Management Unit 21

Ulster County - Town of Shandaken

Cross Section 189 to confluence with Esopus Creek

Management Unit Description

This management unit begins at cross section 189, continuing approximately 4,619 ft. to the confluence with the Esopus Creek. The drainage area ranges from 31.9 mi^2 at the top of the management unit to 32.3 mi^2 at the bottom of the unit. The valley slope is 1.7% and stream water surface slope is 1.4%.

Despite the heavy impacts of channel and infrastructure management, conditions in this management unit are relatively stable. Recovery trends are noted here, and management efforts should focus on accelerating these processes with vegetative treatments and bioengineered bank stabilization.

Summary of Recommendations Management Unit 21	
Intervention Level	Assisted Self-Recovery
Stream Morphology	Encourage narrowing and deepening of channel through plantings at identified site (PS #59) Install bioengineered treatment at bank erosion site
Riparian Buffers	Riparian plantings at four identified sites (PS #56-59)
Infrastructure	None
Aquatic Habitat	Enhance overhead cover by joint planting rip-rap at identified planting site (PS #59)
Flood Related Threats	Resurvey National Flood Insurance Program (NFIP) maps to more accurately reflect the active stream channel
Water Quality	Improve vegetative buffer function
Further Assessment	Evaluate stormwater treatment options

Historic Conditions

As the glaciers retreated about 12,000 years ago, they left their "tracks' in the Catskills. Rubin (1996) mapped the presence of lodgement till between cross-sections 192 and 197, however, the consolidated clay-rich deposit was not observed in the steam banks or bed during the watershed assessment (See Section 2.4, Geology of the Stony Clove Creek, for a description of these deposits). Stream channels incised into lodgement till tend to have unstable stream banks that are often over-steepened and fail by episodic mass wasting.

Figure 2 Flood of 1980, along NYS Route 214 in Phoenicia Courtesy of the Gale Collection

In the time since the most recent glacial retreat, the Stony Clove Creek has seen over a hundred "100-yr" floods, and perhaps ten "1000-yr" floods (Fig. 2). These very large floods would have eroded tremendous volumes of soil and rock from the surrounding mountainsides, which then would have been deposited at the mouth of the creek, creating the flats on which the Village of Phoenicia is built (Fig. 3).

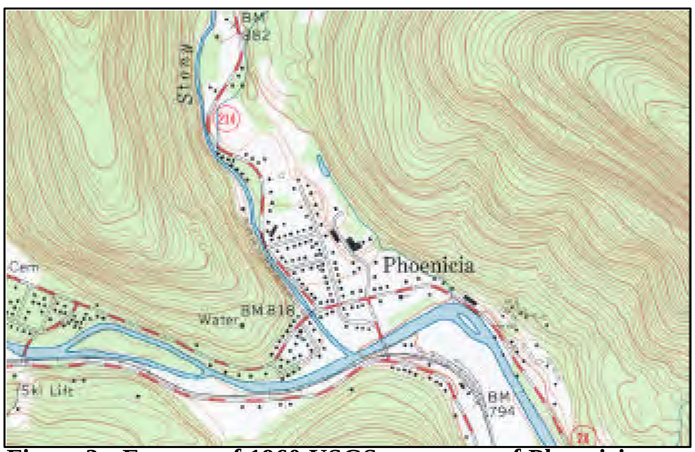


Figure 3 Excerpt of 1960 USGS topo map of Phoenicia, showing the depositional flats created at the confluence of the Stony Clove and Esopus Creeks

As seen from the historical stream alignments, the channel has not displayed significant lateral migration since 1959 (Fig. 4).

Figure 4 Historic stream alignments in Management Unit 21

According to available NYS DEC records, there have been ten stream disturbance permits issued in this management unit. Two emergency permits were issued after the 1987 flood, one to Greg Meister and the other to Kyla Marion. Details of the permitted work are not documented.

Figure 5 Erosion at Cardillo Property August 2, 1996

After the 1996 flood many permits were issued for work in the unit. An emergency permit was issued to Randy Ostrander to repair an existing ford across the stream by grading stream banks and moving stream rocks. In 1997, another permit was issued at this location to repair the existing ford across the creek. Kyla Marion was issued a permit for the repair of an existing 75 ft. long rock retaining wall and to place large rocks in front of this retaining wall. Thomas Comito was issued a permit to replace the rip-rap along the base of his 60 ft. long retaining wall. Jack Cardillo was issued a permit for the replacement of rip-rap along the base of his 40 ft. long retaining wall (Fig. 5). Alice & Michael Halkias applied for, but were not granted, a permit for the reconstruction of their retaining wall, and for recovery of rip-rap dislodged during the flood, to force the channel back to its pre-flood course.

In 1992, the NYS Department of Transportation (DOT) was issued a permit to upgrade the Phoenicia Bridge with a pile foundation and clear-span superstructure, eliminating the center pier used in the former bridge (Fig. 6). Heavy stone fill was used for abutment scour protection. Approximately 20 ft. of a failed stone retaining wall was also replaced.

Figure 6 Old Phoenicia Bridge

After the 1996 flood, an emergency permit was issued to the Town of Shandaken to install 400ft. of rip-rap along the left stream bank at the Simpson Mini Park and to remove a 350 ft. gravel bar.

Stream Channel and Floodplain Current Conditions

Revetment, Berms and Erosion

The 2001 stream feature inventory revealed that 1% (92 ft.) of the stream banks exhibited signs of active erosion along 4,619 ft. of total channel length (Fig. 1). Revetment has been installed on 22% (2,045 ft.) of the stream banks. No berms were identified in this management unit at the time of the stream feature inventory.

Stream Morphology

The following description of stream morphology references insets in the foldout Figure 31. "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. 7), creating reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.1 for stream type descriptions).

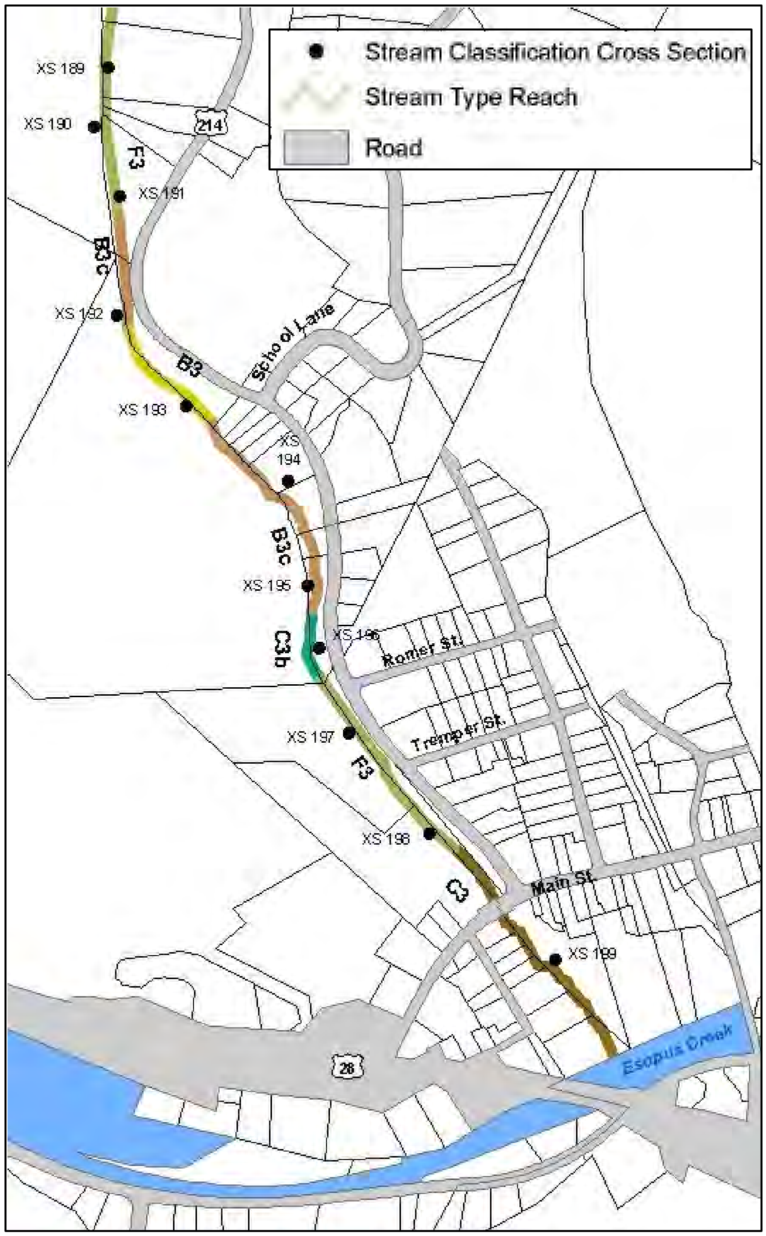


Figure 7 Cross-sections and Rosgen stream types in Management Unit 21

The morphology in this management unit is significantly impacted by valley form and encroachment from highway and residential development, with apparent meander truncation, extensive bank revetment and inadequate riparian vegetation. Historical infrastructure management has left the channel overwidened and aggradational throughout much of the unit. The morphological conditions at the alluvial fan created by the joining of the Stony Clove and Esopus Creek valleys are subordinated by short-term channel responses to management and the influences of adjacent land uses.

Management unit #21 begins with a 621 ft. reach of F3 stream type (Inset D). This reach is *entrenched*, or confined within the stream banks during high flow events. Channel slope drops from 1.8% at the top of the reach to 0.9% at the downstream end. Bed material is dominated by cobble.

Proceeding downstream, the floodplain becomes pinched between NYS Route 214 on the left stream bank and the valley wall on the right stream bank. This 449 ft. reach of B3c stream is moderately entrenched with a slope of 1.4%. Although the dominant bed material is still cobble, boulders are abundant in the reach.

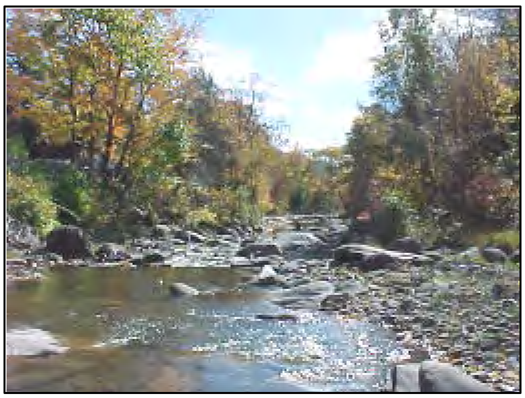


Figure 8 Cross-section 193
Stream Type B3 looking upstream

As channel slope steepens to 2.3%, stream type transitions to B3 for the next 513 ft. (Fig. 8). Beginning at the top of this reach, the stream flows away from NYS Route 214. The left floodplain has been developed with residences immediately adjacent to a steep stream bank, requiring extensive revetment. A 406 ft. long stacked rock wall stabilizes the left stream bank at the top of this reach (Fig. 9).

Figure 9 Stacked Rock Wall

At the downstream end of this wall, a second stacked wall begins. This wall is approximately 317 ft. in length (Inset H) with a stormwater culvert outfall at its base (Fig. 10). This culvert drains the grounds around the elementary school and its parking area.

Figure 10 Culvert

The culvert outfall is lined with large rocks, reducing the risk of erosion from stormwater.

As channel slope decreases, stream type changes back to B3c for the next 904 ft. (Fig. 11). The upstream portion of this reach has a wide channel with an extremely flat slope of 0.4%, while the lower portion of the reach narrows and steepens to 1.7%. Dominant channel material becomes considerably finer, but remains cobble. Downstream of where the stacked rock wall (Inset H) along the left bank ends, rip-rap (Inset C) has been installed on the bank.

Figure 11 Cross-section 194
Stream Type B4c

Figure 12 Hanging culvert on back-channel

On the right stream bank there is a back-channel that still carries flood flows. Although not documented in the historical photography, heavy erosion on the right stream bank of the abandoned channel suggests that it may have carried the main flow of the Stony Clove Creek in the past. A stormwater culvert projects from the right stream bank of this back-channel (Fig. 12). This culvert is presumed to have been installed approximately flush with the stream bank.

At the downstream end of the B3c reach, NYS Route 214 bends toward the creek, narrowing the left floodplain once again.

As the channel reconnects with its floodplain, stream type changes to C3b for a short 289 ft. reach. The channel is only slightly entrenched, with a steeper 2.1% channel slope. Dominant bed material coarsens, but remains cobble.

Downstream of this reach, the stream once again becomes entrenched and the slope decreases to 1.0%. Stream type changes to F3 for this 864 ft. reach (Fig. 13). Gravel has been deposited along the right stream bank. Bar development is common in flat stream reaches because flow velocities are slower and less capable of moving bed load than are steeper reaches. Gravel bars help maintain channel stability during flood events. In stable streams, the bars will erode away while the channel is in flood stage. The bars are then rebuilt as flow decreases, helping the stream

Figure 13 Cross-section 197
Stream Type F3

maintain its stability by reestablishing its pools and riffles. If gravel bars are removed, these processes do not occur and instead, the flood water often dissipates its energy by eroding banks and scouring the stream bed.

Figure 14 Deposition at Cross-section 198 Stream Type F3

At the top of this reach, approximately 304 ft. of rip-rap has been installed along the left stream bank, to protect NYS Route 214 (Inset G). This rip-rap appears to have been in place for a long period of time and is well vegetated, which strengthens and increases its longevity.

This reach becomes overwide and shallow at its downstream end (Fig. 14). Deposition is common in overwide channels because they lose their ability to transport the stream's *bedload*, resulting in *aggradation*, or a rise in stream bed elevation. Overwide channels typically offer poor fish habitat due to warmer water temperatures and filling of deep pools.

Beginning at the upstream end of this overwide section, 94 ft. of rip-rap runs along the left stream bank to protect NYS Route 214 (Inset C). This rip-rap is vegetated, with trees and shrubs on the face, and sedges along the toe of the stream bank (Fig. 15). This vegetation will increase the strength and longevity of this rip-rap.

Just downstream, another 312 ft. of rip-rap have been installed along the left stream bank (Inset F).

Figure 15 Rip-Rap

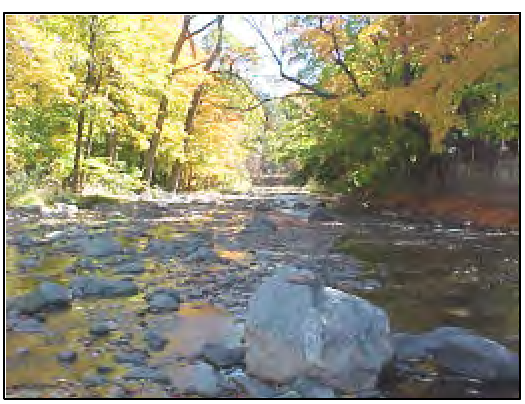


Figure 16 Cross-section 199 Stream Type C3

As the stream approaches the Phoenicia Bridge, the channel begins to narrow and reconnect with its floodplain. Stream type transitions to C3 for the last 979 ft. of this management unit (Fig. 16). Dominant bed material remains cobble and the channel slope increases slightly to 1.2%.

Beginning at the top of this reach the creek is split into two channels by a vegetated mid-channel bar. Most of the stream flow is in the left channel.

On the left stream bank is the Simpson Mini Park, which provides a great spot for visitors to relax on the banks of the Stony Clove Creek. Rip-rap has been installed along the stream bank of this park to protect from bank erosion (Inset B).

A stormwater culvert outfalls at the right stream bank just upstream from the Main Street Bridge. The culvert outfall is lined with large rocks and enters the stream at a low angle. These culvert conditions reduce the risk of erosion from stormwater runoff.

As the stream approaches the Main Street Bridge (Inset E) it remains over-wide and shallow (Fig. 17). This bridge (Bridge #1018780) was last replaced in 1993 and is maintained by the NYS Department of Transportation (NYS DOT).

Figure 17 Main Street Bridge

Bridges often cause stream instability because they constrict stream flow through a narrow area. An undersized bridge opening causes water to back up upstream of the bridge, reducing stream velocity, which results in sediment deposition. In high stage, the floodwater may seek conveyance through alternative paths, forming new channels around the bridge constriction. This bridge has experienced repeated damage during flood events.

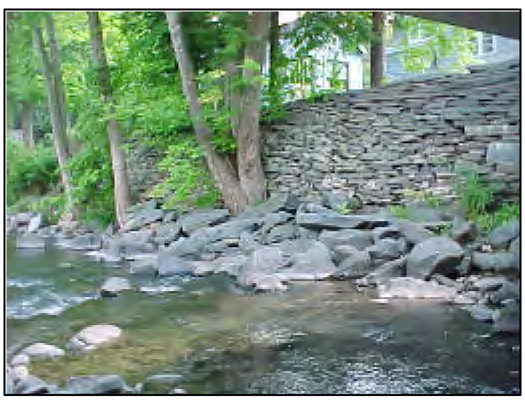


Figure 18 Stacked Rock Wall

As the stream emerges from under the bridge the right stream bank has been stabilized with a 142 ft. stacked rock wall (Fig. 18). The following 148 ft. of stream bank has been stabilized with a high concrete wall and buttressed with gabion baskets at the toe of the wall (Inset A). Several homes are located very close to the edge of this wall.

As the concrete wall ends, the right stream bank has begun to erode, threatening the adjacent home (Fig. 19). Due to the severity of erosion on this bank, it was not identified as an appropriate site for the Streamside Planting Program. More extensive *bioengineering* stabilization treatments would likely be effective in this setting, however.

Figure 19 Erosion on right stream bank

Figure 20 Confluence with Esopus Creek

Proceeding downstream, the Stony Clove Creek confluences with the Esopus Creek, which flows another 8 miles before entering the Ashokan Reservoir (Fig. 20). The Ashokan Reservoir supplies approximately 10% of NYC's drinking water.

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).

The depositional conditions in this unit are consistent with the larger depositional flats at Phoenicia, created at the confluence of the Stony Clove and Esopus Creeks. Historically, large flood flows in the Esopus Creek would have backed up into the Stony Clove valley, causing flows there to slow and deposit sediment load. Extensive channel modification, associated with infrastructure management, has left most of the reaches in this management unit overwide and moderately aggradational. The development of lateral and mid-channel bars supports this interpretation. There are no significant sediment sources in the unit.

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.

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. 21, Appendix A). Japanese knotweed occurrences were documented as part of the MesoHABSIM aquatic habitat inventory conducted during the summer of 2002 (Appendix B).

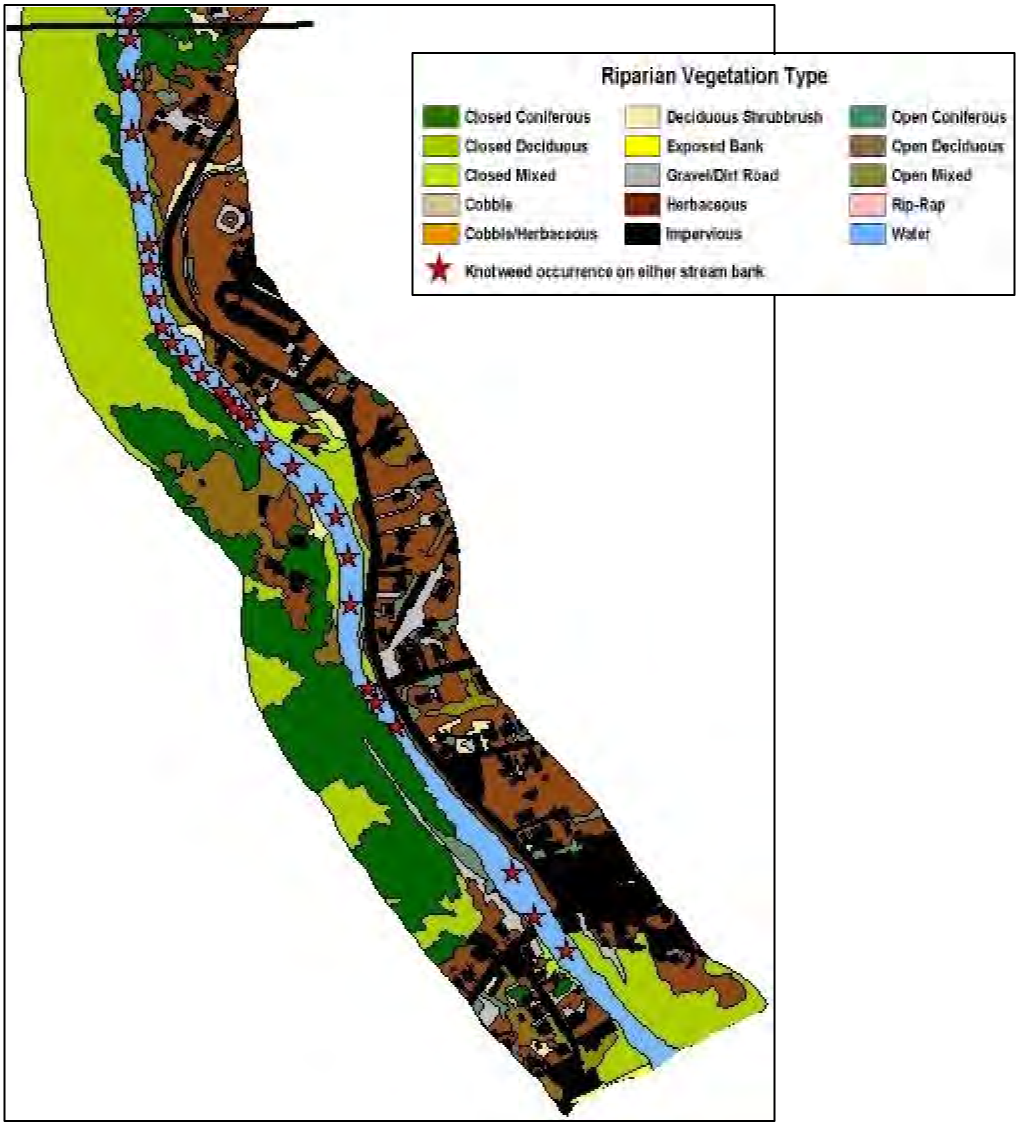


Figure 21 Riparian Vegetation Map for Management Unit 21

The predominant vegetation type within the 300 ft. riparian buffer is forested (53%) followed by herbaceous (24%). Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with plantings of more flood-resistant species. *Impervious* area (17%) within this unit's buffer is primarily the NYS Route 214 along with private residences, commercial properties in Phoenicia and the Phoenicia Elementary School.

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 (Fig. 22). 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. There were four appropriate planting sites documented within this management unit.

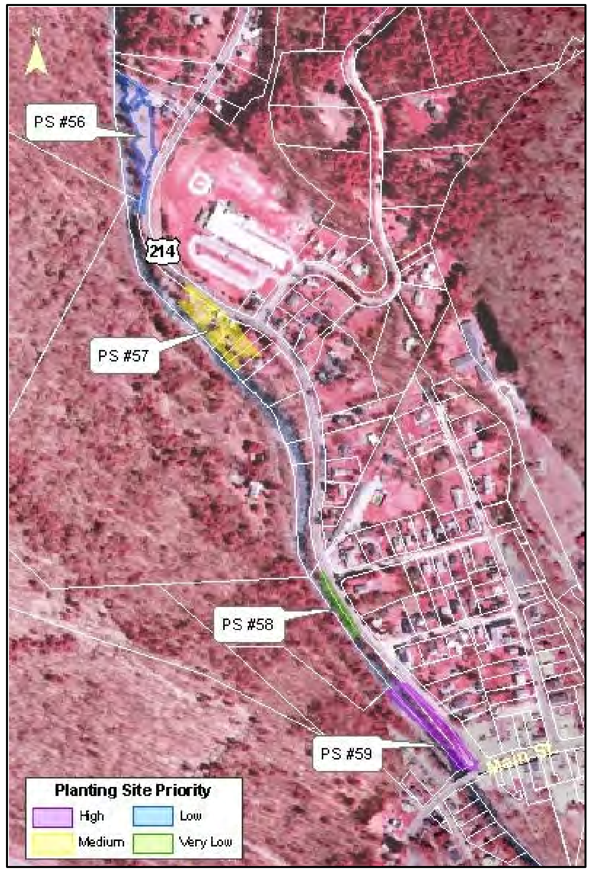


Figure 22 Planting sites location map for Management Unit 21

Figure 23 Planting Site #56

Planting site #56 is located at the residence on the left stream bank at the upstream end of the management unit (Fig. 23). This stream bank has a narrow vegetated buffer and the upland area is mowed lawn.

Native trees and shrubs should be planted in the upland area. Increasing the stream buffer width by at least 20 feet will improve stream bank stability and buffer functionality while still allowing a significant lawn area.

Planting Site #57 is located on five residential properties on the left stream bank (Inset H). The stream bank at this site has been stabilized with a stacked rock wall (Fig. 24). At the top of the bank are lawn areas with several trees and shrubs.

Figure 24 Planting Site #57

Native willow planting along the toe of the stacked rock wall to encourage the development of a low bench is recommended. A well-vegetated bench will reduce flood water velocities near the bank. This site may be difficult to access due to the small residential lot sizes and narrow setbacks between adjacent houses.

Planting site # 58 is located on the left stream bank rip-rap along NYS Route 214 (Inset G). This rip-rap currently has young maple trees and Japanese Knotweed growing through the rocks and sedges along the toe of the stream bank (Fig. 25). Woody debris has also been dumped along this stream bank.

Figure 25 Planting Site #58

While not an example of *joint planting*, the trees growing through this rip-rap area illustrate how vegetation can improve the stability and longevity of revetment. This area should be monitored to ensure the continued success of this vegetation, and augmentation of the existing trees with shrub plantings should be considered.

Removal of the Japanese Knotweed, which is an invasive non-native species, is recommended at this site. Japanese Knotweed does not provide adequate erosion protection because it has a very shallow rooting system.

The practice of dumping yard clippings, including loose brush, on the stream bank is not recommended. This practice can kill existing bank-stabilizing vegetation, inhibit growth of new vegetation and thus contribute to bank instability. As grass clippings and leaves decompose they contribute unnecessary nutrients to the stream, depleting the dissolved oxygen needed by fish and other aquatic organisms.

Planting site #59 is located on the left stream bank at the Simpson Mini Park in Phoenicia (Inset B). This stream bank has been stabilized with rip-rap, and a grass area at the top of the bank is maintained as open space (Fig. 26).

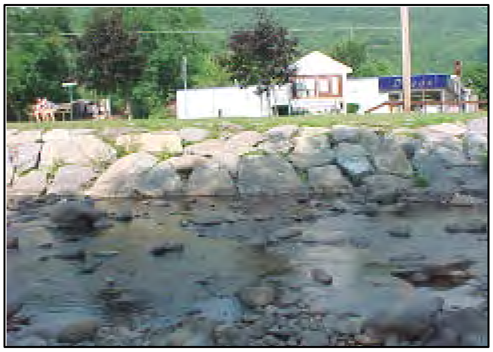


Figure 26 Planting Site #59

This reach of stream is overwide. The development of a vegetated gravel bar on the right side of the stream indicates that the stream is slowly recovering its stable form, but additional plantings of native willows and sedges in the left margin of stream channel will accelerate this recovery. It is also recommended to *joint plant* the existing rip-rap, by inserting plantings into the soil between the rocks. Joint planting will strengthen and increase the longevity of this rip-rap. These plantings will also improve the aquatic habitat by providing shade, resulting in cooler water temperatures. To provide protection against toe erosion, willow *fascines* should be planted along the toe of the stream bank. These planting should be spaced to provide views of the creek.

This site could be used as a demonstration site for streamside planting techniques. Partnerships between local governmental agencies, not-for-profit organizations and community groups should be explored.

<u>Flood Threats</u>

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 areas prone to flooding. 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.

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.

Figure 27 100-year floodplain boundary in Management Unit 21

These maps should be completed for the Stony Clove Watershed in 2004.

According to NFIP maps, there are no houses located within the 100-year floodplain area in this management unit (Fig. 27). The NFIP maps are available for review at the Greene and Ulster County Soil & Water Conservation District offices.

During several recent flood events, the Stony Clove Creek overtopped its banks in this reach. Figure 28 shows damage at a residence on the left stream bank between cross sections 190 and 191 caused by the flood of 1996. The stream flooded the backyard, causing severe damage to a brick patio. Note the dark brown, sediment-laden water left on top of the swimming pool cover as the floodwaters receded.

Figure 28 1996 Flood Damage

Bank Erosion

The stream banks within the management unit are generally stable, with only one moderately eroding site identified at the time of the stream feature inventory. The limited bank erosion within this unit is misleading, as 24% of the stream banks have been hardened with revetment. While rip-rap and other hard controls may provide temporary relief from erosion, they are expensive to install, degrade habitat, and require ongoing maintenance or transfer erosion problems to upstream or downstream areas. Alternate stabilization techniques should be explored for stream banks whenever possible.

The one eroding bank is located downstream from the Main Street Bridge, on the right bank. A residence adjacent to this bank may be threatened if this erosion continues. While this site was not included in the Stony Clove Creek Streamside Planting Program due to the extent of the erosion and adjoining bank treatments, more intensive *bioengineering* treatments would likely be effective in this setting.

Infrastructure

The NYS Route 214 runs immediately adjacent to the stream for much of the management unit.

There are three sections of revetment protecting the roadway (Insets F,G,H). There are four sections of revetment protecting private residences and park areas (Insets A,B,C,H). Planting recommendations for these sites should be implemented.

Bridges can be highly susceptible to damage or ongoing maintenance problems because they require the stream to pass through a narrow area during flood events. Bridge openings should be sized to eliminate backwater effects through at least bankfull stage, and to convey most larger flood flows without significant damage. Because many bridge approaches are constructed by filling in floodplain areas to raise the roadbed, additional culvert drainage in the floodplain under bridge approaches can also help reduce the risk of bridge failure. Floodplain drainage can also lower flood elevations and minimize sediment deposition upstream of the bridge and bank erosion or scour below the bridge.

Figure 29 Main Street Bridge - 1980 Flood

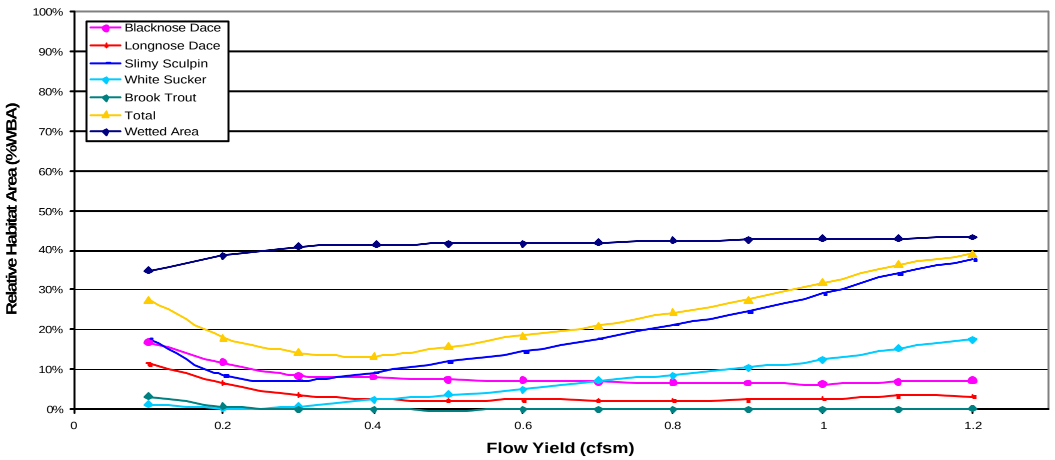
The Main Street Bridge was replaced in 1993 by the NYS DOT, and the center pier was removed, significantly increasing flood conveyance capacity (Fig. 29).

Aquatic Habitat

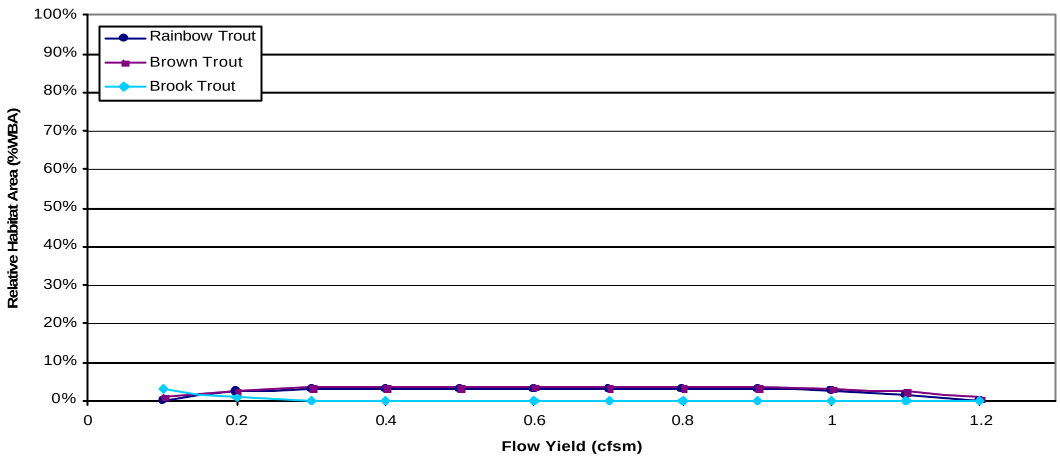
Aquatic habitat was analyzed for each management unit using Cornell University Instream Habitat Program's model called MesoHABSIM. This approach attempts to characterize the suitability of instream habitat for a *target community* of native fish, at the scale of individual stream features (the "meso" 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 #21 has some boulder cover and abundant shallow margins, but very little shading and overhanging vegetation (Fig. 30). The substrate is variable. Average hydraulic conditions are similar to those of management unit #20, but exhibit a slightly wider range of velocities. *Wetted area* covers less than half of the bankfull wetted area and stays relatively constant. The *hydro-morphological units* (HMUs) become much larger above 1.0 cfsm but are still highly variable. The community habitat rating curve shows a trend that is unlike anywhere else in the system. This is attributed to the curve being dominated by slimy sculpin. Similar to management unit #20, sculpin have their lowest habitat levels at around 0.3 cfsm. White sucker also contribute to the unique trend by having more habitat available at higher flows. As flow increases, blacknose dace habitat declines and longnose dace have little suitable habitat. While the introduced trout species have small amounts of excellent habitat, no suitable brook trout habitat whatsoever is available in this management unit.

Overwide, aggradational conditions lead to potential thermal impairment and filling of pools in the unit. Planting recommendations for the unit will mitigate these habitat deficiencies. (See Section 6.6 general recommendations for aquatic habitat improvement)



Rating curve for relative habitat area versus flow for Management Unit 21



Rating curve for trout relative habitat area versus flow for Management Unit 21

Figure 30 MesoHABSIM habitat rating curves for Management Unit 21

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. There were no clay exposures and only a minimal amount of bank erosion identified in this management unit at the time of the stream feature inventory.

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 are three stormwater culverts in this management unit, and direct inputs from the immediately adjacent highway and bridge.

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. There are many houses located in close proximity to the stream channel in this management unit. These homeowners 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 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). Three homeowners in this management unit made use of this program to replace or repair their septic systems.