East Kill Management Unit 6

Town of Jewett – Station 40130 to Station 37758

This management unit began at the Farber Farm Bridge, and continued approximately 2,372 ft. to Station 37758.

Stream Feature Statistics

14.7% of stream banks experiencing erosion
4.4% of stream banks have been stabilized
0% of stream banks have been bermed
0 feet of clay exposures
21.9 acres of inadequate vegetation
1,249 feet of road within 300ft. of stream

Management Unit 6 location
see Figure 4.0.1 for more detailed map

Summary of Recommendations Management Unit 6	
Intervention Level	Assisted Self-Recovery
Stream Morphology	Make repairs at Farber farm site as necessary
Riparian Vegetation	Monitor for introduction of Japanese Knotweed and eradicate new introductions. Increase width of riparian buffer in appropriate locations.
Infrastructure	Interplant rip-rap installations
Aquatic Habitat	Watershed Aquatic Habitat Study
Flood Related Threats	No recommendations at this time
Water Quality	Investigate source of nutrient enrichment and identify methods to reduce eutrophication
Further Assessment	Consider hydraulic analysis of private bridge opening

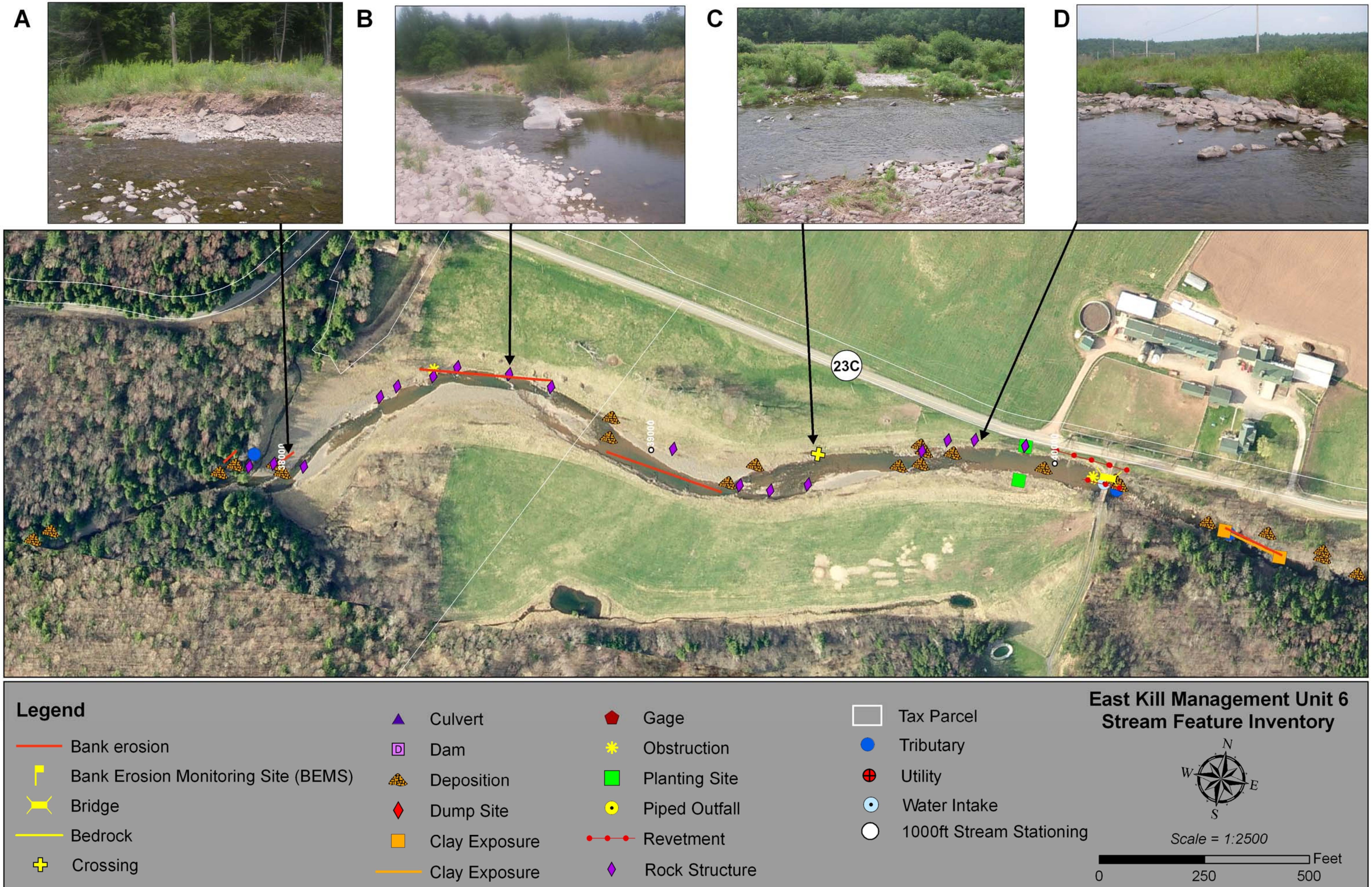
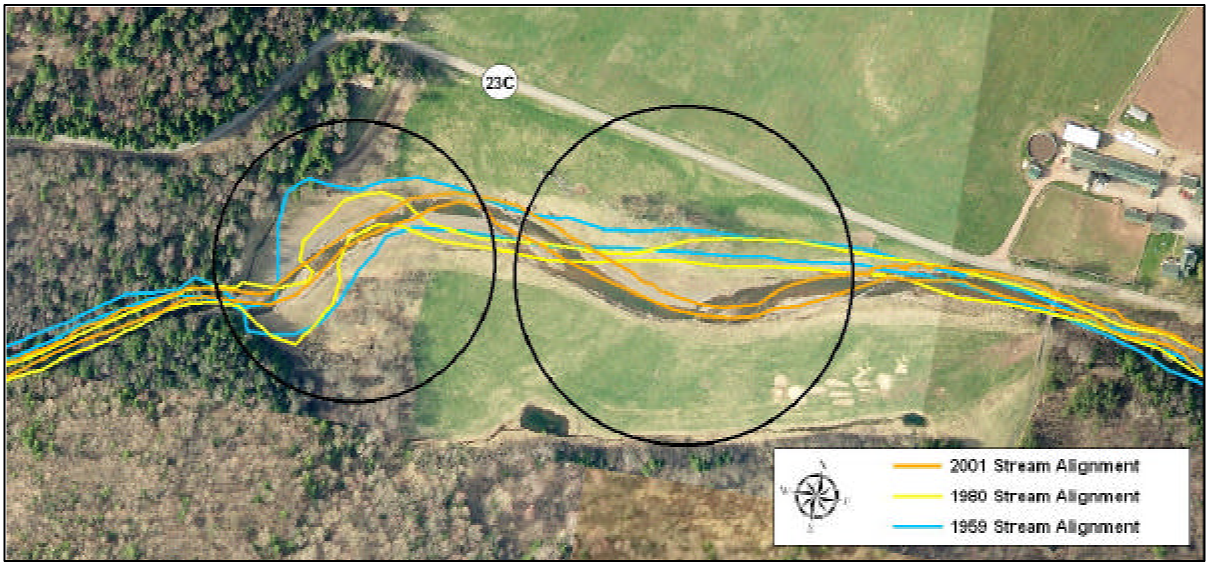


Figure 4.6.1 Management Unit 6 - 2006 aerial photography with stream feature inventory

Historic Conditions



Historic stream channel alignments overlayed with 2006 aerial photograph

As seen from the historical stream channel alignments (above), the *planform* of the channel alignment has changed over the years along this management unit. A review of historic aerial photography showed that there was excessive channel lateral migration in the downstream portion of this management unit, near the confluence of an unnamed tributary. Historically, the stream channel alignment has also been heavily manipulated, resulting in the straightened alignment observed along a significant portion of this reach prior to restoration efforts that were completed in 2000. The Greene County Soil and Water Conservation District designed and coordinated the stream restoration project along this reach, and worked in cooperation with and received support from the NYC Department of Environmental Protection (DEP) for these restoration efforts. The project involved restoring more natural stream morphology with a meandering alignment and higher sinuosity along 2,400 feet of stream channel. The orange (2001) planform seen above represents the constructed channel. For detailed information regarding the restoration project within this management unit see the *Farber Farm Stream Restoration Project – East Kill – Implementation & Monitoring Report* in Appendix E.

As of 2006, according to available NYS DEC records dating back to 1996, there had been one stream disturbance permit issued in this management unit. Following the 1996 flood, a permit was issued for the excavation of sand and gravel to restore stream flows to pre-flood conditions, for the installation or repair of rock rip-rap along the stream bank, and for bridge and culvert repair near station 40138. Stream disturbance permits were also required for the stream restoration project along this reach. The project required permits from NYSDEC and the U.S. Army Corps of Engineers (ACE). The NYSDEC permit (article 15 streambank disturbance & article 21 water quality certification) were issued in 2000 for approximately 3.5 acres of disturbance. The disturbance was limited to the immediate stream corridor and a small borrow area for the fill required to complete the stream channel plan form. USACOE Individual permits were also issued in 2000 and had an expiration date of May 11, 2002.

Stream Channel and Floodplain Current Conditions (2006)

Revetment, Berms and Erosion

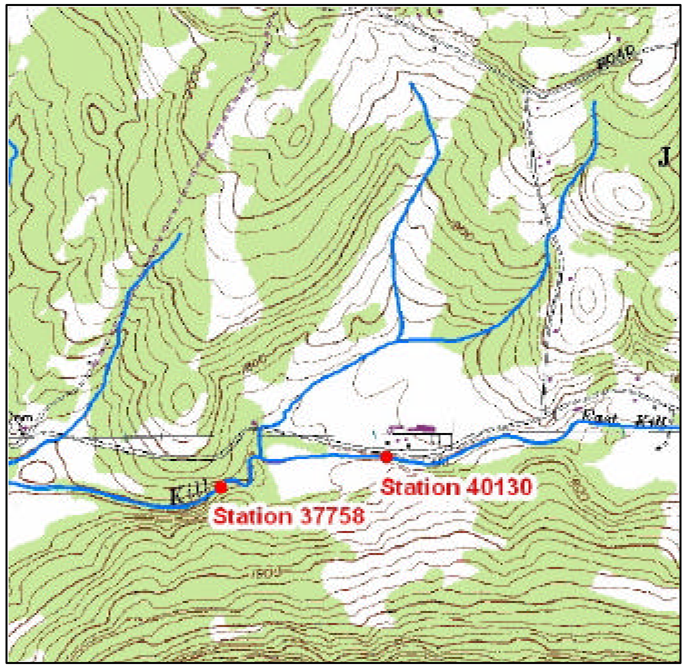
The 2006 stream feature inventory revealed that 14.7% (696 ft) of the stream banks exhibited signs of active erosion along the 4,744 ft of total channel length in the unit (Figure 4.6.1). *Revetment* had been installed on 4.4% (207 ft) of the stream banks. No berms were identified in this management unit at the time of the stream feature inventory.

Stream Channel Conditions (2006)

The following description of stream channel conditions references insets in foldout, Figure 4.6.1. Stream stationing presented on this map is measured in feet and begins at the confluence with the Schoharie Creek at Jewett. “Left” and “right” stream bank 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 an assessment conducted in 2006.

Management unit #6 began at a private bridge on the Farber Farm (Station 40130). The drainage area ranged from 19.34 mi^2 at the top of the management unit to 20.93 mi^2 at the bottom of the unit. The valley slope was 0.75%.

Valley *morphology* in this management unit was laterally controlled at the top of the unit by the encroachment of State Route 23C. As the stream flowed away from Route 23C, valley morphology was relatively unconfined with a broad glacial and *alluvial* valley flat. Generally, stream conditions in this management unit were relatively stable. There were four eroding banks documented in this management unit, including one mass failure. Management efforts in this unit should include preservation of existing wetlands and forested areas and improvements to the riparian buffer by planting *herbaceous* areas and revetted stream banks with native trees and shrubs. Management efforts should also include repair of the stream restoration project; plans for repairing damaged structures and eroding banks within this unit are being developed and work will be initiated in upcoming field seasons.



1980 USGS topographic map – Hunter Quadrangle
contour interval 20ft

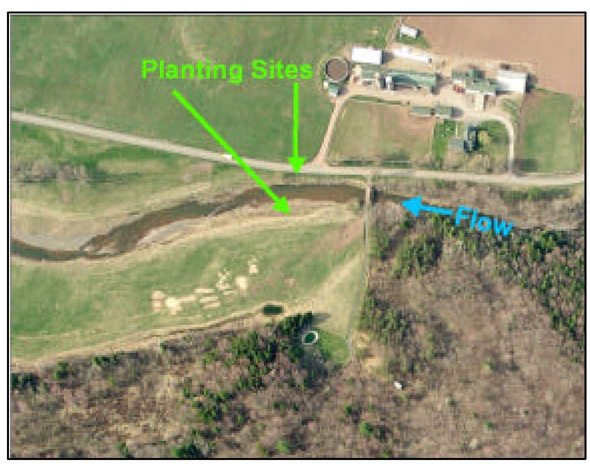
This management unit began as the stream flowed under a private bridge (Station 40130); there was rip-rap along both stream banks upstream and downstream of the bridge. Sediment deposition upstream and downstream of the bridge was observed at the time of the assessment; downstream there was a side bar on the left and full channel aggradation. During periods of high water, streams tend to deposit sediment when velocity slows due to flow constriction under a bridge. While bankfull flows may flow freely through this bridge, higher flows may backwater, resulting in channel aggradation. If this bridge is replaced in the future, it is recommended that

Bridge at Station 40130
photo orientation – looking upstream

Rip-rap at Stations 40130 – 39983
Woody debris at Station 40095
Riparian planting sites at Station 39922

a hydraulic analysis be conducted in order to determine the appropriate bridge width that will provide the capacity to convey flood flows through the opening. Near the bridge abutment, there was a water intake pipe (Station 40124), entering along the left stream bank that provided water for Farber Farm.

Just downstream of the bridge, the left bank was reinforced with 60 feet of rip-rap (Stations 40130 – 40070) that was in fair structural and functional condition. There was a fallen tree along the left bank that provided a minor obstruction to flow. Along the right, the stream bank was reinforced with 147 feet of rip-rap (Stations 40130 – 39983) that was in good structural and functional condition. Interplanting the rip-rap and reinforcing the toe of both stream banks with native shrub and sedge species is recommended. This planting will help to strengthen the revetment, while enhancing aquatic habitat. Continuing downstream a riparian planting site was identified along both stream banks (Station 39922). On the right, there was herbaceous vegetation with a few shrubs interspersed on the face and top of the stream bank, forming a narrow buffer between state Route 23C and the East Kill. This riparian buffer should be enhanced with native trees and shrubs to provide water quality protection from the runoff coming from the impervious road surface. Along the left, a vigorous buffer with mature trees is important because it may filter nutrients and pollutants, if any, from the adjacent agricultural fields. Recommendations for this site include augmentation of the existing buffer with the planting of additional native trees and shrubs along the streambank and the upland area. Buffer width should be increased by the greatest amount agreeable to the landowners. Increasing the buffer width to at least 100 feet



Riparian planting sites at Station 39922 will increase the buffer functionality, by providing improved stream bank stability and protecting water quality.

The Farber Farm Restoration Project, implemented in 2000, began at station 39922, along the proposed riparian planting site. The primary goal of the project was to provide long-term channel stabilization while maintaining the integrity and benefit of a naturally functional channel and floodplain. Secondary project goals included improvement of aquatic and riparian habitat within the project area while maintaining the aesthetic values of a natural stream channel. Water quality protection was also a goal of this project and to achieve that, stream bank erosion was addressed and farm management and grazing practices were modified. The project was constructed during the late summer and early fall of 2000, and in December there was a high flow event that compromised some of the constructed channel. However, most of the rock structures were functioning as designed and received little damage. *Bioengineering* of the restoration site was completed in the spring of 2001. Bioengineering involves the use of live vegetation, either alone or in combination with harder materials such as rock or (dead) wood, to stabilize soils associated with stream banks or hillslopes. Roots stabilize the soil, while stems, branches and foliage slow high velocity water, reducing erosion and encourage deposition of fine sediment. Hydroseed was applied to 1,200 feet of stream banks, and several thousand bareroot seedling and transplants were planted including, streamco willow, hybrid poplar, green ash, red oak, concolor fir and red osier. *Fascines* were also installed along 800 feet of the stream channel. Installation of fascines is a bioengineering method that

Rock vane construction - Summer 2000

High Flow Event - December 2000

uses bundles of small branches of willow or other riparian tree/shrub species, tied together and laid into shallow trenches along a stream to stabilize and revegetate stream bank areas.

Bioengineering - Spring 2001

Monitoring surveys of the project site were conducted in 2001, 2002 and 2004. Following the heavy rains and snow melt in early April 2005, a flood event inspection was conducted. As mentioned previously, detailed information regarding the design, construction and monitoring of this restoration project can be found in Appendix E. The conditions discussed in this section will reflect the observations of the 2006 field inventory and assessment.

The first *rock vane* (Station 39922) of the restoration project was along the right bank. There were 15 rock vanes constructed during the restoration project, but only 14 were observed during the 2006 field assessment. Rock vanes protect the stream bank by redirecting the thalweg away from the stream bank and towards the center of the channel, and rock vanes also improve in-stream habitat through scour, oxygenation, and cover. Single rock vanes are constructed with large boulders which are oriented upstream with angles off the bank from 20 to 30 degrees, just downstream of the point where the stream flow encounters the stream bank at acute angles. At the time of the assessment, this rock vane was in good structural and functional condition. The upstream portion of this rock vane was buried in the bed due to full channel aggradation (Stations 40150 – 39684) conditions that started upstream of the bridge and continued downstream for approximately 466 feet. Excessive sediment deposition persisted through this reach of stream and included side and transverse bars.

Rock vane at Station 39922

Full channel aggradation at Stations 40150 -39684 photo orientation – looking upstream

The second rock vane (Station 39800), also along the right bank, was in good structural condition but appeared to be in fair functional condition. A significant length of the vane was buried in the bed due to aggradation. The third rock vane (Station 39737, Figure 4.6.1 Inset D), along the right bank, appeared to be in good structural and functional condition. There were some willow and sedges reinforcing this rock vane. Continuing the planting site along the right stream bank, will help to improve the stability of these rock structures while providing an important buffer for water quality and improving the aesthetic and habitat value of the structures.

Continuing downstream, there was the first of three *cross vanes* across the stream channel. A cross vane is a type of rock vane used to provide grade control, to keep the thalweg in the center of the channel, and to protect the bank. A cross vane consists of two rock vanes and one center structure perpendicular to the flow. This center structure sets the invert grade of the streambed. Therefore, this structure can be used to raise the bed and is often used at the head of a riffle to set the elevation of the upstream pool. At the time of the assessment, the cross vane appeared to be holding grade and the thalweg was flowing through a hole in the left vane arm.

Cross vane at Station 39679

Excessive sediment deposition including, side and point bars, continued downstream. To obtain access to the agricultural fields along the left side of the stream, there was a stream crossing at station 39436 (Figure 4.6.1 Inset C). Continuing downstream, there were three

Rock vane at Station 39305
photo orientation – looking at

rock vanes along the left stream bank (Stations 39393, 39305 and 39230). A significant portion of each of these rock vanes was buried under a side bar (Stations 39620 – 39205) that stretched for 415 feet in the bed of the stream channel along the left. Due to the excessive sediment deposition and apparent damage to the structures from previous high flow events, the rock structures were in poor structural condition and appeared to be functioning poorly or not at all.

There was significant algal growth through this reach of the stream, which is evidence of nutrient enrichment, which may lead to *eutrophication*. Eutrophication is a process in which the addition of nutrients (primarily nitrogen and phosphorus) stimulates algal or plant growth, which eventually die off and bacteria consume the dead plants and use the available dissolved oxygen reducing the amount available to fish and other stream life. Runoff associated with the nearby agricultural activity is the likely cause of the nutrient enrichment. Investigation of the possible sources of nutrient inputs and developing measures to prevent continued enrichment of the East Kill is recommended.

Continuing downstream along the left, there was erosion (Stations 39192 – 38901) along 291 feet of the stream channel, exposing approximately 2,039 ft^2 of the bank. There was a deep scour hole along the toe of the bank and several rocks from the upstream rock vanes were observed along the bank. At the top of the bank, there was herbaceous vegetation to the edge. Without deep-rooted shrub and tree species, it is likely that this bank will continue to erode during future high flows. This erosion site may be a good candidate for remediation using vegetative toe and bank protection. Recommendations for this site include planting

Erosion at Stations 39192 - 38901

native trees and shrubs along the streambank and the upland area. Buffer width should be increased by the greatest amount agreeable to the landowners. A vigorous buffer with mature trees is important at this site because it may also filter nutrients and pollutants, from the adjacent agricultural fields, thereby potentially reducing the nutrient enrichment and algal growth within the stream. Prior to proceeding with any work, this site would require a more detailed site assessment. During future repairs of the restoration project, it may be necessary to address the erosion at this site to improve bank stability with repairs to the rock structures and through bioengineering techniques.

Opposite the eroding bank, there was a rock vane (Station 39051) along the right stream bank. At the time of the field assessment, most of this rock vane was buried under the aggradation through this stretch of the stream, and it did not appear to be functional.

Rock vane at Station 39051

As the stream meandered to the left, there was a point bar (Stations 38888 – 38003) along the left channel bed for approximately 885 feet. On the outside of the meander bend, opposite the point bar, there were five rock vanes followed by a cross vane. At the time of the assessment, the small upstream portion of the first rock vane (Station 38718) was partially buried under sediment, and there was woody debris lodged between the vane and the adjacent stream bank; the vane appeared to be in fair structural and functional condition. Beginning along this rock vane, there was erosion (Stations 38716 – 38401) affecting 316 feet of the right bank. Stream bank erosion often occurs on the outside of meander bends where the stream velocity is greatest during high flows. Rock vanes are constructed to redirect flow away from the bank, however, due to the damage these

Erosion at Stations 38716 – 38401
Rock vane at Station 38718

structures experienced during previous high flows and the excessive sediment deposition through this reach of stream, the effectiveness of the rock vanes has been reduced. Repair to the damaged rock vanes will help to stop the erosion at this site and prevent future erosion along this meander bend. The second rock vane (Station 38614, Figure 4.6.1 Inset B) along the meander bend was in good structural and functional condition, with herbaceous vegetation and willows established where the vane keyed into the stream bank. Although the erosion continued downstream of this structure, the bank was relatively stable along this rock vane. The third rock vane (Station 38488) along this meander had been significantly compromised. Half of the structure was buried, and scour and erosion had undermined the structure, which was no longer keyed into the bank. The fourth rock vane (Station 38434) along the eroding meander bend appeared to be in poor structural and functional condition. The erosion ended just downstream of this rock structure, and the right stream bank was stable through the fifth rock vane (Station 38344) along this meander, which was in good structural and functional condition. At the time of the assessment, the cross vane (Station 38306) appeared to be in relatively good structural and functional condition, although some of the rocks forming the key for the right vane arm were becoming exposed. As described here, the condition of the rock structures that were used to construct this meander bend varied; further assessment of these and the other structures within this management unit is recommended. Once an on-site assessment of the constructed channel is conducted and the needed repairs identified, it is recommended that all damaged structures receive repair and reinforcement

Rock vane at Station 38488

Cross vane at Station 38306
photo orientation – looking upstream

with bioengineering techniques, and that the eroding banks receive stabilizing treatments.

Wetland boundary approximately delineated by NWI (Stations 38338 - 37816)

Along the downstream portion of this meander bend there was a 0.6 acre palustrine wetland (Stations 38338 - 38100) with scrub-shrub vegetation along the right stream bank, followed by a 0.9 acre riverine wetland (Stations 38100 - 37816) along both stream banks. These wetlands were classified as PSS1A and R3USA respectively (see Section 2.6 for detailed wetland type descriptions). Directly adjacent to the riverine wetland and set back along the left stream bank, there was a 0.6 acre forested palustrine wetland that was classified as PFO1A. Wetlands are important features in the landscape that provide numerous beneficial functions including protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods.

As the stream meandered to the right through the riverine wetland, there were two rock vanes along the left bank. Most of the first rock vane (Station 38057) was buried under excessive sediment deposition and did not appear to be functional at the time of the assessment. Just downstream of this rock structure, there was erosion (Stations 38053 – 38007, Figure 4.6.1 Inset A) along 46 feet of the right stream bank. There was herbaceous vegetation to the top of the stream bank; stability of this bank may be improved by planting native trees and shrubs to establish a riparian buffer, in combination with sedge plantings to reinforce the toe of the bank. Just downstream of this erosion site, there was the

Intermittent tributary at Station 37936 second rock vane (Station 37979) along the left bank; at the time of the assessment the upstream portion of the vane was buried under sediment and it appeared to be in poor structural and functional condition.

Cross vane at Station 37922

Continuing downstream, a small unnamed intermittent tributary (Station 37936) entered through subsurface flow along the right bank. Just downstream, there was a cross vane (Station 37922), which was the final rock structure of the constructed channel. At the time of the assessment, the right vane arm was buried and the cross vane did not appear to be properly functioning. As mentioned previously, a more detailed assessment of the restoration project damages will help to determine the extent of repair that is needed for each of the rock structures. The GCSWCD, in cooperation with the NYCDEP, plans to make repairs to this restoration project, which should improve bank stability and channel morphology throughout this management unit.

At the end of this management unit there was a *mass failure* (Stations 37900 – 37857), along 43 feet of the left stream bank that had exposed approximately 645 ft^2 of mixed till. At the time of the assessment, this bank appeared to be slowly recovering, with herbaceous vegetation, becoming established on the face of the bank. Along a portion of this erosion site, the toe of the bank appeared to be stabilized by the cross vane. However, without deep-rooted shrub and tree species along the face of this bank, it may continue to erode during future high flows. Just upstream from this bank, the land use changed from agriculture to forest. The forested riparian zone, along with additional plantings of shrubs and trees on the face of the bank may

Erosion at Stations 37900 - 37857

help to improve the stability of this bank.

Sediment Transport

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

Sediment transport in this unit was influenced by valley morphology. The relatively unconfined valley form and topography suggest that this unit was a sediment storage zone. This unit has experienced wide-spread sediment transport deficiencies. Bed load transported by the stream channel exceeds the transport capacity of management unit #6, resulting in channel aggradation and lateral migration. Sediment storage areas can benefit the general health of the stream system by limiting bed load delivered to downstream reaches during large storm events. Sediment sinks such as this throughout the watershed should be preserved where adjacent land uses permit. Mature riparian vegetation will be important in such settings to limit the extent of lateral channel migration and bank erosion.

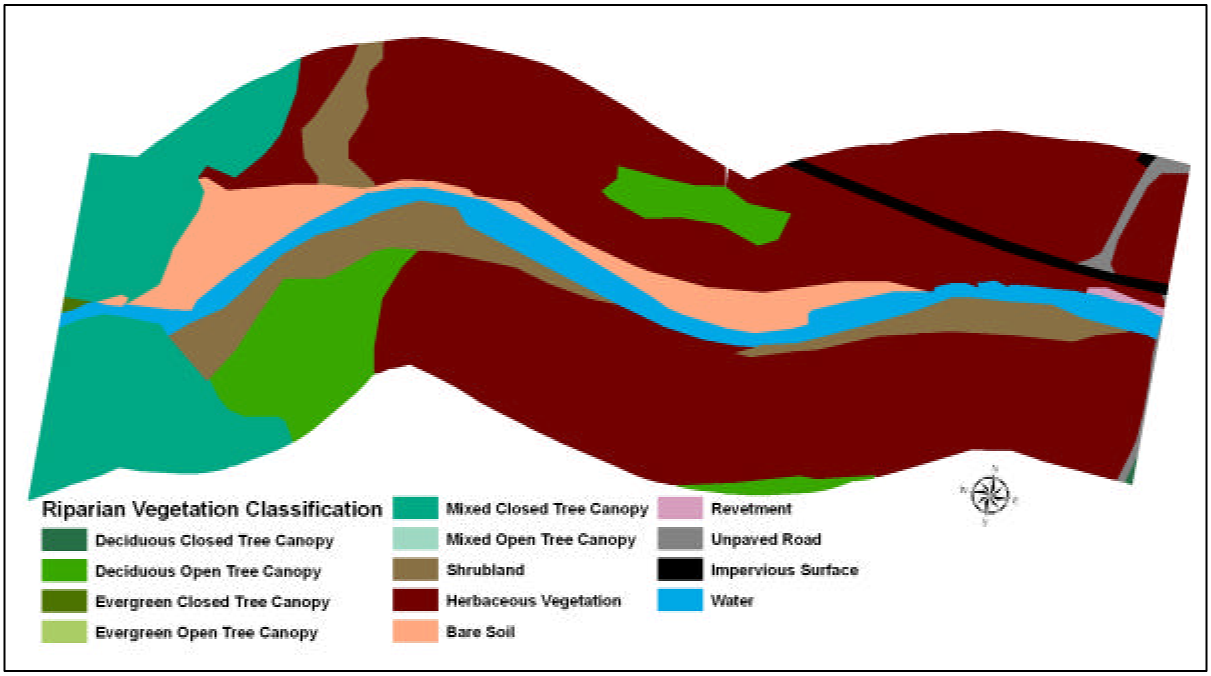
The ability of the channel to convey sediment was also affected by two private bridges that appeared to be contributing to backwater conditions and upstream channel aggradation. Installation of floodplain drainage under bridge approaches may reduce the backwater conditions and improve sediment transport continuity.

Riparian Vegetation

One of the most cost-effective and self-sustaining methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the banks and floodplains, especially within the first 50 to 100 ft of the stream. A dense mat of roots under trees and shrubs binds the soil together, making it much less susceptible to erosion. Mowed lawn (grass) does not provide adequate erosion protection on stream banks because it typically has a very shallow rooting system and cannot reduce erosive forces by slowing water velocity as well as trees and shrubs. One innovative solution is the interplanting of revetment with native trees and shrubs which can significantly increase the working life of existing rock rip-rap, while providing additional benefits to water, habitat, and aesthetic quality. *Riparian*, or streamside, forest can buffer and filter contaminants coming from upland sources, shallow groundwater or overbank flows, and slow the velocity of floodwaters causing sediment to drop out while allowing for *groundwater recharge*. Riparian plantings can include a great variety of flowering trees, shrubs, and sedges native to the Catskills. Native species are adapted to our regional climate and soil conditions and typically require less maintenance following planting and establishment. One suitable riparian improvement planting site was documented within this management unit. There were also multiple locations within this unit that would benefit from interplanting of revetted embankments or enhancing the riparian buffer zone with native vegetation.

Some plant species that are not native can create difficulties for stream management, particularly if they are invasive. Japanese knotweed (*Fallopia japonica*), for example, has become a widespread problem in recent years. Knotweed shades out other species with its 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 stream banks. The results can include rapid stream bank erosion and increased surface runoff leading to a loss of valuable topsoil. Japanese knotweed locations were documented as part of the stream feature inventory conducted during the summer of 2006 (Riparian Vegetation Mapping, Appendix B). The first appearance of Japanese knotweed on the East Kill main stem does not occur until management unit #7. The best means for controlling knotweed is prevention of its spread, therefore, efforts should be made to ensure that all fill brought into the area is clean and does not have fragments of knotweed or other invasive plants. If Japanese knotweed sprouts or small stands are observed, they should be eradicated immediately to avoid further spread within this unit and downstream management units. Periodic monitoring for knotweed introductions in this unit is recommended.

An analysis of vegetation was conducted using aerial photography from 2001 and field inventories (see map below and Riparian Vegetation Mapping, Appendix B). In this management unit, the predominant vegetation type within the 300 ft. riparian buffer was herbaceous (60 %) followed by forested (23%). *Impervious* area (1.2 %) within this unit's buffer was primarily the local and private roadways, and residential structures. Areas of herbaceous (non-woody) cover may present opportunities to improve the riparian buffer with



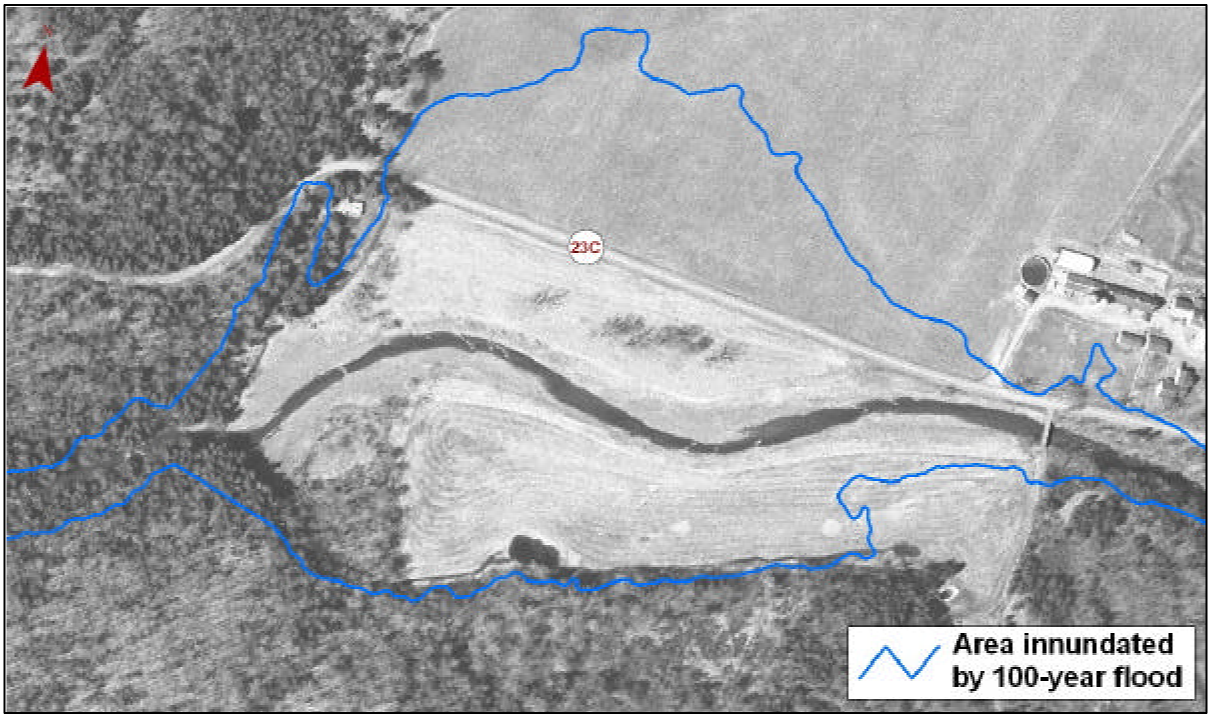
Riparian vegetation classification map based on aerial photography from 2001

tree plantings in order to promote a more mature vegetative community along the stream bank and in the floodplain.

<u>Flood Threats</u>

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. The NYS DEC Bureau of Program Resources and Flood Protection has developed new floodplain maps for the East Kill on the basis of recent surveys. The new FIRM hardcopy maps are available for viewing at the Greene County Soil & Water Conservation District Office and the Jewett Municipal Building. The FIRM maps shown in this plan are in draft form and currently under review. Finalization and adoption is expected by the end of 2007.

According to the current floodplain maps (below), no existing structures in this unit appeared to be situated within the estimated 100-year floodplain. The 100-year floodplain is that area predicted to be inundated by floods of a magnitude that is expected to occur once in any 100-year period, on the basis of a statistical analysis of local flood record. Most communities regulate the type of development that can occur in areas subject to these flood risks.



100-year floodplain boundary map

Aquatic Habitat

Generally, habitat quality appeared to be somewhat compromised throughout this management unit. Canopy cover was inadequate along most of both stream banks. Little woody debris within the stream channel was observed throughout the unit. Woody debris provides critical habitat for fish and insects, and adds essential organic matter that will benefit organisms downstream. There was also excessive algal growth that may have a negative impact on fish and insect populations.

It is recommended that an aquatic habitat study be conducted on the East Kill with particular attention paid to springs, tributaries and other potential thermal refuge for cold water fish, particularly trout. Once identified, efforts should be made to protect these thermal refugia locations in order to sustain a cold water fishery throughout the summer.

Water Quality

Clay/silt exposures and sediment from stream bank and channel erosion pose a potential threat to water quality in the East Kill. Fine sediment inputs into a stream increase *turbidity* and can act as a transport mechanism for other pollutants and pathogens. There were no significant clay exposures in this management unit.

Stormwater runoff can also have a considerable impact on water quality. When it rains, water falls on roadways and parking areas before flowing untreated directly into the East Kill. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly degrade water quality. There were no stormwater culverts in this management unit in 2006.

Nutrient loading from failing septic systems is another potential source of water pollution. Leaking septic systems can contaminate water with nutrients and pathogens making it unhealthy for drinking, swimming, or wading. There were a few buildings located in close proximity to the stream channel in this management unit. These building owners should inspect their septic systems annually to make sure they are functioning properly. Servicing frequency varies per household and is determined by 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. To assist watershed landowners with septic system issues, technical and financial assistance is available through two Catskill Watershed Corporation (CWC) programs, the Septic Rehab and Replacement program and the Septic Maintenance program (See Section 2.12). Through December 2005, no homeowners within the drainage area of this management unit had made use of these programs to replace or repair a septic system.

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