Manor Kill Management Unit 6

Town of Conesville – Station 19795 to Station 15492

This management unit begins at Station 19795 continuing approximately 4,303 ft to Station 15492 in the Town of Conesville.

Stream Feature Statistics

29% of streambanks experiencing erosion
2.85% of streambanks have been stabilized
0% of streambanks have been bermed
115.31 feet of clay exposures
38.55 acres of inadequate vegetation
1,614 feet of road within 300ft. of stream
30.94% of streambanks are proposed for planting

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	No recommendations at this time.
Riparian Vegetation	Treat, remove and prevent the spread of Japanese knotweed where feasible. Plant a buffer of trees and shrubs along proposed planting sites and increase width of riparian buffer in appropriate locations.
Infrastructure	When bridges are replaced, construct with the appropriate height and width to allow conveyance of flood flows.
Aquatic Habitat	Watershed Aquatic Habitat Study
Flood Related Threats	Flood proof the structures within 100 year floodplain; possibly plan for potential flood buyout program.
Water Quality	Building owners adjacent to the stream should inspect their septic systems annually to make sure they are functioning properly, and participate in the CWC septic programs.
Further Assessment	Consider hydraulic analysis of bridge openings; Establish Bank Erosion Monitoring Sites at mass failures.

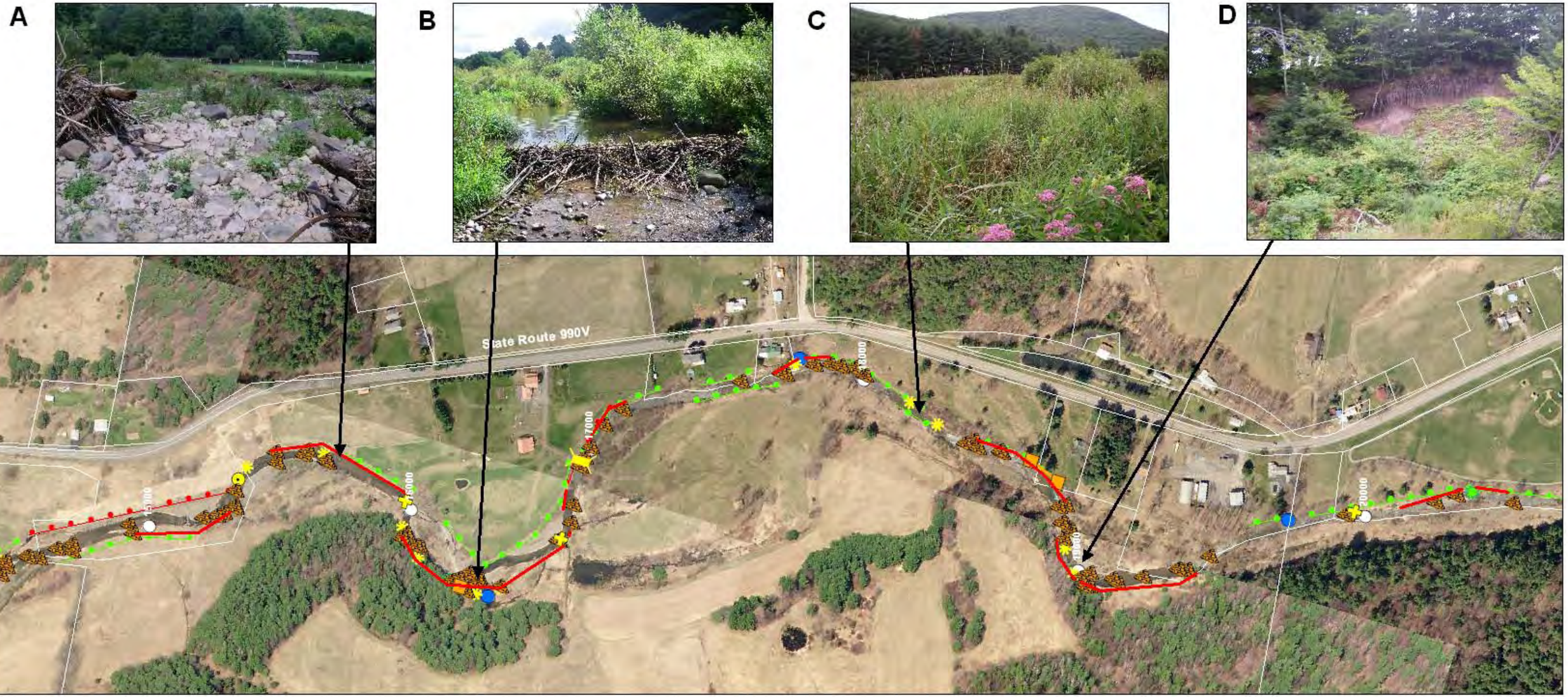
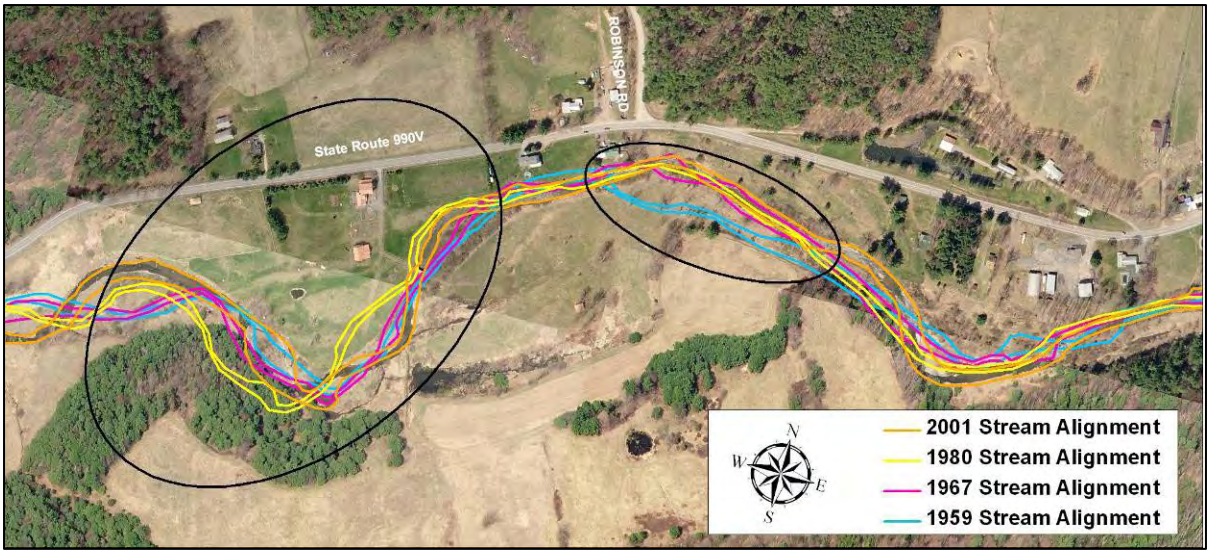


Figure 4.6.1 Management Unit 6 - 2006 aerial photography with 2008 stream feature inventory.

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 has remained fairly stable through the upstream portion of the management unit, but the channel has meandered over the years along the middle and downstream portions of this management unit. The stream has experienced lateral migration in a few locations over the years. Lateral migration is the movement of a channel across its floodplain, which usually results in extensive bank erosion. The outside banks of meander bends tend to move laterally across the valley floor and down the valley.

As of 2007, according to available NYS DEC records dating back to 1989, there have been five stream disturbance permits issued in this management unit. There were four permits issued to an individual property owner. In 1989, a permit was issued for the construction of a wooden bridge across the Manor Kill for farm use; in 1998 a permit was issued to retrieve the decking of this bridge from the stream. In 1995, a permit was issued for a stream crossing for a log forwarder. In 2000, along the same property, there was a permit issued to place rip rap and willows along the streambank; and in 2002 there was a permit renewal for the repair of approximately five feet along the streambank. In 2006, a permit was issued to a second individual to install a five foot diameter culvert for a private driveway.

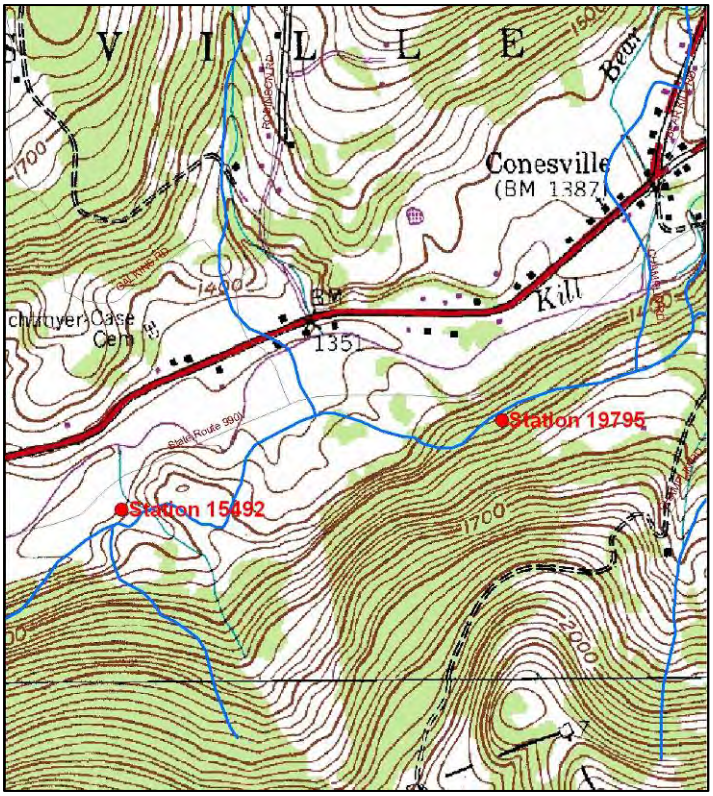
Stream Channel and Floodplain Current Conditions (2008)

Revetment, Berms and Erosion

The 2008 stream feature inventory revealed that 29% (2,489ft.) of the streambanks exhibited signs of active erosion along the 8,606 ft. of total streambank length in the unit (Fig. 4.6.1). *Revetment* has been installed on 2.85% (245 ft) of the streambanks. There were no streambank berms inventoried in the 2008 assessment.

Stream Channel Conditions (2008)

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 Reservoir in Conesville. "Left" and "right" streambank 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 2008.



1980 USGS topographic map – Prattsville Quadrangle contour interval 20ft

Management unit #6 began at Station 19795. The drainage area ranged from 28 mi^2 at the top of the management unit to 30.25 mi^2 at the bottom of the unit. The valley slope was 0.57%.

Valley morphology in this management unit was relatively unconfined with a broad glacial and *alluvial* valley flat; along a portion of the stream, morphology was influenced by the encroachment of State Route 990V. Generally, stream conditions in this management unit were unstable, with deficient sediment transport ability resulting in aggradational

conditions throughout, and approximately 2,489 feet of erosion. There were 11 eroding banks documented in this management unit including two mass failures. Management efforts in this unit should focus on preservation of existing wetlands and forested areas and improvements to the riparian buffer by planting *herbaceous* areas with native trees and shrubs.

Just downstream of the start of Management Unit 6 an unnamed tributary (Station 19752) entered along the right streambank. The tributary may have originated at a culvert near State Route 990V, providing stormwater drainage. At the time of the assessment, there was no flow; there was minor scour of the right streambank at its confluence with the Manor Kill.

Tributary at Station 19752

Downstream of the tributary, there was a proposed riparian planting site (Stations 19719 – 19622) covering approximately 97 feet of the right streambank. There was minor erosion along this bank; at the top of the bank there is a thin line of young trees and shrubs followed by mowed lawn. Enhancing the quality of the buffer and increasing the buffer width to at least 100 feet will help to stabilize the stream bank and protect water quality through this reach by slowing stormwater runoff and filtering pollutants associated with the nearby land use. Recommendations for this site include discontinued mowing to the top of the bank, allowing succession to proceed with natural regeneration of shrub and early successional tree species, and augmentation of the existing buffer by planting 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. Although the erosion at this site was relatively minor, this site may require

Riparian Planting Site at Stations 19719 - 19622

Wetland Boundary approximately delineated by NWI Stations 19500 - 18555

a more detailed site assessment prior to proceeding with any vegetative plantings.

As the stream meandered to the right, there was a 2 acre palustrine wetland (Stations 19500 – 18555). 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 under certain conditions maintaining surface water flow during dry periods. This wetland is classified as PSS1/EM1E, *palustrine, scrub-shrub, broad leaved deciduous, emergent, persistent, seasonally flooded/saturated* (see Section 2.6 for detailed wetland type descriptions). Along this wetland, there were multiple areas of channel *aggradation*, the process by which streams are raised in elevation by the deposition of material eroded and transported from other areas. These areas included several point bars, multiple transverse bars and full channel aggradation.

Along the meander bend, there was erosion (Stations 19405 – 19009) for approximately 397 feet of the left streambank. Streambank erosion often occurs on the outside of meander bends where the stream velocity is greatest during high flows. There was herbaceous vegetation with few trees along this bank. Along the upstream portion of the erosion, there were fallen and compromised trees that appeared to contribute to upstream aggradational conditions and localized scour. Portions of this erosion site appeared to be self-recovering with herbaceous vegetation becoming re-established on the face of the bank. Recommendations for this site include discontinued mowing to the stream's edge,

Erosion at Stations 19405 - 19009

allowing natural regeneration of shrub and early successional tree species.

Woody Debris at Station 19000

Continuing along this meander bend, the *thalweg*, or deepest part of the stream channel, flowed up against the left streambank causing the first mass failure (Figure 4.6.1, Inset D, Stations 19015 – 18872). This mass failure resulted in an erosion area of approximately 7,174 ft^2, exposing roots and compromising mature trees along the bank. During the field assessment, this bank was identified as a proposed Bank Erosion Monitoring Site (BEMS) to study erosion along this reach. To monitor BEMS, a cross-section and long profile may be conducted to collect baseline data. Once the baseline data has been collected, this cross-section can be resurveyed in the future to calculate the bank's erosion rate. Along this erosion site, multiple large trees (Stations 19000 and 18918) had fallen across the stream channel contributing to upstream aggradation and localized scour of the channel bed and toe of the streambank. The first woody debris obstruction contributed to scour that created large, deep pools. Woody debris such as this, is beneficial to a stream system, it provides critical habitat for fish and insects, and adds essential organic matter that will benefit organisms downstream.

As the stream gently meandered to the left, there was a channel *divergence* (Station 18897) along the left, where a flood chute split off from the main channel. Flood chutes convey flow through a secondary channel during periods of high flows; this flood chute flows behind a point bar (Stations 18882 – 18828) and converges (Station 18378) with the main channel approximately 519 feet downstream. Point bars commonly form on the inside of meander bends, where stream velocity is slower during high flows, allowing

Channel Divergence at Station 18897

sediment to drop out of the water column and settle along the stream bed.

Japanese Knotweed at Station 18760

Further downstream, there was the first significant stand of Japanese knotweed in this unit (Station 18760, there were smaller patches further upstream in this unit). Japanese knotweed is an invasive non-native species which does not provide adequate erosion protection due to its very shallow rooting system; knotweed also grows rapidly and tends to crowd out more beneficial streamside vegetation. The best means for controlling knotweed is prevention of its spread. Therefore, effort should be made to ensure that existing stands are not fragmented via unnatural processes (i.e. mowing without removal of all mowed material) and transported into downstream areas. Small stands should be eradicated immediately to avoid further spread within this unit and downstream management units. There are removal methods that may be used for larger stands (see Section 2.7); these methods should be used with caution and carefully executed to avoid further spread of Japanese knotweed.

Continuing downstream, there was erosion (Stations 18771 – 18410) along the right streambank for approximately 361 feet. Along the upstream portion of the erosion site, lacustrine clay was exposed (Stations 18718 - 18607) in the channel bed and toe of the streambank. Clay inputs into a stream are a serious water quality concern because they increase *turbidity,* degrade fish habitat, and can act as transport for, or mask the presence of, other pollutants and pathogens. There was little to no riparian buffer along much of this erosion site, and it was located along a proposed riparian planting site (Stations 18713 – 18413). Recommendations for this site include discontinued mowing to the stream's edge to allow succession to proceed, and establishing and enhancing the buffer

Riparian Planting Site at Stations 18713 - 18413

Wetland boundary approximately delineated by NWI Stations 18335 - 17754

through the planting of native shrub and tree species. Reinforcing the toe of the streambank with native sedge species is also recommended. Buffer width should be increased by at least 100 feet or the greatest amount agreeable to the landowners. Prior to proceeding with any vegetative plantings, a more detailed assessment may be necessary and the eroding conditions should be given careful consideration when identifying the appropriate species and locations for plantings. Aggradational conditions persisted along this stretch of stream. Downstream of the proposed planting site there was a one acre palustrine wetland (Stations 18335 – 17754) classified as PEM1A, *palustrine, emergent, persistent, temporarily flooded*.

Continuing downstream, there was an old beaver dam (Station 18281) causing a partial obstruction of the left portion of the stream channel. This beaver dam appeared to contribute to upstream and downstream aggradational conditions. There was a second old beaver dam (Station 18168) further downstream across the full channel that also posed a partial obstruction to stream flow and contributed to localized aggradational conditions. While beaver impoundments can sometimes be a nuisance, beavers have historically played a beneficial and ecologically important role in the stream system. Beaver activity adds organic debris (trees, leaves, etc. which provide the base of the food chain), reduces water velocities and flood-related hazards downstream, and creates wetland areas that filter sediment and release water to the stream and groundwater slowly throughout the year.

Beaver Dam at Station 18281

Along this stretch of stream, there were two additional proposed riparian planting sites; one on the left streambank (Figure 4.6.1, Inset C, Stations 18252 – 18132) for

Erosion at Stations 17875 - 17793

approximately 120 feet and the other on the right streambank (Stations 18215 – 17786) for approximately 429 feet. Recommendations for these sites remain consistent with the previously discussed planting sites including, planting native tree and shrub species along the streambank and upland areas and increasing the buffer width to at least 100 feet or the greatest amount agreeable to the landowners. Aggradational conditions persisted along this stretch of stream including multiple point bars and a transverse bar. Along the downstream portion of the planting site along the right streambank, there was erosion (Station 17875 – 17793) for approximately 82 feet. These conditions may need additional assessment and should be considered when identifying the appropriate species and locations for plantings along this portion of the planting site.

Continuing downstream, a sizable unnamed *tributary* (Station 17786) entered along the right streambank. This tributary drains the slopes of the adjacent mountains before it reaches the flatter topography of the valley floor where it enters the Manor Kill. As a result of this stream slope change, the tributary lost its ability to transport sediment gathered from the mountain slopes, and began to deposit sediment at its mouth and into the more gently sloped Manor Kill. This is a common feature of confluence areas, which often contain extensive sediment bars, function as important sediment storage areas and are typically among the most dynamic and changeable areas in the stream system. The New York State Department of Environmental Conservation classifies streams and rivers based on their "best use" (NYSDEC, 1994). This tributary was classified C by the NYS DEC, indicating that the best uses for this stream are supporting fisheries and other recreational activities.

Head Cut at Station 17788

Erosion at Stations 17782 - 17690

Just upstream of the tributary confluence, there was a *head cut* (Station 17788). A head cut is a marked change in stream bed slope, as in a step or waterfall, which is unprotected or of greater height than the stream can maintain. The stream was actively eroding the streambed downward to a new base level; there was a drop in channel elevation of approximately six feet.

Continuing downstream, there was erosion (Stations 17782 – 17690) along the right streambank for approximately 92 feet. The erosion had compromised several young trees and caused a large tree to fall across the stream channel; the fallen woody debris was posing an obstruction to flow that appeared to contribute to upstream aggradational conditions and localized scour of the channel bed and toe of the streambank. At the top of the bank, a fence was undercut, beyond which there was a house. If this bank continues to actively erode, both the fence and home may be in danger.

Further downstream, there were two additional proposed riparian planting sites. The first site stretched along the left streambank (Stations 17693 – 17418) for approximately 275 feet. There was herbaceous vegetation to the stream's edge with a few willows and sedges along the bank. At the top of the bank, there was a fence surrounding a maintained field. Recommendations for this site include establishing a woody buffer by planting native tree and shrub species. The second riparian planting site (Stations 17618 – 17440) stretched along the right streambank for approximately 178 feet. This site had a mix of herbaceous vegetation and shrubs along the face of the streambank, with mown lawn to the top of the bank. In addition to augmenting the existing buffer with native plantings, recommendations for this site include discontinued mowing to the top of the

Riparian Planting Site at Stations 17618 - 17440

streambank, allowing succession to proceed with natural regeneration of shrub and early successional tree species. It is recommended that buffer width for both sites be increased to at least 100 feet or the greatest amount agreeable to the landowners. There were two small stands of Japanese knotweed along this stretch of stream which should be removed.

As the stream meandered to the left, there was a significant wetland complex (Stations 17384 – 16428) comprised of three federal wetlands. Two of the wetlands were along the stream corridor, both of these were palustrine; the first was approximately a 0.8 acres, the second was approximately 1.4 acres in size. These wetlands are classified as PFO1A, *palustrine, forested, broad-leaved deciduous, temporarily flooded*, and PEM1A, *palustrine, emergent, persistent, temporarily flooded*, respectively (see Section 2.6 for detailed wetland type descriptions). The third wetland was set back from the stream along a tributary (Station 16407) that drains to the Manor Kill, and is also classified as PEM1A.

Wetland boundary approximately delineated by NWI Stations 17384 – 16428

Riparian Planting Sites Stations 17300 – 16963 and 16937 - 16264

There were two proposed riparian planting sites (Stations 17300 – 16963 and Stations 16937 - 16264) along this wetland complex stretching for a total of approximately 1,010 feet along the right streambank. Along these sites, there was mown lawn to the stream's edge. Recommendations for this site include, discontinued mowing to the stream's edge and establishing a wooded buffer with native vegetation at least 100 feet wide or the greatest width agreeable to the landowner. There were areas of erosion along this site. One of the erosion sites (Stations 17200 – 17010) had resulted in an erosion area of approximately 2,094 ft^2 along approximately 190 feet of the right streambank. This bank was nearly vertical and had some herbaceous

Erosion at Stations 17200 - 17010

Revetment at Stations 17146 - 16971

vegetation and willows at the toe of the bank. Prior to proceeding with any vegetative plantings, the eroding conditions should be given careful consideration when identifying the appropriate species and locations for plantings; a more detailed site assessment and bank grading may be necessary.

Along portions of this erosion site, the right streambank was reinforced with rip rap (Stations 17146 – 16971) comprised of large rocks, stacked nearly vertical, for approximately 175 feet. Sections of the revetment had failed structurally; it was in poor functional condition and did not provide adequate scour protection. It is likely that the revetment will continue to fail during future high flows. The bank may need to be graded to lessen the slope of the revetment; interplanting the rip rap and reinforcing the toe of this streambank with native shrub and sedge species is recommended. Such plantings may help to strengthen the revetment, while enhancing aquatic habitat. The risk to bank stability can be minimized by maintaining mature trees along the critical 100 foot buffer zone. Aggradational conditions persisted through this stretch of stream including, multiple side bars, a point bar and a transverse bar.

Continuing downstream, the Manor Kill flowed under a private bridge (Station 16957). Gravel deposits upstream and downstream of the bridge were noted. Deposits such as these are commonly caused by inadequate sizing of the bridge opening. An undersized bridge opening causes water to back up upstream of the bridge, reducing stream velocity, which results in sediment deposition. There has been damage to the abutment on both sides of the bridge; in 1998 a streambank disturbance permit was issued to repair the damage. Flood damage to bridges is typically caused by inadequate hydraulic capacity of the bridge, misaligned piers and/or abutments,

Bridge at Station 16957

or accumulation of debris. As bridges are replaced over time, these issues should be evaluated and adjusted if necessary to lessen the probability of flood damage by providing a more effective conveyance channel that promotes water and sediment flow through the bridge opening.

Revetment at Stations 16944 - 16874

Downstream of the bridge, the right streambank was reinforced with rip rap (stations 16944 – 16874) for approximately 70 feet. It was in fair structural and functional condition and didn't appear to provide adequate scour protection. As with the rip rap upstream of the bridge, a planting site continues along here and interplanting the revetment and reinforcing the toe of this streambank with native shrub and sedge species is recommended.

Just downstream of the rip rap, continuing along the proposed planting site, there was erosion (Stations 16842 – 16778) along the right streambank for approximately 64 feet. The erosion had compromised some shrubs and young trees that had fallen along the streambank. Herbaceous vegetation appeared to be re-establishing itself along portions of the eroding bank. This erosion site may be a good candidate for remediation using vegetative toe and bank protection.

Continuing downstream, there was a channel crossing (Station 16693) to provide access to the agricultural fields along the left side of the stream. Maintenance of the crossing appeared to contribute to upstream and downstream aggradational conditions. Along the left streambank, there was minor erosion (Stations 16710 – 16695) just upstream of the crossing for approximately 15 feet. Erosion (Stations 16677 – 16296) continued downstream of the crossing for approximately 381 feet along the left. Both of these erosion sites had herbaceous vegetation to the top of

Channel Crossing at Station 16693

Beaver Dam at Station 16432

the bank with a few willows along the face and toe of the streambank. Active maintenance of herbaceous vegetation to the stream's edge is not recommended; discontinuation will allow natural regeneration of native tree and shrub species to proceed. Over time, this may result in a deep-rooted woody riparian buffer that may improve streambank stability.

Along the downstream portion of this erosion site, there was a beaver dam (Station 16432) occupying the left portion of the stream channel, from the left streambank to a well vegetated center bar (Stations 16432 – 16293). The stream channel was over wide through this stretch of stream. The beaver dam appeared to contribute to upstream and localized aggradational conditions. Just downstream of the beaver dam, an unnamed tributary (Station 16407) entered along the left streambank. The flow through this tributary appeared to be affected by beaver activity, with multiple deep pools, including one at its confluence with the Manor Kill. Further downstream, there was a more substantial beaver dam (Figure 4.6.1, Inset B, Station 16370) also stretching from the left streambank to the center bar (Stations 16432 – 16293), occupying the left portion of the stream channel. This dam caused backwater upstream of the dam and appeared to contribute to excess sediment deposition upstream and downstream of the dam. Through this section of the stream, the channel was over wide and there were multiple areas and types of aggradational conditions including, center, side, point and transverse bars. These conditions seem to be maintained by abundant beaver activity.

Mass Failure at Stations 16317 - 16052

As the stream meandered downstream, the *thalweg* flowed up against the toe of the left bank, undermining the steep slope and causing a mass failure (Stations 16317 – 16052). During the field assessment, this

bank was identified as a proposed Bank Erosion Monitoring Site (BEMS) to study erosion along this reach. Collection of baseline data, including a cross-section and long profile, is recommended. Once the baseline data has been collected, this cross-section can be resurveyed in the future to calculate the bank's erosion rate. At the time of the assessment, this mass failure had resulted in an erosion area of approximately 6,621 ft^2, exposing areas of lacustrine clay (Station 16315) and compromising mature trees. The fallen trees were in multiple locations along the streambank (Stations 16283, 16153 and 16052) and were contributing to upstream aggradation and localized scour of the channel bed and toe of the streambank, including scour of a deep pool along the downstream end of the erosion site. Excess sediment deposition resulted in the formation of side, point, transverse and center bars along this meander bend. There were also multiple small patches of Japanese knotweed through this stretch of stream.

Woody Debris at Station 16052

Continuing downstream, there was a 1.3 acre palustrine wetland followed by a 1.1 acre palustrine wetland that started in management unit 6 and continued into management unit 7. These wetlands are classified PEM1E, *palustrine, emergent, persistent, seasonally flooded/saturated*, and PSS1E, *palustrine, scrub-shrub, broad-leaved deciduous, seasonally flooded/saturated*, respectively. At the start of this wetland, as the stream meandered to the left, there was a substantial point bar (Figure 4.6.1, Inset A, Stations 16060 - 15714) stretching along the left channel bed for approximately 346 feet. Point bars commonly form on the inside of meander bends, where stream velocity is slower during high flows, allowing sediment to drop out of

Wetland boundary approximately delineated by NWI
Stations 16055 – 14985

Riparian Planting Site at Stations 15969 - 15716

Channel Crossing at Station 15966

the water column and settle along the stream bed. There was abundant woody debris on the upstream portion of the point bar that exacerbated the aggradational conditions through this stretch of stream.

Continuing along this meander bend, there was a stream channel crossing (Station 15966) that appeared to serve primarily as a stream access point. It appeared as though channel material was placed upstream and downstream of the access point to help maintain the crossing and to protect the streambank. The channel material used for bank protection is not likely to withstand significant stream velocities. During future high flows, this material will likely be mobilized and carried to downstream locations. This type of channel modification is not recommended. The NYS DEC Protection of Waters Program requires a permit for stream bed or bank disturbance including excavating gravel material and placing fill along streambanks.

Downstream of the channel crossing, there was a proposed riparian planting site (Stations 15969 – 15716) along the right streambank for approximately 254 feet. Recommendations for this site include discontinued mowing to the stream's edge, allowing succession to proceed with natural regeneration of shrub and early successional tree species, and establishing a wooded buffer with plantings of native shrub and tree species. The risk to bank stability can be minimized by maintaining mature trees along the critical 100 foot buffer zone. Buffer width should be increased by the greatest amount agreeable to the landowners. A vigorous riparian zone with deep-rooted native trees and shrubs would increase buffer functionality such as filtering nutrients and pollutants, if present, from the nearby land use. This site will

Riparian Planting Site at Stations 15969 - 15716

Erosion at Stations 15962 – 15500 (upstream portion)

require a more detailed site assessment, and the erosion would need to be addressed prior to proceeding with any riparian plantings.

Erosion at Stations 15962 -15500 (downstream portion)

Along the planting site, and continuing downstream, the right streambank was eroding (Stations 15962 – 15463) for approximately 499 feet. There was mown lawn to the top of the bank along the upstream portion of the erosion site, beyond which there was a fence surrounding a horse pasture. Continued erosion along this bank may compromise a portion of the fence. The erosion continues downstream of the pasture; this portion of the erosion site has old field or periodically maintained herbaceous vegetation to the top of the bank. The bank height and severity of the erosion also appeared to worsen moving downstream. Along the downstream end of the erosion site, there were remains of an old foundation that appeared to contribute to localized scour of the channel bed and toe of the streambank, and caused upstream backwater and aggradational conditions. The channel was over wide along this stretch of the stream. This site may benefit from the installation of *bioengineering* techniques that utilize 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. If bioengineering techniques are going to be considered for streambank stabilization through this reach, an in-depth survey, a thorough morphological assessment and a project design may be required. Management unit 6 ended just downstream of this erosion site.

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 3.2 for more details on Stream Processes).

Sediment transport in this unit is influenced by valley morphology and multiple beaver dams and woody debris obstructions. The unconfined valley form and topography suggest that this unit is a sediment storage zone, supplied by tributaries and active erosion. This unit suffers from wide-spread sediment transport deficiencies. Bed load transported through this unit exceeds the transport capacity of this management unit, resulting in channel aggradation and some areas of lateral migration. In general, sediment storage areas benefit the general health of the stream system by limiting bedload delivered to downstream reaches during large storm events. However, mature riparian vegetation will be important in such settings to limit the extent of lateral channel migration and continued bank erosion.

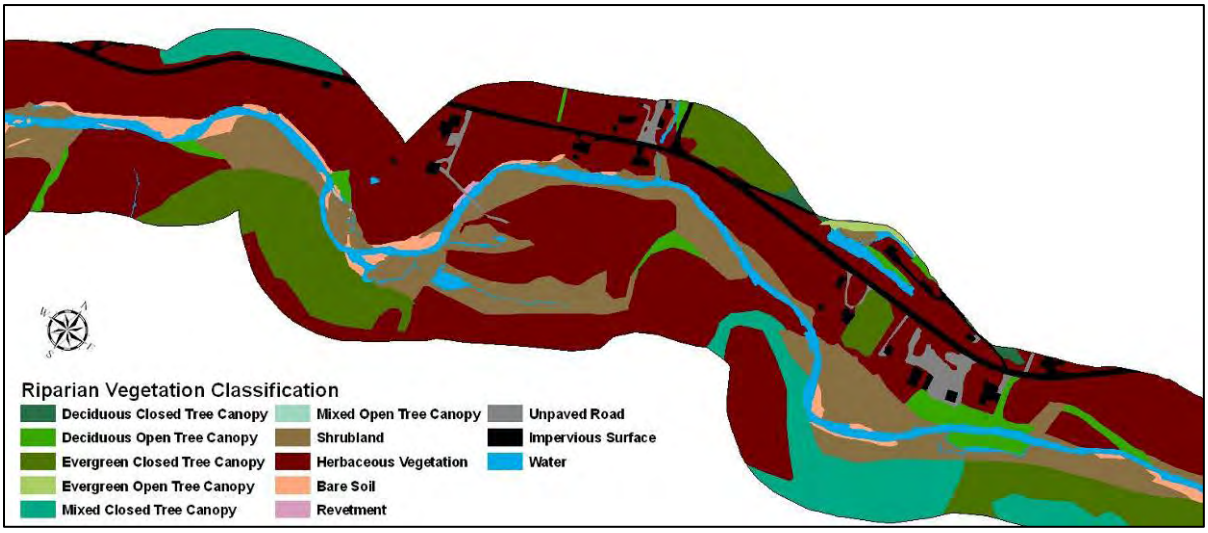
Riparian Vegetation

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. There were nine riparian improvement planting sites documented within this management unit; proposed planting sites cover approximately 30.94 percent of the streambanks in this unit.

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 streambanks. The results can include rapid streambank 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 2008 (Riparian Vegetation Mapping, Section 2.7). In total, 10 Japanese knotweed occurrences covering an estimated length of 32 feet were documented during the stream feature inventory. The best means for controlling knotweed is prevention of its spread, therefore, effort 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 to downstream management units.

Japanese knotweed at Station 17973

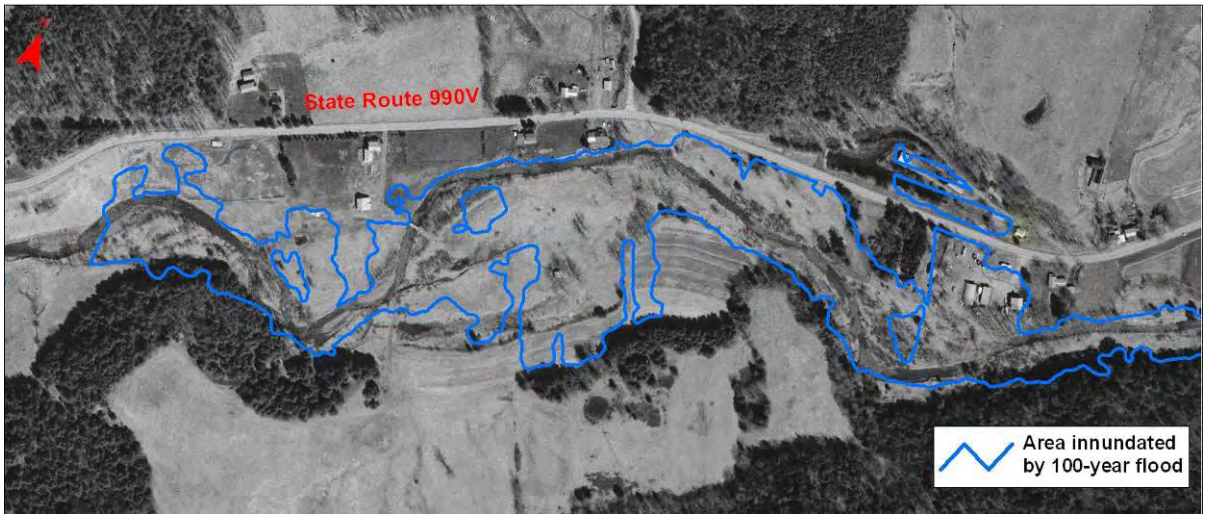
An analysis of vegetation was conducted using aerial photography from 2006 and



Riparian vegetation classification map based on aerial photography from 2006

field inventories (see above map and Riparian Vegetation Mapping, Section 2.7). In this management unit, the predominant vegetation type within the 300 ft. riparian buffer was herbaceous (48.91%) followed by forested (21.77%). *Impervious* area (4.25 %) within this unit's buffer was primarily the local and private roadways. Areas of herbaceous (non-woody) cover may present opportunities to improve the riparian buffer with tree plantings in order to promote a more mature vegetative community along the streambank and in the floodplain.

Flood Threats



100-year floodplain boundary map

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 Manor Kill on the basis of recent surveys. The new FIRM hardcopy maps are available for viewing at the Schoharie County Soil & Water Conservation District Office.

According to the current floodplain maps (above), three 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.

Aquatic Habitat

Generally, habitat quality appeared to be poor throughout this management unit. Canopy cover was inadequate along a significant portion of both streambanks. There were some areas of woody debris accumulation observed in the unit. Woody debris provides critical habitat for fish and insects, and added essential organic matter that will benefit organisms downstream.

In 2008, researchers from SUNY Cobleskill conducted macroinvertebrate and fish surveys along the Manor Kill. There were two sampling sites within Management Unit 6. See the macroinvertebrate and fish reports (Appendix F) for more detailed information regarding the surveys and their findings.

It is recommended that an aquatic habitat study be conducted on the Manor 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 Manor Kill. Fine sediment inputs into a stream increase *turbidity* and can act as a transport mechanism for other pollutants and pathogens. There were two 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 Manor 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 observed in this management unit in 2008. However, the tributary at Station 19752 may be part of stormwater infrastructure draining Rte 990V.

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 2007, no homeowner within the drainage area of this management unit had made use of these programs to replace or repair a septic system.

References

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