Management Unit 11

Ulster County - Town of Shandaken

Bank Erosion Monitoring Site #18 to Cross Section 147

Management Unit Description

This management unit begins slightly above bank erosion monitoring site #18 and continues approximately 2,500 ft. to cross section 147. The drainage area ranges from 16.1 mi^2 at the top of the management unit to 16.5 mi^2 at the bottom of the unit. The valley slope is 1.6% and stream water surface slope is 1.4%.

Stream conditions in this unit are moderately unstable, primarily due to the impact of highway, utility line right-of-way and residential encroachment on the stream corridor. There are several installations of stream bank revetment, which should be interplanted to increase revetment longevity and improve aquatic habitat, which lacks sufficient overhead cover. The three bank erosion monitoring sites should be treated with vegetative treatments. Erosion sites #18 and #20 will require in-channel structures as well. In-channel structures should also be installed upstream of Grubman Road Bridge to mitigate abutment scour and backeddy erosion. The target fish community has at best only nominal amounts of suitable habitat available.

Summary of Recommendations Management Unit 11	
Intervention Level	Full Restoration/Assisted Self-Recovery
Stream Morphology	None
Riparian Vegetation	Riparian plantings at four identified planting sites (PS #35-38)
Infrastructure	Install in-channel structures to protect abutments at Grubman Road Bridge
Aquatic Habitat	Enhance overhead cover by joint planting rip-rap at identified planting sites (PS #35-36)
Flood Related Threats	Resurvey National Flood Insurance Program (NFIP) map to more accurately reflect the active stream channel
Water Quality	None
Further Assessment	Ongoing monitoring of bank erosion monitoring sites #18, 19, 20 Evaluate impact of road runoff Evaluate stormwater treatment options for culvert outfall

Historic Conditions

As the glaciers retreated about 12,000 years ago, they left their "tracks' in the Catskills. Rubin (1996) mapped the presence of glacial lake clay only in the Greene County portion of this management unit (Fig. 3). The remainder of the unit is mapped as unconsolidated deposits (See Section 2.4, Geology of the Stony Clove Creek, for a description of these deposits)

By the turn of the century, the Stony Clove and Kaaterskill Railroad was facilitating valley settlement in the area (Fig. 2). The railroad crossed the stream in this management unit, and while there is no apparent road crossing of the stream, the presence of several houses on the southeast hillside indicate that there must have at least been a ford in the vicinity.

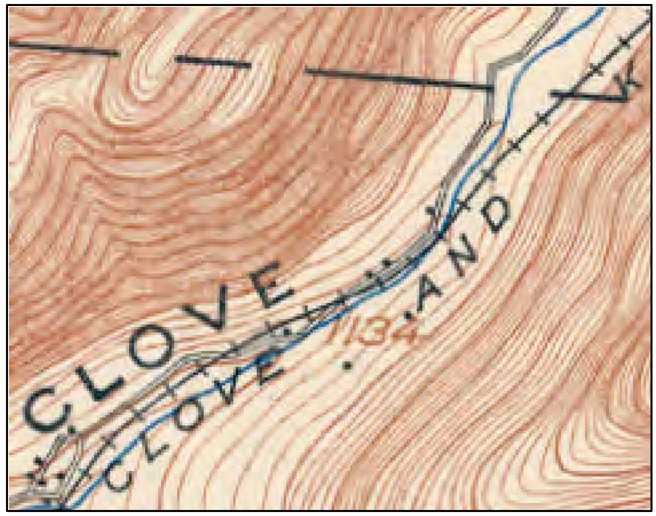


Figure 2 Excerpt from USGS 15' topographic map 1903

The reaches in this management unit are characterized by a *"pinch point"* in the Stony Clove valley form, exacerbated by road and railroad corridor encroachment. After abandonment of the railroad around 1940, the rail crossing was converted to a road crossing, becoming Grubman road.

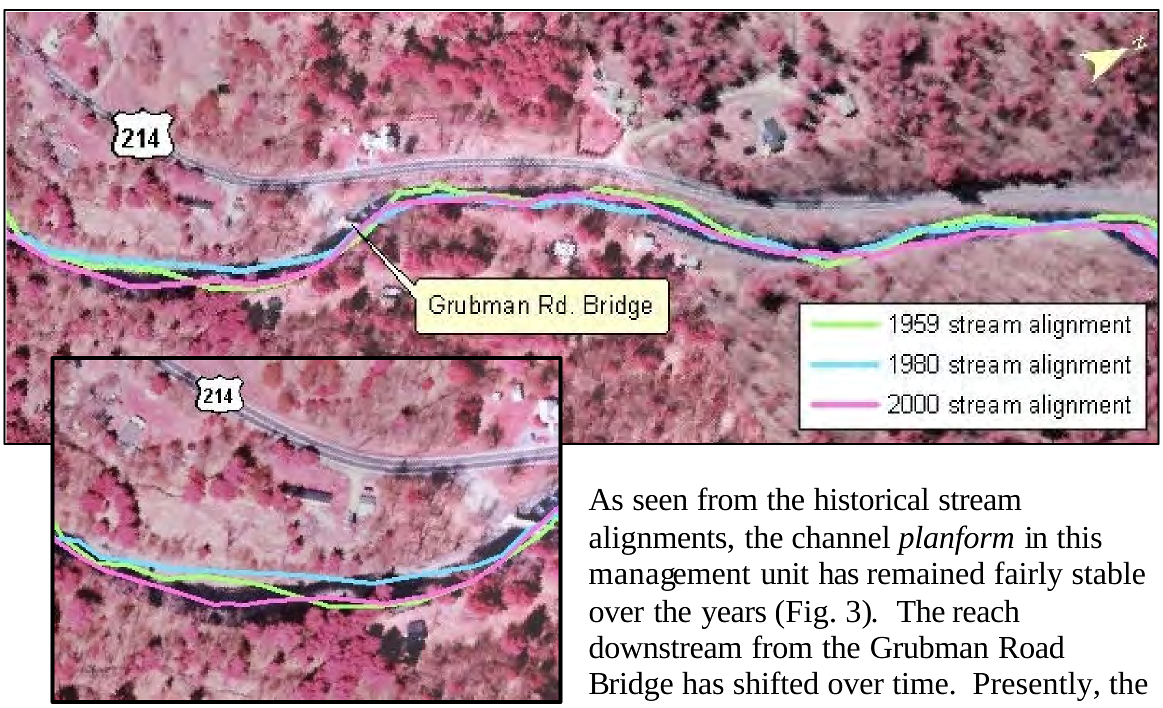


Figure 3 Historical stream channel alignments of Management Unit 11

As seen from the historical stream alignments, the channel *planform* in this management unit has remained fairly stable over the years (Fig. 3). The reach downstream from the Grubman Road Bridge has shifted over time. Presently, the channel has migrated against the left stream bank, causing erosion in this reach.

According to available NYS DEC records there have been six stream disturbance permits issued in this management unit. An emergency permit was issued to Christopher Lay after the 1987 flood event. The permit project description for this site is missing. Another emergency permit was issued for this property after the 1996 flood to remove 100 yd^3 of debris and gravel from the stream channel and place gravel on the eroded stream banks (Inset G). An emergency permit was issued to Edwin Schatzel after the 1996 flood event, to remove 25 yd^3 of gravel from in front of an intake structure and foot valve to restore water flow. An emergency permit was issued to Dorothy Zaharatos after the 1996 flood event, to replace the bridge abutment, wingwall and rip-rap at the Grubman Road bridge (Inset B). Later in 1996, another permit was issued to Dorothy Zaharatos to install rip-rap and associated gravel back fill along the stream bank. In 1999, a permit was issued to Anne Schatzel, to repair the headwall and wingwall of the Grubman Road Bridge (Fig. 5).

Figure 4 House undermined by bank erosion during the January 1996 flood

Figure 5 1999 Grubman Road Bridge damage to abutment

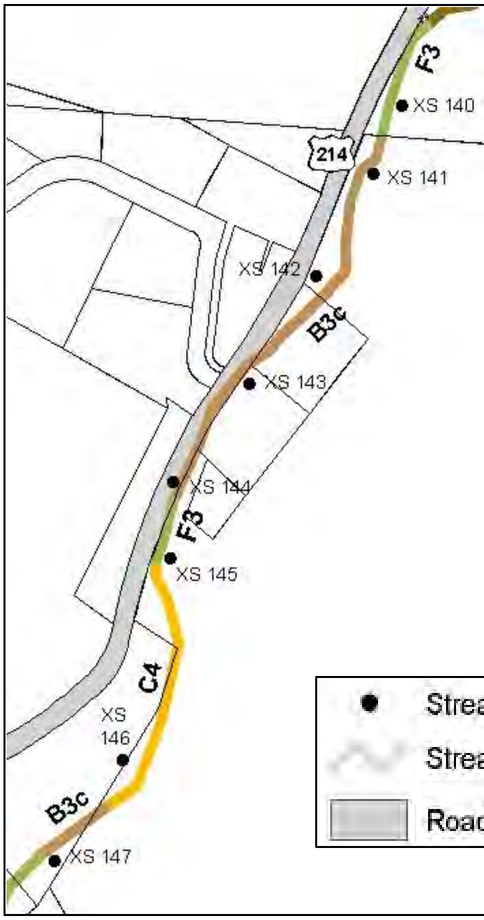
Stream Channel and Floodplain Current Conditions

Revetment, Berms and Erosion

The 2001 stream feature inventory revealed that 16% (786 ft.) of the stream banks exhibited signs of active erosion along 2,500 ft. of total channel length (Fig. 1). Revetment has been installed on 13% (666 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 23. “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 several times in this unit (Fig. 6), creating reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.1 for description of stream types).

The morphology in this management unit is significantly impacted by highway, utility line right-of-way and residential encroachment, with apparent meander truncation, extensive bank revetment and inadequate riparian vegetation. Lateral migration has been controlled by the bank hardening in a number of locations, and there is evidence of some channel overwidening and associated aggradation, perhaps in response to activities related to bridge maintenance.

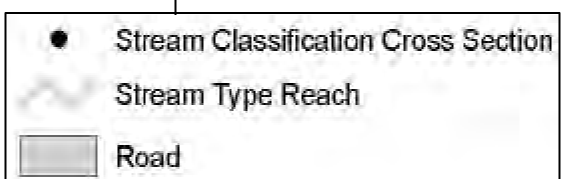


Figure 6 Cross-sections and Rosgen stream types for Management Unit 11

Management unit #11 begins slightly upstream of the Greene/Ulster County line, with a 347 ft. reach of F3 stream type (Fig. 7). This stream reach is *entrenched*, or confined within the stream banks during high flow events. Stream channel slope is quite flat, at 1.4%, and the dominant bed material is cobble. The channel runs along the toe of the NYS Route 214 road embankment, which is truncating its natural meander pattern. An 88 ft. rip-rap revetment along the right stream bank protects the embankment (Inset D). This revetment has some woody vegetation beginning to grow through it, providing some overhead cover and improving revetment longevity.

At the downstream end of the rip-rap, bank erosion monitoring site #18 begins on the right stream bank (Inset H). The *shear stress*, or the force of flowing water, has eroded the bank during high flow events. Currently, this

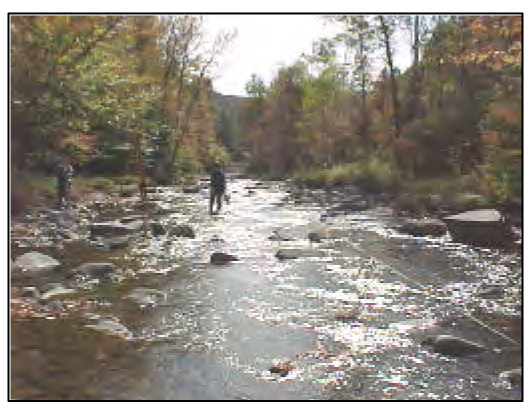


Figure 7 Cross-section 140 Stream Type F3

erosion appears to be inconsequential, but could become more severe in the future, potentially threatening NYS Route 214. Furthermore, there is a stand of Japanese Knotweed growing on the stream bank (Inset H). Japanese knotweed is an invasive non-native species which establishes quickly on disturbed stream banks. Japanese Knotweed does not provide adequate erosion protection on stream banks because it has a very shallow rooting system and should be removed from this site.

The Bank Erodibility Hazard Index (*BEHI*) score of site #18 is ranked "High", the third highest prioritization category in terms of its vulnerability to erosion. This bank erosion site is considered a medium priority for restoration because of its lack of threat to water quality, small size (225 ft^2), and absence of an immediate threat to infrastructure.

Recommendations to restore this site include installing a well vegetated bench with *rock vanes* to redirect stream flows away from the right bank, and vegetative plantings on the upper bank. In-depth survey and design would be required to plan a stream restoration project at this site.

There is a stormwater culvert with a concrete headwall on the right bank at the downstream end of the erosion site (Fig. 8). Approximately 150 ft. downstream is another smaller stormwater culvert with a concrete headwall on the right bank. Both of these culvert outlets are well vegetated with grass and shrubs and do not pose erosion concerns.

Figure 8 Culvert

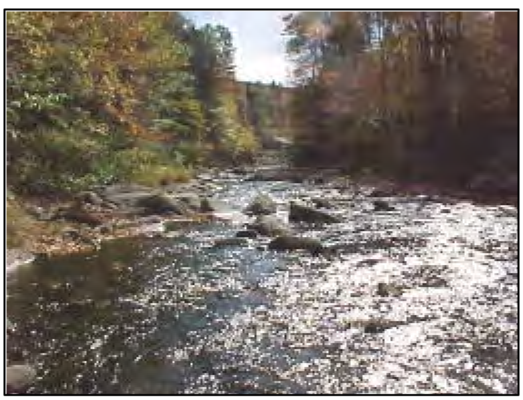


Figure 9 Cross-section 141 Stream Type B3c

As the Stony Clove Creek crosses into Ulster County, stream type transitions into B3c for the next 1,108 ft. of stream (Fig. 9). This reach is moderately entrenched, gaining some access to its floodplain, and channel slope remains constant at 1.4%.

Beginning at the top of this reach, 135 ft. of rip-rap runs along the right stream bank to protect NYS Route 214 (Fig. 10 & Inset C). This revetment has some woody vegetation beginning to grow through it, providing some overhead cover and improving revetment longevity.

Figure 10 Rip-rap left bank

As the channel widens, the stream meanders to the right, and the *thalweg* flows against the left stream bank. Stream bank erosion often occurs on the outer banks of streams where velocity is greatest. As noted in the flood history of this management unit, this stream bank and a residence built adjacent to it suffered severe damage from the 1987 and 1996 flood events (Fig. 4). The stream bank has been armored with 241 ft. of rip-rap (Inset G). There is limited overhead cover on this side of the stream, and the smooth face of the layed-in rip-rap increases the velocities of flood flows.

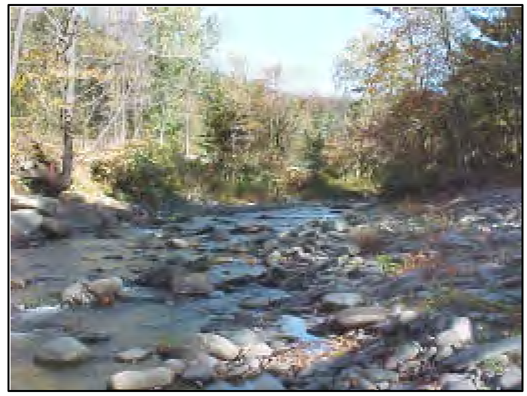


Figure 11 Cross-section 145
Stream Type F3, looking upstream

Proceeding downstream, the channel begins to narrow, as the stream transitions into F3 stream type (Fig. 11). This 165 ft. reach is entrenched, with a channel slope of 1.5%, and a cobble-dominated bed.

At the top of this reach, bank erosion monitoring site #19 begins on the left stream bank and extends approximately 79 ft. downstream (Inset F). This 5 ft. high stream bank has experienced erosion during high flow events, leaving only exposed roots and soil on the stream bank.

The BEHI score of site #19 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 because of the absence of a significant threat to water quality or infrastructure and its small size (386 ft^2).

Recommendations for this site include grading the stream bank to a slope suitable for revegetation with native trees and shrubs. Willow *fascines* could be installed at the toe of the stream bank to prevent undercutting of the new slope. In-depth survey and design would be required to plan a stream restoration project at this site.

Figure 12 Cross-section 146
Stream Type C4, looking upstream

As the channel reconnects with its floodplain, the stream type changes to C4 for the next 691 ft. (Fig. 12) The slope of the reach decreases to 1.1%, and the dominant bed material changes to gravel.

The channel begins to narrow as the stream approaches the bridge at Grubman Road, which crosses the Stony Clove at an oblique angle on a meander bend (Inset B). Rip-rap has been installed on the right stream bank, upstream and downstream from the bridge, totaling 202 ft. in length (Fig. 13).

As described in the stream disturbance permit section, this bridge has experienced serious damages during flood events. The current bridge abutments appear to provide adequate width to pass bankfull flows, as well as ample conveyance of larger flood flows. A center pier divides the channel, with significant deposition to the left of the pier on the inside of the meander. Scour at the right bridge abutment, though not significant at the time of the stream feature inventory, has been an ongoing problem. The installation of a cross-vane structure upstream of the bridge to control the width and depth of the channel may alleviate this problem.

Figure 13 Rip-rap upstream from bridge

As the stream emerges from the bridge, bank erosion monitoring site #20, is located on the left stream bank (Inset E). The stream meanders to the right, and the thalweg flows along the left bank, exposing this bank to extreme shear stress during high flow events. This erosion site is approximately 259 ft. long. Erosion has stripped away the vegetation along most of the bank. At the top of this 9 ft. high bank sits a private residence, with a driveway immediately adjacent to the stream bank. The driveway and home are seriously threatened by this erosion.

The BEHI score of site #20 is ranked as "High", the third highest prioritization category in terms of its vulnerability to erosion. This bank erosion site is considered a medium priority for restoration because it poses a serious threat to infrastructure but is relatively small in size (2382 ft^2) compared to other bank erosion sites in the watershed and poses no significant threat to water quality.

Recommendations for this site include moving the active stream channel away from the left stream bank, and installing a well vegetated bench, with *rock vanes* to redirect stream flows away from the banks. The stream bank and terrace should be revegetated. In-stream work here should be coordinated with placement of structures upstream of the bridge. In-depth survey and design would be required to plan a stream restoration project at this site.

Continuing downstream, the channel widens significantly, resulting in gravel deposition in this reach. Erosion continues along the next 394 ft. of the left stream bank (Inset A). The bank height is significantly lower in this section, and the erosion is less severe, distinguishing it from the preceding site. Consequently, this section is not monitored as a bank erosion site. A gravel bar appears to be forming along this bank, which may encourage the channel to narrow, while relieving some of the shear stress on the toe of the bank.

As the entrenchment moderates and bed material coarsens to cobble, stream type changes into B3c for the final 189 ft. of this management unit (Fig. 14). Channel slope of this reach increases to 1.6%. The left bank erosion ends midway through this reach.

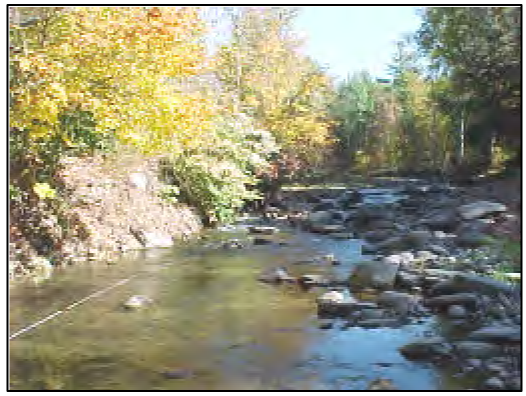


Figure 14 Cross-section 147
Stream Type B3c, looking upstream

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).

In general, sediment transport function appears to be fairly stable in this management unit, with isolated incidents of aggradation and associated bank erosion. Most of the aggradation is observed on the inside of meander bends where bar development would be expected. Overwidened and entrenched conditions at cross-section #142 are likely to result in bed aggradation at bankfull flows, and bed degradation at high flows.

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

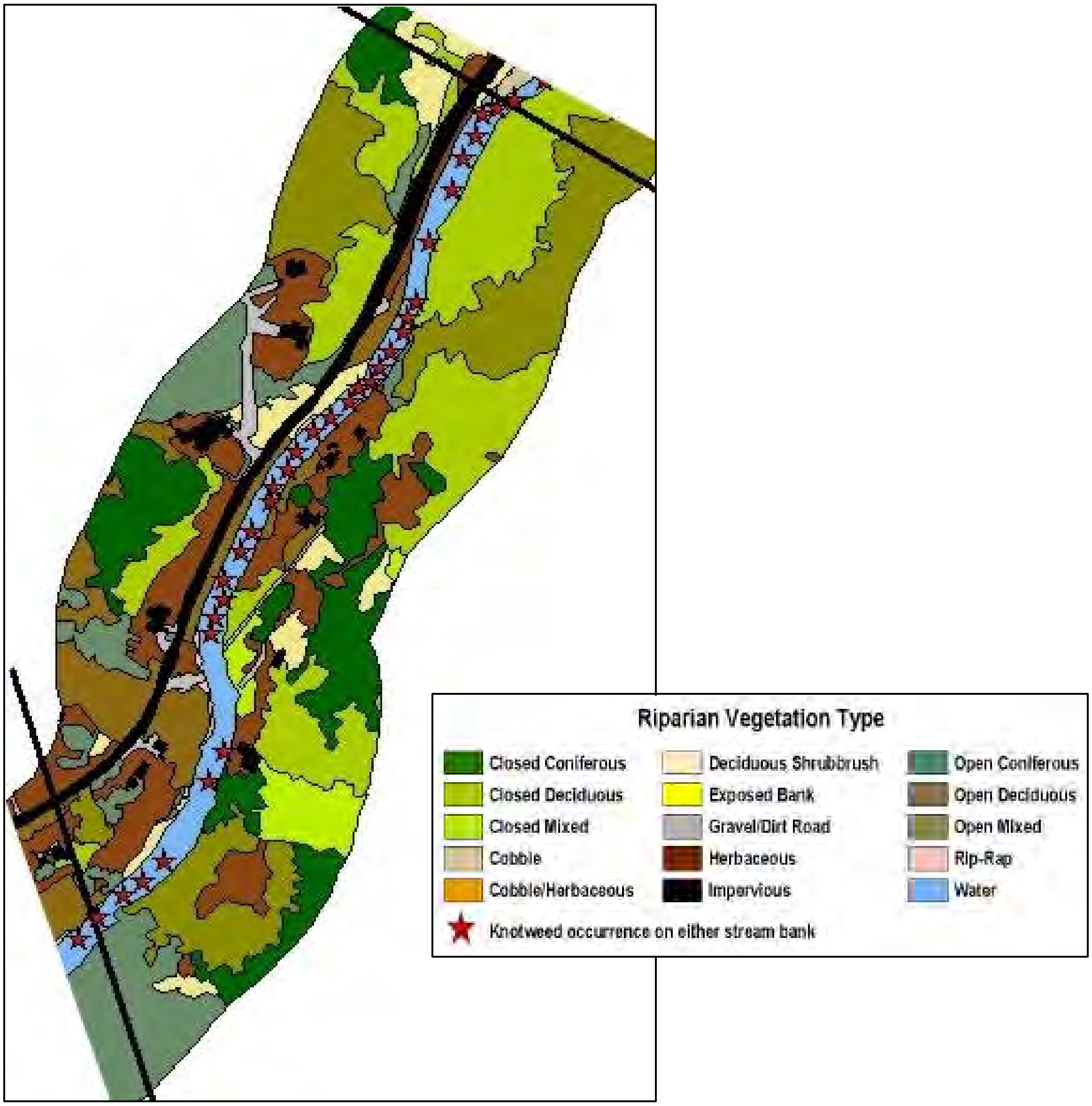


Figure 15 Riparian vegetation map of Management Unit 11

The predominant vegetation type within the 300 ft. riparian buffer is forested (74%) followed by herbaceous (15%). Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer planting with more flood-resistant species. *Impervious* area (5%) within this unit's buffer is primarily the NYS Route 214 roadway and private residences. The presence of Japanese knotweed is pervasive in this management unit.

Just over half of the length of this management unit lies within 50 ft. of NYS Route 214. The riparian vegetation between the stream and the highway is in generally poor health, in part due to highway corridor and utility line right-of-way management. As a result, its contribution to stream bank stability and ecosystem health is limited.

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. 16). 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.

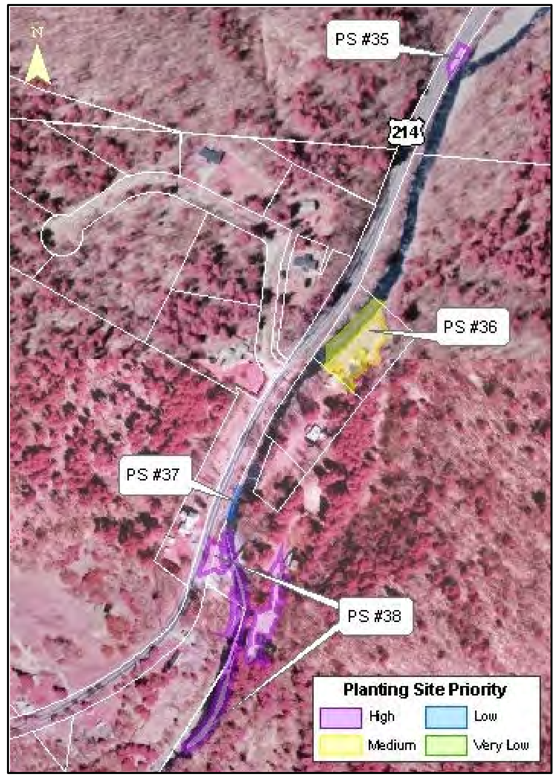


Figure 16 Planting site location map for Management Unit 11

Figure 17 Planting Site #35

Planting site #35 is located along the rip-rap at the top of the management unit, on the right stream bank (Fig. 17 & Inset D).

Joint planting of the existing rip-rap is recommended, by inserting plantings into the soil between rip-rap rocks at this site. Willow *fascines* should be installed along the toe of the stream bank. These plantings will strengthen and increase the longevity of this rip-rap and improve the aquatic habitat by providing shade, thereby cooling water temperatures. The planting of the rip-rap requires coordination with the NYS DOT and Central Hudson Energy Group.

Planting site #36 is located along the rip-rap in the middle of this management unit (Fig. 18 & Inset G).

Figure 18 Planting Site #36

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 improve the stream buffer, native trees and shrubs should be planted at the top of this bank, which is currently a large grassy area.

Figure 19 Planting Site #37

Planting site #37 is located along the left side of NYS Route 214 just south of Moggre Road (Fig. 19). This site is located on the right stream bank, on the outside of a meander bend. The stream bank is currently lined with small cobble material.

Plantings of native trees and shrubs are recommended along the stream bank and sedges at the toe of the stream bank. These plantings will help prevent erosion on this stream bank.

Planting site #38 is located along the right and left stream bank downstream from the Grubman Rd. Bridge (Fig. 20 & Inset B). While this site ideally would be treated by installing a in-channel structures to redirect erosional forces away from the bank, vegetative treatments may defer the need for these measures.

Figure 20 Planting Site #38

Installing of willow fascines along the toe of both the left and right stream bank in conjunction with other structural *bioengeering* techniques, to try to stabilize this stream bank is reommeded. In-depth survey and design would be required to plan a stream restoration project at this site.

Aggressive Japanese knotweed management is recommended throughout the unit, but particularly in those locations where treatments disturb and expose soil in the banks.

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.

Figure 21 100-year floodplain boundary in Management Unit 11

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.

According to the NFIP maps, there are no houses located within the 100-year floodplain boundary in this management unit (Fig. 21). The current NFIP maps are available for review at the Greene and Ulster County Soil & Water Conservation District offices.

Bank Erosion

The majority of the stream banks within the management unit are stable, with only 16% of the stream banks experiencing significant erosion. There are three bank erosion sites totaling 786 ft. in length within this management unit. One of these sites represents a flood hazard to a private residence and its driveway.

Infrastructure

There are two sections of rip-rap protecting NYS Route 214 in this management unit and one section of rip-rap protecting an abandoned home (Inset C & D). 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. Alternate stabilization techniques should be explored for these stream banks.

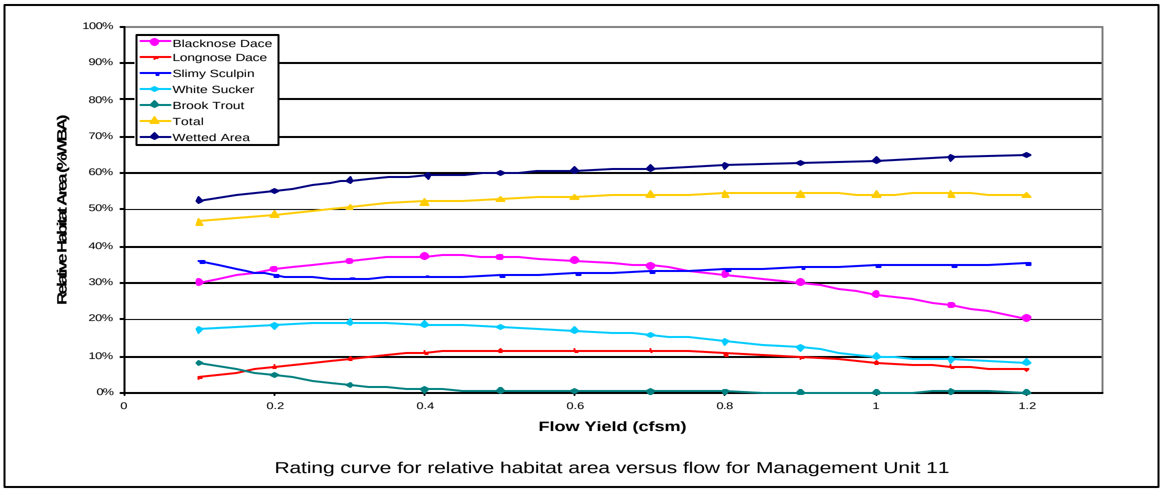
Utility lines parallel the roadway and cross the stream at various points requiring the utility company to cut swaths through the riparian vegetation at each crossing. Utility companies keep the vegetation cut, often to the ground, along the right of way. Plantings of low-maintenance shrub species in the right of way should be considered to reduce the frequency and intensity of disturbance of riparian vegetation resulting from management activities.

The Grubman Road Bridge is adequately sized, providing ample flood conveyance for bankfull and significantly larger flows. However, permit history indicates abutment scour and *backeddy* erosion are an ongoing problem. The addition of in-channel structures to redirect erosive forces away from stream banks and maintain proper channel dimension and grade may mitigate these flood related risks.

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 #11 is located very close to the road. The habitat pattern is somewhat similar to management units #9 and #10, with extensive shallow margin areas and some rip-rap. At the lowest flows, a little more than half of the bankfull *wetted area* is covered with water. The rating curve increases steadily to 70%, with an inflection point around 0.3 cfsm. At 1.2 cfsm, the *hydro-morphological units* (HMU) are larger in area, but the overall habitat stays relatively constant. Slimy sculpin habitat is abundant, with a little loss around 0.3 cfsm. Blacknose dace habitat, in contrast, peaks around 0.5 cfsm and then declines. Longnose dace habitat declines slowly and white sucker habitat stays constant, declines slowly, and then levels out again. Brook trout habitat is almost non-existent, but the other two trout species have a moderate amount of suitable habitat. (See Section 6.6 general recommendations for aquatic habitat improvement)



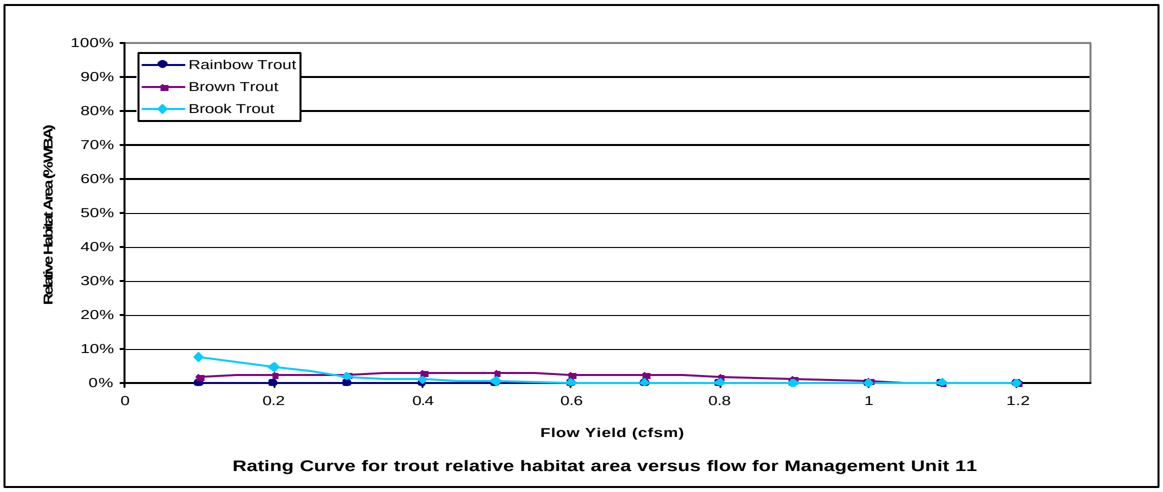


Figure 22 MesoHABSIM Habitat rating curves for Management Unit 11

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. No clay exposures were 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 two stormwater culverts in this management unit. Any treatment options for these sources would need to be installed on the west side of NYS Route 214, due to the limited area between the road and the stream channel. The buffer and filter function of the existing riparian vegetation here is limited due to the narrowness of the corridor and the low vigor of the vegetation.

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 were 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.