Management Unit 4

Greene County - Town of Hunter
Cross Section 65 to Cross Section 90

Management Unit Description

This management unit begins at Cross Section 65 and continues approximately 3,774 ft. to the private bridge at Cross Section 90. The drainage area ranges from 4.2 mi^2 at the top of the management unit to 7.5 mi^2 at the bottom of the unit. The valley slope is 3.2% and stream water surface slope is 2.8%.

Generally, stream conditions in this management unit show signs of stress. The unit is laterally controlled for much of its length by the valley form, with a very constricted stream corridor. Residential and infrastructure encroachment on the stream corridor have truncated meander formation and degraded *riparian* function. Management efforts here should focus on enhancing riparian zone integrity and restoring bank erosion site #8. Other isolated incidences of erosion can be addressed with vegetated bank treatments, and possibly riparian zone plantings. Replacement or maintenance of bridges should reflect the *morphological* and *sediment* transport requirements. GCSWCD will provide technical assistance for bridge replacement and maintenance in the unit. Although abundant for adult brown and rainbow trout, aquatic habitat is generally of low quality.

Summary of Recommendations Management Unit 4	
Intervention Level	Assisted self-recovery at selected locations Full Restoration at bank erosion monitoring site #8
Stream Morphology	Full restoration of bank erosion monitoring site #8
Riparian Vegetation	Riparian plantings at four identified planting sites (PS #17-20)
Infrastructure	None
Aquatic Habitat	Enhance overhead cover by joint planting of rip-rap at identified planting sites (PS #19-20)
Flood Related Threats	Floodplain drainage at the private bridge at the downstream end of the management unit (Fig. 28) Resurvey National Flood Insurance Program (NFIP) map to more accurately reflect the active stream channel Geomorphically appropriate replacement design for third downstream bridge (Fig. 23)
Water Quality	Address clay exposures at bank erosion monitoring site #8
Further Assessment	Ongoing monitoring of bank erosion monitoring sites #8, 9, 10 Stream feature inventory on Myrtle Brook Identify sediment source from tributary downstream of private bridge (Fig. 23) Evaluate possible contamination at gravel parking area near first bridge in the management unit Monitor headcut

Historic Conditions

Beers 1867 Greene County atlas indicates another sawmill on the creek in this management unit, just downstream of the confluence of Myrtle Brook. However, logging by Fenwick Lumber Company in the early 20th Century may have more significantly impacted stream form and function in Myrtle Brook, which confluences with the Stony Clove in this unit. A powered rail line brought timber from the top of Southwest Hunter Mountain (Fig. 2) to the mill (Fig. 3), where it was washed in a mill pond off of Myrtle Brook, milled and transferred by gravity rail down to near NYS Route 214, loaded on wagons, and carted down Ostrander Road, across Stony Clove Creek (where you can still find the bridge abutments) and loaded onto railroad boxcars on the Ulster and Delaware line.

Figure 2 Timber and logging operation crew at summit camp on Southwest Hunter Mountain. Courtesy of the Brooks Collection.

Note in Figure 2 that all sizes of timber were being cut. These “clear cuts” would certainly have produced tremendous sediment loads as rains washed over bare hillsides once covered with forest, and probably significant amounts of slash (leftover branches and debris cut and discarded from marketable timber) would have made its way into the streams as well. While the mill was run by steam power, use of the pond at the mill could also have had significant impacts on Myrtle Brook.

Figure 3 Mill by the Fenwick Lumber company near Myrtle Brook.
Courtesy of the Brooks Collection.

Historical stream channel alignments are not available for this management unit. This unit is located near the top of the watershed, where the stream is smaller, making the channel difficult to distinguish on aerial photographs.

According to available NYS DEC records there have been five stream disturbance permits issued in this management unit. Four of these permits were issued after the January 1996 flood event. At the top of the management unit, Walter Doherty was issued a permit to replace rip-rap on his property and to remove debris from the stream channel, which accumulated during the flood event(Inset D). Alex Latyshevsky was issued a permit to repair the bridge on his property, the third bridge in this management unit from the upstream end. The permit also included debris clearing and installation of rip-rap to provide protection for the bridge abutments. Robert Thomson was issued a permit to remove debris and install rip-rap along his stream bank (Inset A). Due to apparent failure of his first rip-rap installation, Robert Thomson was issued a second permit to install rip-rap along his stream bank in 2000. Downstream from the Thomson property, Henry Stucky was issued a permit to re-establish the original stream channel by excavating accumulated gravel and placing it into a new stream channel cut during the flood event.

Stream Channel and Floodplain Current Conditions

Revetment, Berms and Erosion

The 2001 stream feature inventory revealed that 7% (550 ft.) of the stream banks exhibited signs of active erosion along 3,774 ft. of total channel length (Fig. 1). Revetment has been installed on 8% (604 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 foldout Figure 37. "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. 4), creating small reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.1 for stream type descriptions).

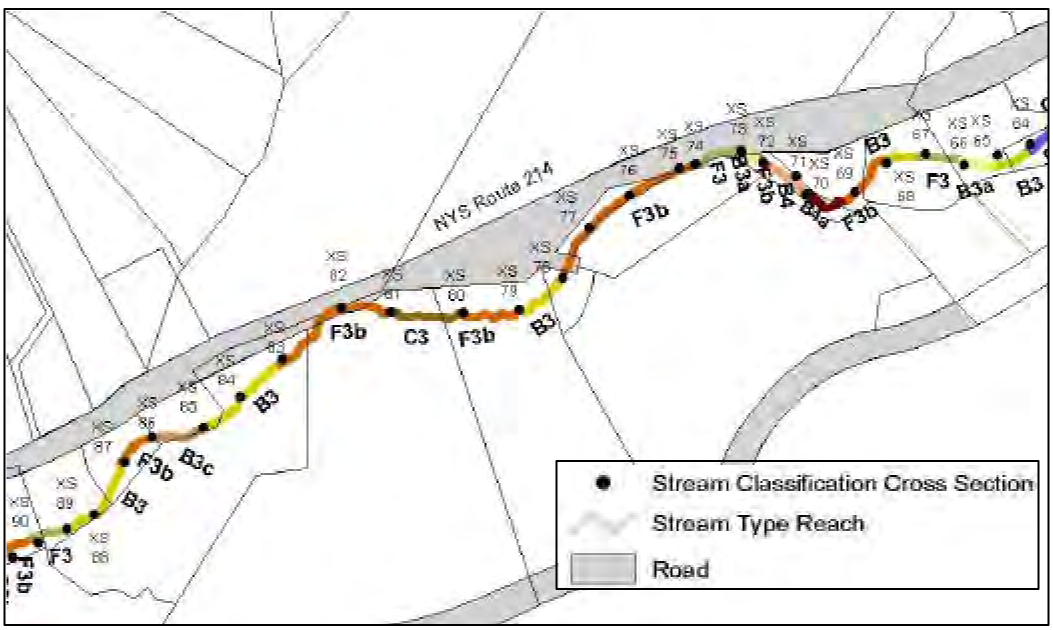


Figure 4 Cross-sections (XS) and Rosgen stream types for Management Unit 4

The unit is laterally controlled for much of its length by the valley form, with a very constricted stream corridor, exacerbated by encroachment from road and rail embankments. A knoll on stream left creates a constriction, or "pinch-point", near cross-sections 70 to 75. Abrupt changes in confinement often lead to sediment transport imbalances, evident in this unit.

Management unit #4 begins with a B3 stream type for the first 32 ft. The stream channel is moderately *entrenched* with a slope of 3.3% and cobble-dominated channel bed material. At the end of this reach, the slope increases significantly, to 5.3%, changing the stream type to B3a for the next 106 ft. (Fig. 5).

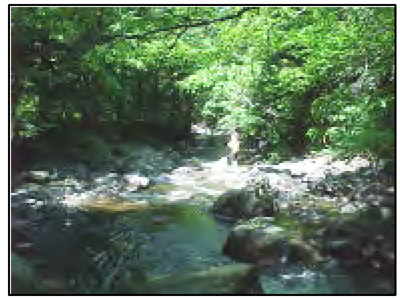


Figure 5 Cross-section 66 Stream Type B3a

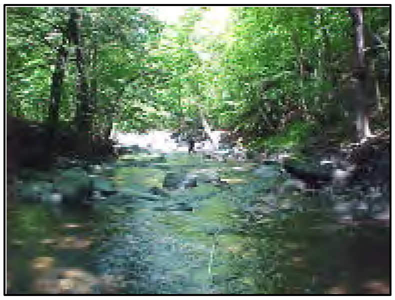


Figure 6 Cross-section 67 Stream Type F3

As the stream continues, it becomes entrenched, preventing floodwaters from spilling onto the floodplain. Stream slope flattens to 1.7% through this 137 ft. F3 stream reach (Fig. 6).

As the stream transitions into a B3 stream type for the next 117 ft., it becomes moderately entrenched with a channel slope of 3.2% (Fig. 7). Rip-rap has been placed along 67 ft. of the upstream portion of an outside meander bend on the right stream bank, at the bottom of this reach (Inset D). Stream bank erosion often occurs on the outer banks of streams where velocity is greatest.

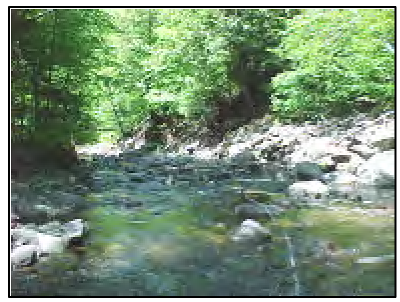


Figure 7 Cross-section 68 Stream Type B3

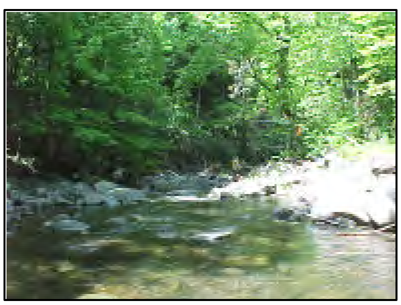


Figure 8 Cross-section 69 Stream Type F3b

In the middle of the meander bend, at the end of the rip-rap section, stream type changes to F3b (Fig. 8). This 183 ft. reach is entrenched, with a wider cross section compared to other sections of this unit. The slope remains fairly steep, at 3.4%.

The *thalweg* moves against the right bank, which is actively eroding (Fig. 9). This stream bank is subject to scour at the toe during high flow events, causing the bank to become undercut, despite riparian vegetation including mature trees at the top of the bank, which provides some protection against this erosion.

Figure 9 Bank Erosion

At the next meander bend, *dominant bed material* size decreases to very coarse gravel, and stream type changes to B4a for the next 155 ft. (Fig. 10). The channel is moderately entrenched with a steep slope of 4.6%.

On the outside of the meander bend at the top of this reach, the stream begins to erode the left bank. Bank erosion monitoring site #8 is 273 ft. in length and 8941 ft.^{2} in area, qualifying it as the fifth largest eroding area along Stony Clove Creek (Inset H).

Figure 10 Cross-section 70
Stream Type B4a

This erosion site is more than thirty ft. in height with no vegetation remaining on most of its face. Previous geologic mapping indicated the presence of *lodgement till* along this section of the management unit, and the stream feature inventory identified large areas where the bank material is clay or clay-rich lodgement till, evident at this erosion site. During high flows clay exposed to stream flow is introduced into the stream as *suspended sediment*. Introduction of clay into the stream represents a threat to water quality and aquatic habitat.

The Bank Erodibility Hazard Index (*BEHI*) score of site #8 is ranked "Very High", the second highest prioritization category in terms of its vulnerability to erosion. This bank erosion site is considered a high priority for restoration due to its large eroding area and severe water quality threat.

Figure 11 Cross-section 71
Stream Type B4

Approximately halfway through bank erosion site #8, stream slope decreases to 3.3% as stream type changes to B4 (Fig. 11). This 116 ft. reach remains moderately entrenched with coarse gravel bed material.

Myrtle Brook enters the Stony Clove Creek from the right at the bottom of this reach (Inset G). Myrtle Brook's headwaters are located on the southern slopes of Hunter Mountain. Myrtle Brook flows 2.4 miles, crossing NYS Rt. 214 under bridge #1041280, to its mouth at Stony Clove Creek. Myrtle Brook's NYS DEC best usage classification is C, indicating its best usage is supporting fisheries and non-contact activities.

The 2001 stream inventory revealed that Myrtle Brook contributes a relatively large amount of silts and sand to the Stony Clove, but did not identify the source. A stream feature inventory should be conducted in Myrtle Brook to identify sediment sources and treatment opportunities.

Downstream of Myrtle Brook, the stream becomes entrenched and dominant channel material size increases to cobble (Fig. 12). This

Figure 12 Cross-section 72
Stream Type F3b

Figure 13 Clay Exposure

F3b stream reach is 81 ft. in length with a slope of 2.5%. Bank erosion site #8 ends at the bottom of this reach. There is a large clay-rich exposure of lodgement till on the left bank (Fig. 13).

As the stream turns back toward NYS Route 214, stream type changes to B3a, for a short 77 ft. reach. This reach is moderately entrenched with an extremely steep slope of 4.8%.

The NYS DOT has installed a 53 ft. concrete T-wall with sheet piling at the toe of the right stream bank, truncating the stream's natural meander pattern, and narrowing the width of available floodplain. The result is a constriction causing a *backwater* effect and associated *aggradation*, and setting up conditions for *lateral erosion* or a *headcut* to occur.

Even though stream stability is potentially threatened through this reach, bank armoring at this site is necessary to prevent erosion of the NYS Route 214 road embankment. If this wall did not exist, the stream would likely erode the toe of this bank, eventually causing its failure and destroying the roadway.

As the stream straightens along the T-wall, slope flattens to 1.7% and the channel widens. Along the length of the right bank is a 95 ft. long block wall, beginning immediately downstream from the T-wall in the previous reach, also with sheet piling at the toe of the bank (Inset C). This 145 ft. reach of F3 stream type is aggrading (Fig.14). Decrease in slope here results in deposition of bed material and raising of the stream bed. Aggradation often results in the stream becoming divided into multiple threads and eroding its banks (Fig.15).

Figure 15 Cross-section 75
Stream Type F3b

Aggradation also steepens stream channel gradient downstream of the deposition site. This proves true for the next 578 ft. reach of F3b stream type (Fig.15). Slope at the top of this entrenched reach increases to 4.1%. Along 217 ft. of the right bank, road embankment protection continues as concrete T-wall with sheet piling at the toe (Inset C). After the first 50 ft. of this reach, stream slope decreases to 2.3%

At the end of the T-wall there is a culvert with rip-rap on the right bank (Fig. 16). The culvert outlet is set back from the stream channel on a steep slope. This outlet could be highly prone to erosion if the outlet channel was not lined with stone material. Along the left bank of this reach is a residential property with a grass lawn mowed to the edge of the stream bank. This bank is experiencing minor erosion which may become a larger problem in the future. Streamside plantings of trees and shrubs would reduce this erosion threat.

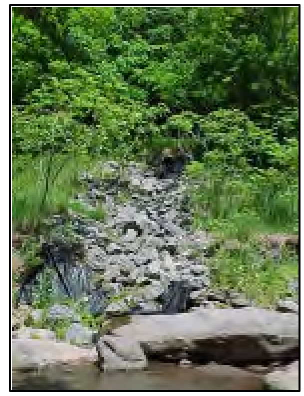


Figure 16 Culvert

As the stream bends left away from NYS Route 214, the toe of the right stream bank has eroded and rendered the face of this bank raw and unvegetated. Bank erosion monitoring site #9 is 93 ft. in length along this bank (Inset B).

The BEHI score of site #9 is ranked "High", the third highest prioritization category in terms of its vulnerability to erosion. Previous geologic mapping did not identify lodgement till or glacial lake clay exposures in this reach. This bank erosion site is considered a lower priority for restoration due to its small eroding area (807 ft^2) and low threat to infrastructure or water quality.

Figure 17 Rip-Rap

Directly downstream from this erosion site the stream narrows as it approaches the Benjamin Road Bridge (BIN#3201040, Inset F). This bridge, maintained by the Town of Hunter, appears to be in good condition and to have adequate capacity to pass high flow events. Upstream of the bridge, the right stream bank has been stabilized with 53 ft. of rip-rap (Fig.17). This rip-rap is protecting a gravel parking area at the top of the bank. The close proximity of this parking area to the stream may represent a risk of contamination by petroleum products running off parking areas unprotected by riparian vegetation or stormwater drainage.

Downstream from the Benjamin Road Bridge, stream type changes to B3. This 178 ft. reach is moderately entrenched with a slope of 3.1%.

Proceeding downstream, the channel once again widens and becomes entrenched. Stream type changes to F3b with the slope remaining nearly constant at 3%. Near the top of this reach, the stream passes under a private bridge (Fig. 18). This bridge appears to be in good condition and to have adequate capacity to pass high flow events. There are no records of NYS DEC stream disturbance permits for this bridge.

Figure 18 Private Bridge

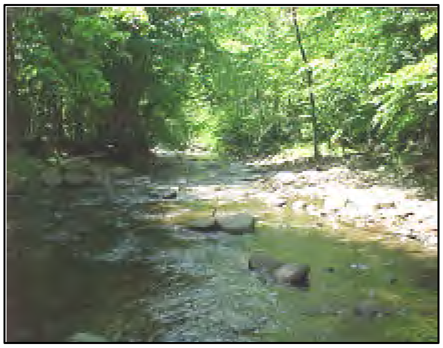


Figure 19 Cross-section 81 Stream Type C3

Continuing downstream, the channel reconnects with its floodplain, the stream straightens and the slope flattens to 1.7% (Fig. 19). A small gravel bar has formed on the right bank. Gravel bar formation is typical of C3 type streams.

At the top of this reach, the stream passes under another private bridge (Fig. 20). This bridge was damaged in the January 1996 flood. Additional *floodplain drainage*, using culverts set at the floodplain elevation under the north bridge approach, may help prevent future damage. Most of this 224 ft. reach is fairly straight but stable.

Figure 20 Private Bridge

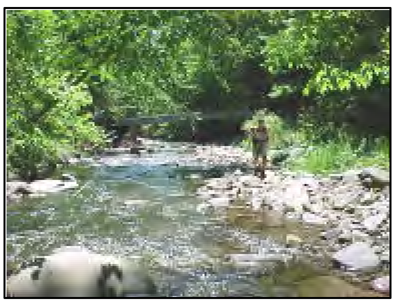


Figure 21 Cross-section 83 Stream Type F3b

As the channel begins to meander toward the right bank, stream type changes to F3b (Fig. 21) for the next 421 ft. of stream. Once again the stream becomes entrenched, unable to access its floodplain and steepens to 2.8%.

At the top of this reach, a culvert with a concrete headwall drains to the stream at the right bank (Fig. 22). The culvert outlet is on a steep slope. This outlet could be highly prone to erosion if the outlet channel was not lined with stone material.

Figure 22 Culvert

Immediately downstream from this culvert a small, unnamed tributary enters Stony Clove Creek also on the right bank. This tributary is not rated under the NYS DEC best usage classification system.

As the channel bends to the left, the thalweg moves against the right bank, where 119 ft. of rip-rap has been placed to protect NYS Route 214 road embankment (Inset E).

Moving away from NYS Route 214 again, entrenchment moderates, and stream type transitions into B3. At the top of this 325 ft. reach, the stream passes under a private bridge (Fig. 23). During a high flow event in 2000, scour occurred behind the left bridge abutment. Due to damage to the abutment, the deck of the bridge has tilted to one side, rendering the bridge impassable since the flood. Landowners are still unable to access their property on the opposite side of the stream.

Figure 23 Private Bridge

Inadequate sizing of bridge openings commonly causes severe damages to bridges. An undersized bridge opening (i.e., too narrow) causes water to back up upstream of the bridge and scour abutments. A geomorphically appropriate bridge design is necessary for

a suitable replacement bridge. Additional *floodplain drainage*, using culverts set at the floodplain elevation under the north bridge approach, may help mitigate this problem.

Directly downstream from this bridge a small, unnamed tributary enters Stony Clove Creek from the left bank. This tributary is not rated under the NYS DEC best usage classification system. During the 2001 stream feature inventory, fine silt inputs were observed coming from this tributary. A stream feature inventory should be conducted to identify sources of sediment evaluate treatment opportunities.

Figure 24 Tributary

Near the bottom of this reach, another tributary enters the creek from the right bank (Fig. 24). This unnamed tributary, over a mile in length, begins on the steep slopes of South West Hunter Mountain, runs along Heavenly Valley Road, and finally crosses under NYS Route 214 to enter the Stony Clove. This tributary is rated D, under the NYS DEC best usage classification system. This is the lowest classification indicating the water is only suitable for fishing.

As the stream widens and slope flattens to 1.6%, stream type changes to B3c for 190 ft. (Fig. 25). There is sparse vegetation at the residential property along the right stream bank. This area would benefit from upland plantings to increase the stream riparian buffer. This reach appears to be aggrading. Aggradation steepens stream channel gradient downstream of the deposition site.

Figure 25 Cross-section 86 Stream Type B3c

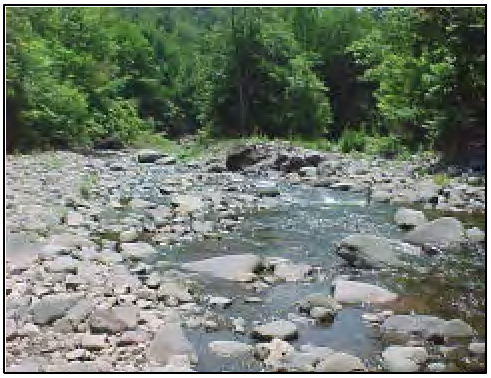
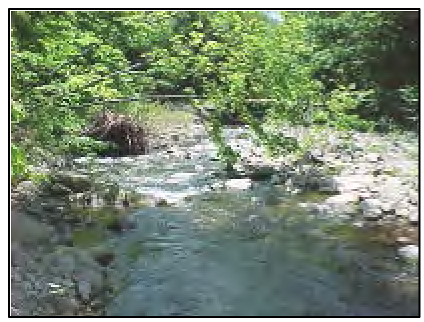


Figure 26 Cross-section 88
Stream Type F3b

As the stream widens significantly, becomes entrenched and slope increases to 2.4%, stream type changes to F3b (Fig. 26). At the top of this 116 ft. reach, bank erosion monitoring site #10 begins (Inset A). The thalweg moves against the right bank, and high *shear stress* exerted on the outside of the meander bend has caused a 130 ft. long bank failure. The owner of this property has recently installed rip-rap on the bank for protection. Adding vegetation to this site would greatly improve site stability and longevity. Approximately halfway through the meander, the right bank rip-rap ends. Although less severe, the residential property downstream from this site is also experiencing erosion on the right bank. The risk of bank erosion at this site would be greatly reduced by streamside plantings.

The BEHI score of site #10 is ranked "Moderate", the third lowest prioritization category in terms of its vulnerability to erosion. This bank erosion site is considered a low priority for restoration due to its small eroding area (888 ft^2) and its low threat to infrastructure or water quality.



As the stream flows out of the meander bend, the channel narrows, becomes moderately entrenched, and slope steepens to 3% through 307 ft. of B3 stream type (Fig. 27). Gravel bars have formed on the inside of two meander bends in this reach. Permit history for this site indicates that during high flow events, the stream channel has cut a new channel in this reach and landowners have filled the new channel to re-establish the stream in its previous path.

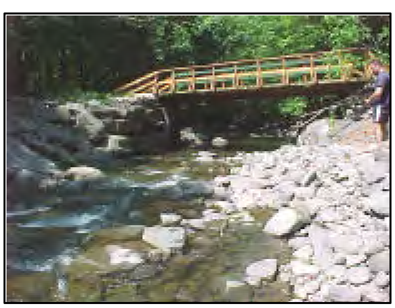


Figure 28 Cross-section 90
Stream Type F3

As the stream narrows to pass under a private bridge near the bottom of this management unit, stream type changes to F3 for the last 88 ft. of this management unit (Fig. 28). There is a large gravel deposit along the right stream bank. Inadequate sizing of bridge openings commonly causes gravel deposits upstream of bridges. An undersized bridge opening (i.e., too narrow) causes water to back up upstream of the bridge, reducing stream velocity, which results in sediment deposition. At high stage, floodwater may seek conveyance through alternative paths, forming new channels around the bridge constriction, as appears to have happened at this site. Additional *floodplain drainage*, using culverts set at the floodplain elevation under the north bridge approach, may help mitigate this problem.

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).

Increasing nearly 80% in drainage area over its length, this management unit appears to exhibit excess sediment supply due to the contribution of several large tributaries. Aggradation is apparent in a number of reaches, which is exacerbated by backwatering effects at several bridges, infrastructure encroachment and natural landform constrictions. Several over-steepened sections downstream of these aggradational areas were noted; one of these (near cross-section 70) is a headcut, with evidence of active upstream migration, including increased bank heights and floodplain disconnection, bank collapse and undercut riparian vegetation.

These sediment transport problems will have significant implications for management of this unit, especially with regard to infrastructure planning and treatment design.

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. 29, 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. riparian buffer is forested (72%) followed by herbaceous (15%). Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with plantings of more flood-resistant species. *Impervious* area (6%) within this unit's buffer is primarily the NYS Route 214 roadway and private residences.

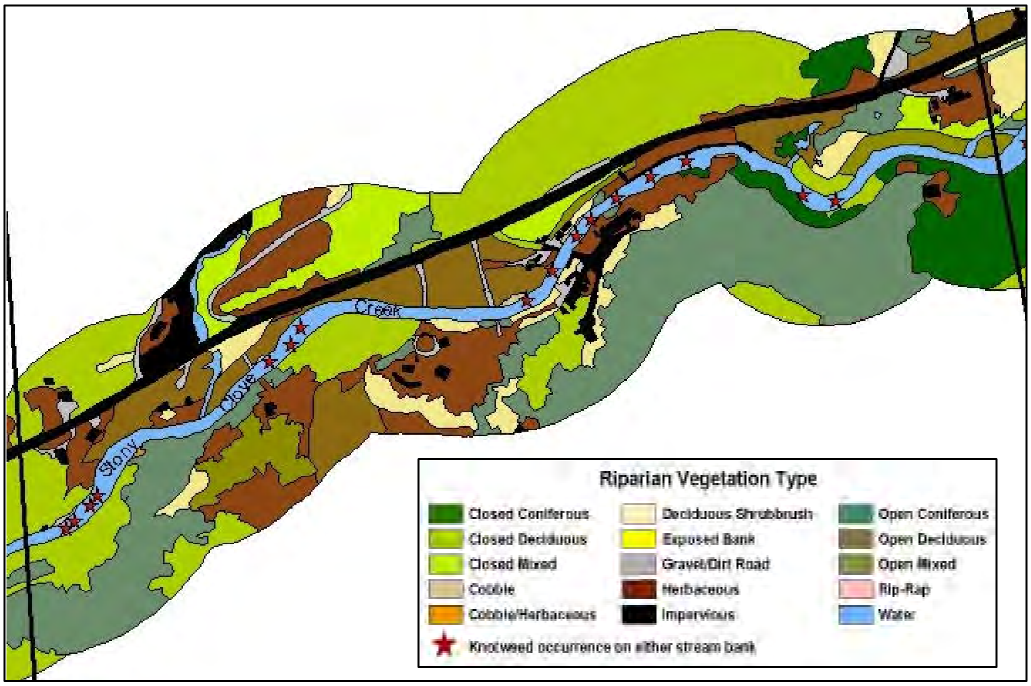


Figure 29 Riparian vegetation map for Management Unit 4

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. 30). 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. Four appropriate planting sites were documented within this management unit.

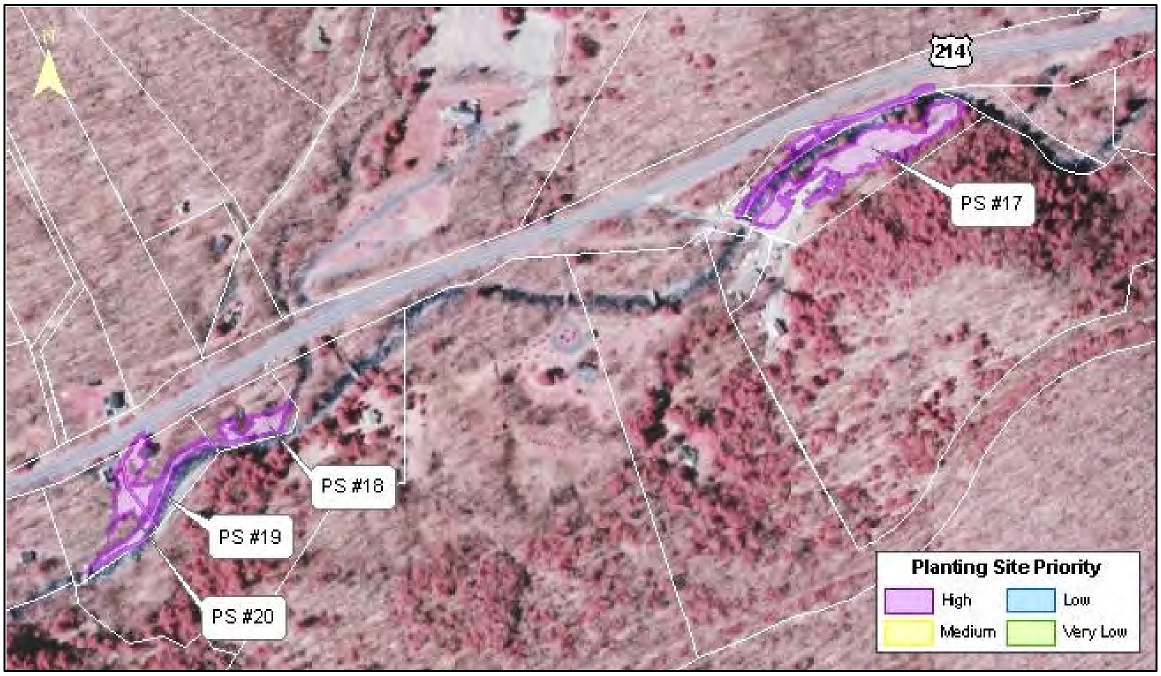


Figure 30 Planting sites location map for Management Unit 4

Figure 31 Planting Site #17 Looking upstream

Planting site #17 is located on the left bank at residential properties upstream from Benjamin Rd. Bridge (Fig. 31). This property has a large mowed lawn area, which extends to the edge of the stream bank. The left stream bank is experiencing minor erosion. To successfully prevent further erosion of this stream bank, stream banks should be planted with native trees and shrubs. To further increase stability of this site a buffer should be established on the grass area at the greatest width agreeable to the landowner.

Planting site #18 is located at a private residence (fire#2124) on NYS Route 214 (Fig. 32). There is a low bench on the right stream bank with scattered shrubs and grass. This site should be monitored to assure vegetation continues to establish. If establishment does not continue, additional native tree and shrub plantings are recommended to increase the density of the upland stream buffer.

Figure 32 Planting Site #18

Planting site #19 is located at a residence (fire#2108) on NYS Route 214 (Fig. 33). At this site there is a steep bank, which is mostly covered with trees, below which is a small flat grass area, and the stream bank is armored with rip-rap. Inserting plant materials into the soil between rip-rap rocks, or *joint planting*, is recommended. Joint planting will strengthen and increase the longevity of this rip-rap, while adding aesthetic and habitat value. To provide protection from scour at the toe of the stream bank, willows should be planting along the base of the stream bank. To prevent erosion from runoff, plantings of native trees is recommended on the upper section of the steep bank, which is currently bare. Due to the steepness of this bank, the use of a *geotextile* may be necessary to ensure planting success.

Figure 33 Planting Site #19

Planting site #20 is located at a residence (fire#2092) on NYS Route 214, directly downstream from planting site #19 (Fig. 34). A grass lawn area currently extends to the edge of the right stream bank. At one time this bank may have been completely armored with rip-rap, but now consists of large scattered cobbles and bare soil. To provide protection from scour at the toe of the stream bank, willows should be planted along the base of the stream bank. The stream bank and terrace above should also be planted with native trees and shrubs.

Figure 34 Planting Site #20

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

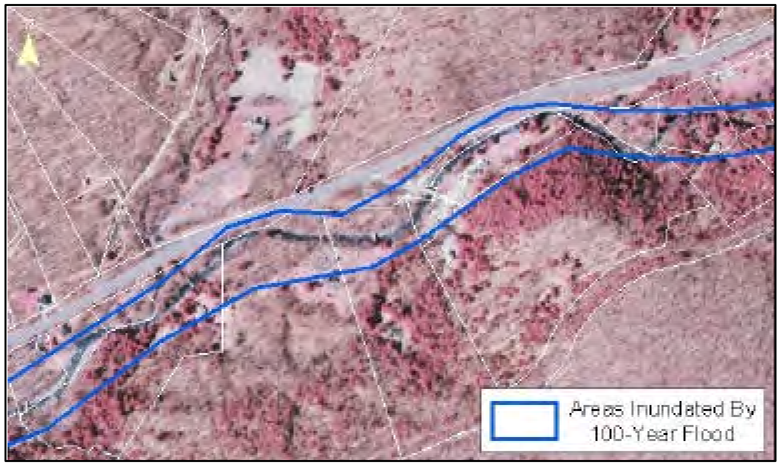


Figure 35 100-year floodplain boundary in Management Unit 4

According to current NFIP maps, there are twelve houses located within the 100-year flood boundary in this management unit (Fig. 35). Current NFIP maps are available for review at the Greene and Ulster County Soil & Water Conservation District offices.

Bank Erosion

Most stream banks within the management unit are stable, with only 7% of stream banks experiencing erosion. There are four bank erosion sites, totaling 550 ft. in length, in this management unit.

At the top of the management unit bank erosion site #8 (Inset H) is 273 ft. in length and 8941 ft.^{2} in area, qualifying it as the fifth largest eroding area along the Stony Clove Creek. The left bank is more than 30 ft in height and has no vegetation on the majority of its face. There are large areas where the bank material is clay-rich lodgement. This bank erosion site is considered a high priority for restoration due to its large eroding area and severe water quality threat.

Bank erosion sites #9 and #10 (Insets B & A) are considered a low priority for restoration due to low threats to infrastructure or water quality.

Infrastructure

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.

The history of stream disturbance permits indicates that the third private bridge in this management unit has been severely damaged in past flood events, is currently impassable, and may be constricting and diverting flood flows. This bridge should be evaluated for upgrade or removal.

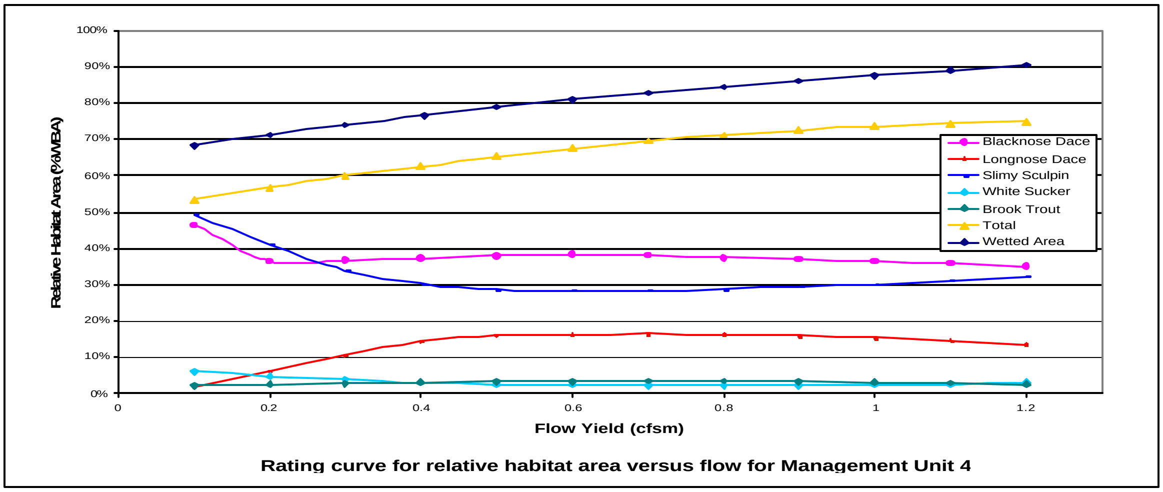
Although approximately 615 ft. of the stream is located within 50 ft. of NYS Route 214, there are no serious apparent flood threats to this roadway. One reach at the top of the management unit where the stream could have threatened NYS Route 214 has been heavily armored with a concrete T-wall, block wall, and sheet piling (Inset C).

Bank erosion site #10, which has been partly armored with rip-rap (Inset A), is located on the outside of a meander bend. While rip-rap and other hard controls may provide temporary relief from erosion, they are expensive to install, degrade habitat, and often fail or transfer erosion problems to upstream or downstream areas. This rip-rap has failed in the past and will likely fail again if it is not strengthened with vegetative measures. Stability of channel morphology at the site should be evaluated as part of any stabilization design.

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 #4 runs close to NYS Route 214 and is dominated by shallow runs, riffles, and rapids that include an abundance of boulders. At all flows, the *wetted area* covers a large portion of bankfull wetted area width and has a steadily increasing trend towards 95%. Around 80% of the wetted area is highly suitable for fish. Habitat conditions for all species are relatively stable across the investigated range of flows. The majority of the wetted area is suitable for slimy sculpin and blacknose dace. Habitat levels for brook trout and white sucker are very low under all flows. 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 aquatic habitat improvement in Section 6.6)



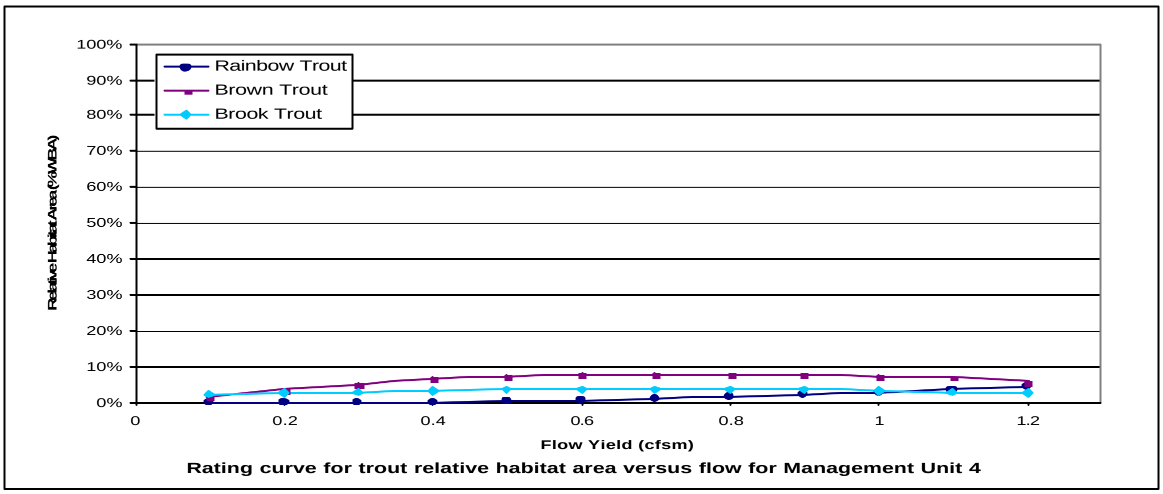


Figure 36 Habitat rating curves for Management Unit 4

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 are large clay exposures along the left stream bank at bank erosion site #8. This site should be restored to prevent further clay inputs into the stream from this bank.

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 outfalls in this management unit, all of which drain some road runoff. Contamination from road runoff can be buffered by adding a well-vegetated swale between the source of contamination and the active channel, where possible.

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.