing are generally less confined by the valley form, while confinement increases significantly downstream of the bridge.

Management unit #1 begins approximately one mile downstream from Notch Lake, at the headwaters of the Stony Clove Creek. The first 600 ft. of inventoried stream is located on NYS DEC Catskill Forest Preserve and is designated as forever wild.

This management unit starts with a short 80 ft. reach of F3 stream (Fig. 6). This reach is dominated by small cobble bed material and is *entrenched*, or confined within its banks during flood events. This entrenchment is partially due to the 146 ft. cobble *berm* constructed on the right bank (Inset C). This old berm may once have protected a pasture or residence from flooding but presently the land use is forested. This berm prevents flood waters from spilling into the floodplain. As a result flood velocity is increased, which has caused moderate stream *degradation*, and which is destabilizing the adjacent road embankment. The berm, however, has become vegetated with fairly mature woody vegetation, the benefits of which probably outweigh those of complete removal. Therefore, it is recommended that the berm be breached in strategic locations to provide floodplain access for stormwaters while preserving mature trees. The embankment could then be repaired using *bioengineering* techniques.

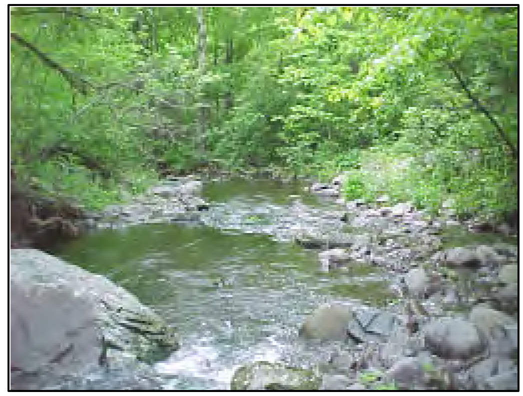


Figure 6 Cross-section 1
Stream Type F3

A small stormwater culvert, draining an area on the east side of NYS Route 214, outfalls from the left bank near the top of the reach (Inset G). The culvert outlet is vegetated with grass, is set back from the active stream channel, and enters the stream at a low angle. All these culvert conditions reduce the risk of erosion from stormwater runoff.

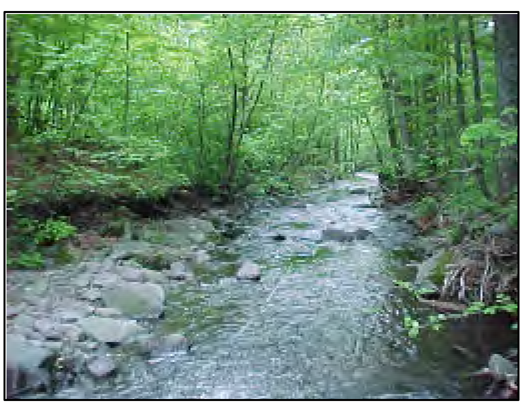


Figure 7 Cross-section 2
Stream Type C3b

At the end of the berm, channel entrenchment decreases significantly and the stream is reconnected with its floodplain for the next 90 ft. of C3b stream (Fig. 7). The channel slope increases to 3.7% and the bed material is dominated by cobble.

Proceeding downstream, the stream becomes moderately entrenched for the next 484 ft. as stream type transitions into B3 (Fig. 8). As the stream *meanders* to the right at the end of the reach, there is a 30 ft. long stacked rock wall on the left bank. Due to its low height, this wall does not

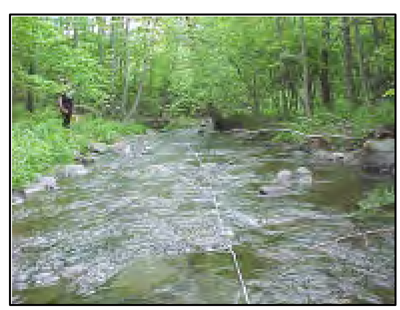


Figure 8 Cross-section 4
Stream Type B3

significantly impact the stream channel. A small tributary from the right bank enters Stony Clove Creek just downstream of the stacked rock wall. This tributary is not classified under the NYS DEC best usage classification system.

Figure 9 Cross-section 6
Stream Type C3b

Once again, channel entrenchment decreases and the stream reconnects with its floodplain over the next 151 ft. of C3b stream (Fig. 9). The channel slope is fairly steep at 2.9% with small cobble bed material. At the end of this reach another small tributary enters from the right bank. This tributary is not classified under the NYS DEC best usage classification system.

Figure 10 Cross-section 10
Stream Type B3

The next 843 ft. of stream alternates between B3 and B3a and is moderately entrenched, still allowing the stream limited access to its floodplain (Fig. 10). This reach is steep, with slopes ranging from 3.6% to 4.7%. This long reach of stream is stable with cobble bed material until the last 173 ft. where the bed material decreases to large gravel. This decrease is bed material size may be an indication of sediment transport limitations caused by *backwatering* at the downstream bridge. A garage has been built on the right stream bank just upstream from the bridge. There is some evidence of minor erosion on the bank behind the garage, which could be treated with bioengineering techniques.

Figure 11 Cross-section 13
Stream Type F1b

As the stream approaches the NYS Route 214 crossing, stream type changes to F1b (Fig. 11 & Inset B). This 156 ft. reach of stream becomes entrenched just before it passes under the road through NYS Bridge #1041280. This bridge, built in 1948, is maintained by NYS DOT. The bed material in this reach is dominated by the concrete bed through the box culvert.

As the stream emerges from underneath the bridge, it immediately drops from the concrete channel creating a deep pool in the natural streambed (Inset B looking upstream). The next 173 ft. of F3 stream type becomes highly entrenched, slope dramatically decreases to 0.8% and streambed material changes to cobble.

Bank erosion monitoring site #1 is located approximately 120 ft. downstream of the bridge, on the left stream bank (Inset F). This 71 ft. long site has a 10 ft. high undercut bank but is vegetated with trees at the top of bank. The bank at this site is vulnerable to erosion during high flow events due to its entrenchment. According to Rubin's (1996) stream corridor geology map, the stream throughout most of this reach is cut through unconsolidated deposits (See Section 2.4, Geology of the Stony Clove Creek, for a description of these deposits).

The Bank Erodibility Hazard Index *(BEHI*) score is ranked "Moderate", the third lowest prioritization category in terms of its vulnerability to erosion. This erosion site is the lowest priority in the watershed due to its small size (702 ft^2), and lack of infrastructure or water quality threats. Bioengineering stabilization treatments would likely be effective in this setting.

Figure 12 Cross-section 15 Stream Type B3c

Continuing downstream, stream type changes to B3c, for a short 73 ft. reach (Fig. 12). This moderately entrenched reach remains fairly flat with a 0.8% slope and the streambed material remains cobble. There is a 71 ft. stacked rock wall along the right bank to protect the Notch Inn dirt access road (Inset E).

As the stream flows toward another bridge (Inset A), it again becomes narrower and entrenched as stream type transitions into A3 for the next 116 feet. The slope increases dramatically to 5.7% and bed material remains cobble. When NYS Route 214 was built it originally crossed this bridge; since then the highway has been relocated northwest to its present location. This bridge was formerly maintained by the Town of Hunter but given that Notch Inn Road was rerouted by the town in 2003 and no longer crosses this bridge, the town will no longer assume maintenance responsibilities. A gate will be installed in 2004 to limit access across the span to just the owner of the Notch Inn.

Figure 13 Stream Type A1a+

In the last 31 ft. of stream of this management unit, the stream turns sharply to the right and stream type changes to A1a+ (Fig. 13). The stream remains entrenched but bed material changes to bedrock and slope increases. As management unit #1 ends, the stream passes under a third bridge (Inset D). This bridge, also maintained by the Town of Hunter, is no longer necessary due to the rerouting of Notch Inn Road. The bridge span is scheduled for removal in 2004.

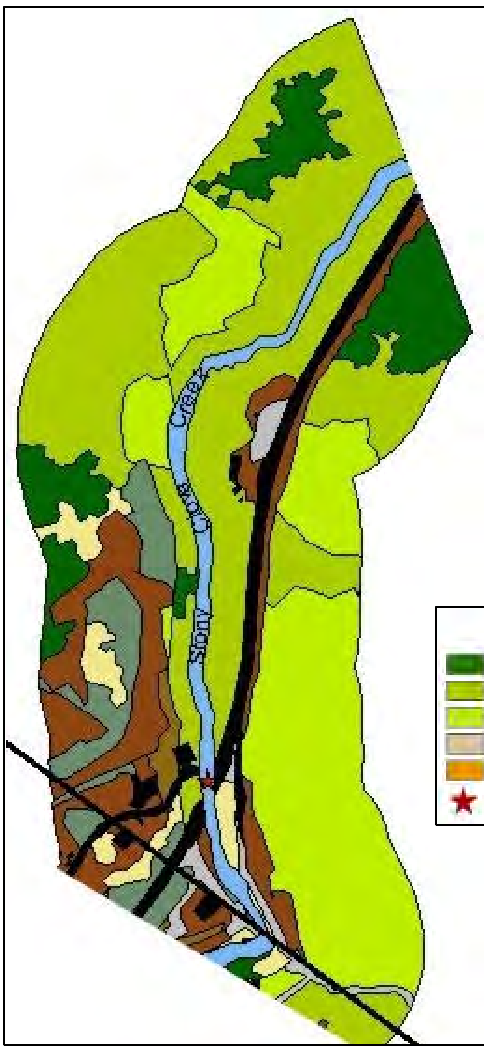
Sediment Transport

Streams move sediment as well as water. Channel and floodplain conditions determine whether the reach aggrades, degrades, or remains in balance over time. If more sediment enters than leaves, the reach aggrades. If more leaves than enters, the stream degrades (See Section 3.1 for more details on Stream Processes).

Sediment transport function through this management unit appears to be in balance; there is no indication of significant aggradation or degradation, with the possible exception of the reach upstream of the NYS Route 214 bridge, as noted above.

Riparian Vegetation

One of the most cost-effective methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the bank, especially within the first 30 to 50 ft. of the stream. A dense mat of roots under trees and shrubs bind the soil together, and makes it much less susceptible to erosion under flood flows. Grass does not provide adequate erosion protection on stream banks because it has a very shallow rooting system. Interplanting with native trees and shrubs can significantly increase the working life of existing rock rip-rap placed on streambanks for erosion protection. *Riparian*, or streamside, forest can buffer and filter contaminants coming from upland sources or overbank flows. Riparian plantings can include a great variety of flowering trees and shrubs native to the Catskills. Native species are adapted to regional climate and soil conditions and typically require little maintenance following installation and establishment.



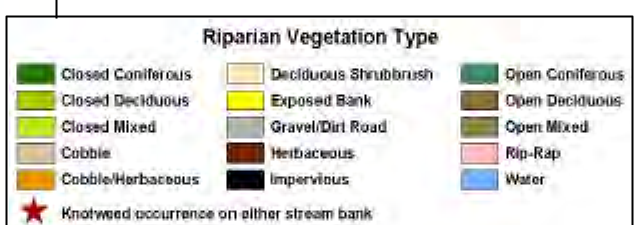


Figure 14 Riparian vegetation map for Management Unit 1

Plant species that are not native can create difficulties for stream management, particularly if they are invasive. Japanese knotweed (*Polygonum cuspidatum*), for example, has become a widespread problem in recent years. Knotweed shades out other species with it's dense canopy structure (many large, overlapping leaves), but stands are sparse at ground level, with much bare space between narrow stems, and without adequate root structure to hold the soil of streambanks. The result can include rapid streambank erosion and increased surface runoff impacts.

An analysis of vegetation was conducted using aerial photography from 2001 and field inventories (Fig. 14, Appendix A). Japanese knotweed occurrences were documented as part of the MesoHABSIM aquatic habitat inventory conducted during the summer of 2002 (Appendix B).

The predominant vegetation type within the 300 ft. buffer in this management unit is forested (80%) followed by herbaceous (11%). Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with planting of more flood-resistant species. *Impervious* area (4%) within this unit's buffer is primarily the NYS Route 214 roadway. Although approximately 515 ft. of this roadway is within 50ft. of the stream, there is a forested buffer along the stream which reduces the impacts of road runoff.

In June 2003, suitable riparian improvement planting sites were identified through a watershed-wide field evaluation of current riparian buffer conditions and existing stream channel morphology. These locations indicate where plantings of trees and shrubs on and near stream banks can help reduce the threat of serious bank erosion, and can help improve aquatic habitat as well. In some cases, eligible locations include stream banks where rock rip-rap has already been placed, but where additional plantings could significantly improve stream channel stability in the long-term, as well as biological integrity of the stream and floodplain. Areas with serious erosion problems where the stream channel requires extensive reconstruction to restore long-term stability have been eliminated from this effort. In most cases, these sites can not be effectively treated with riparian enhancement alone, and full restoration efforts would include re-vegetation components. No appropriate planting sites were documented within this management unit.

While excluded from the Streamside Planting Program described above due to the need to first treat the bank erosion problem, bioengineering treatments of eroding banks between the bridges adjacent to the Notch Inn are recommended. This treatment could include additional plantings in the riparian zone to improve buffer function and erosion resistance.

Flood Threats

Inundation

As part of its National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) performs hydrologic and hydraulic studies to produce Flood Insurance Rate Maps (FIRM), which identify flood-prone areas. The initial identification for these maps was completed in 1976. Some areas of these maps may contain errors due to stream channel migration or infrastructure changes over time.

There are no floodplain maps available for this management unit, but the existing structures in this unit appear to be situated out of the estimated 100-year floodplain.

To address the dated NFIP maps, the NYS DEC Bureau of Flood Protection is currently developing floodplain maps, using a new methodology called Light Detection And Ranging (LIDAR). LIDAR produces extremely detailed and accurate maps, which will indicate the depth of water across the floodplain under 100-year and other flood conditions. These maps should be completed for the Stony Clove Watershed in 2004.

The current NFIP maps are available for review at the Greene and Ulster County Soil & Water Conservation District offices.

Bank Erosion

The majority of stream banks within the management unit are stable. The single stream bank experiencing erosion, located between the NYS Route 214 bridge and the first town bridge, is vulnerable to erosion because the stream is entrenched. Stream entrenchment prevents high flows from spilling into the floodplain, resulting in higher velocity of in-channel flood waters and erosion. This reach is capable of conveying *bankfull* flows without exacerbating erosion, but flows exceeding bankfull stage may continue destabilizing erosion trends noted in the reach.

Infrastructure

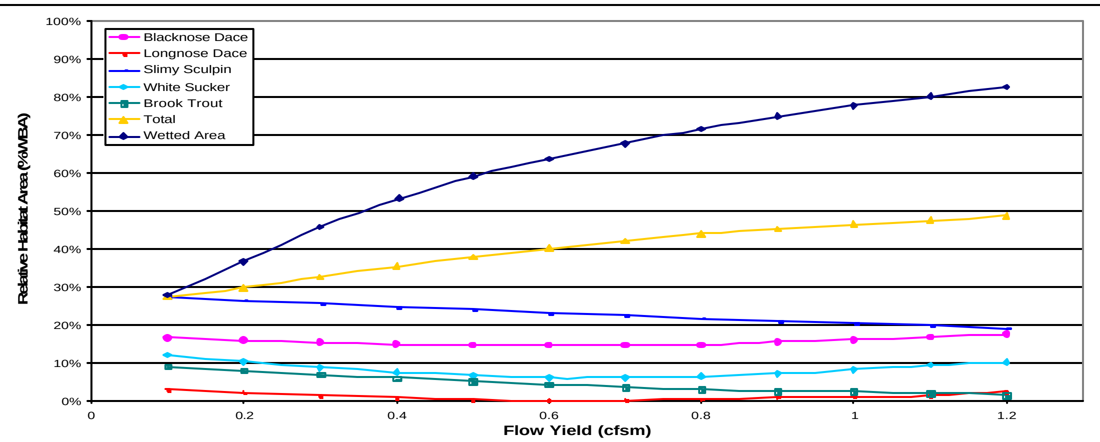
Although approximately 515 ft. of this roadway is within 50ft. of the stream, there are no apparent flood threats to this roadway. The road embankment at the first reach of the unit is threatened to some degree by degradation. All three bridges in this management unit show evidence of backwatering at high flows. The two bridges furthest downstream should be evaluated for replacement or removal. When scheduled for replacement, the NYS Route 214 bridge should be sized to eliminate backwater effects through at least bankfull stage.

<u>Aquatic Habitat</u>

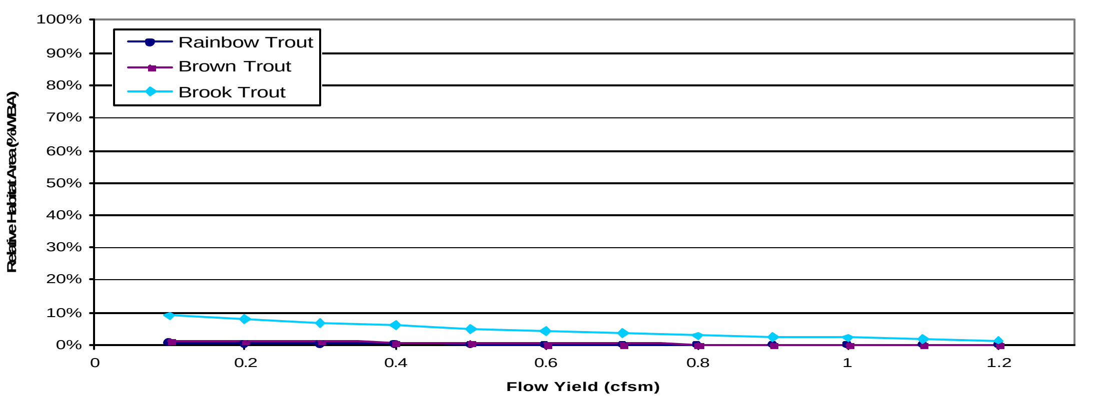
Aquatic habitat was analyzed for each management unit using Cornell University Instream Habitat Program's model called MesoHABSIM. This approach attempts to characterize the suitability of instream habitat for a *target community* of native fish, at the scale of individual stream features (the "meso" scale), such as riffles and pools. Habitat is mapped at this scale for a range of flows. Then the suitability of each type of habitat, for each species in the target community, is assessed through electrofishing. These are combined to predict the amount of habitat available in the management unit as a whole. The habitat rating curves in the figure below depict the amount of suitable habitat available at different flows. See Appendix B for a more detailed explanation of methods.

Management unit #1 is dominated by riffles and rapids and is shallow with relatively fast, diverse flow velocities. At very low flows, the *wetted area* is only a third of bankfull wetted area, but then increases steadily with flow to almost bankfull. At the lowest flow, almost the entire wetted area is suitable for the target community. Suitable area then declines with increasing flows to a little over half.

Slimy sculpin habitat fills the entire wetted area at 0.1 cfsm and then declines slowly with increasing flow. Blacknose dace habitat is about half as large as slimy sculpin habitat for low flows, but then increases toward the same level as slimy sculpin at higher flow. White sucker follow the same trend as blacknose dace, with a minimum around 0.5 cfsm. Brook trout habitat steadily declines with increasing flows and longnose dace has barely any habitat. Overall, habitat conditions are relatively stable. Of all investigated species, brook trout has the greatest disadvantage; it is one of the largest and most mobile species and also has very low levels of suitable habitat present, which decline with flow. Even at very low flows that could provide more habitat, rising water temperature poses serious limitations for brook trout. Interestingly, brown and rainbow trout do not have much prime habitat (p>50%), but the amount of low quality habitat (p= 20%-50%) is still substantial. (See general recommendations for fish habitat improvement in Section 6.6)



Rating curve for relative habitat area versus flow for Management Unit 1



Rating curve for trout relative habitat area versus flow for Management Unit 1

Figure 15 MesoHABSIM habitat rating curves for Management Unit 1

Potential migration barriers occur at hydraulic jumps (waterfalls and bridge culvert outfalls) in the management unit at lower flows, potentially segmenting fish habitat. Generally good riparian conditions provide canopy cover to the reach, moderating temperatures during summer low flows.

Water Quality

Clay exposures and sediment from stream bank and channel erosion pose a significant threat to water quality in Stony Clove Creek. Clay and sediment inputs into a stream may increase *turbidity* and act as a carrier for other pollutants and pathogens. The absence of glacial lake silts/clays and/or clay-rich lodgement till means this unit is not likely to contribute significantly to suspended sediment loading.

Stormwater runoff can also have a considerable impact on water quality. When it rains, water falls on roadways and flows untreated directly into Stony Clove Creek. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly impact water quality. There is one stormwater culvert in this management unit, which drains some road runoff. Possible contamination from road runoff is most likely buffered by the length of well-vegetated swale between the outfall and the active stream channel.

Nutrient loading from failing septic systems is another potential source of water pollution. Leaking septic systems can contaminate water making it unhealthy for swimming or wading. Unlike downstream sections of the Stony Clove Creek, there are not many houses located in close proximity to the stream channel in this management unit. Homeowners who do reside along the stream should inspect their septic systems annually to make sure they are functioning properly. Each household should be on a regular septic service schedule to prevent the over-accumulation of solids in their system. Servicing frequency varies per household and is determined by the following factors: household size, tank size, and presence of a garbage disposal. Pumping the septic system out every three to five years is recommended for a three-bedroom house with a 1,000-gallon tank; smaller tanks should be pumped more often.

The New York City Watershed Memorandum of Agreement (MOA) allocated 13.6 million dollars for residential septic system repair and replacement in the West-of-Hudson Watershed through 2002. Eligible systems included those that were less than 1,000-gallon capacity serving one- or two-family residences, or home and business combinations (CWC, 2003). No homeowners in this management unit made use of this program to replace or repair their septic system.

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[1] The earlier dated is based on the fact that no road is shown in Mitchell's 1946 *New Map of New York*. However, this map purported to depict stage lines, and the bark road was likely not improved for passenger service until perhaps several decades later.