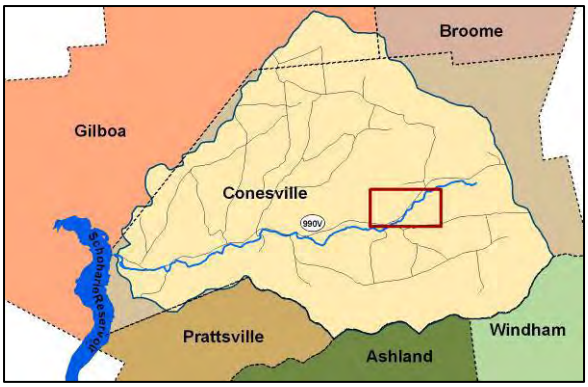
Manor Kill Management Unit 2

Town of Conesville – Manor Creek Rd. (Station 45598) to Beaver Hill Rd. (Station 38909)

This management unit begins at Manor Creek Road, and continues approximately 6,689 ft to Beaver Hill Road in the Town of Conesville.



Management Unit 2 location
see Figure 4.0.1 for more detailed map

Stream Feature Statistics

21% of streambanks experiencing erosion
1.15% of streambanks have been stabilized
2.92% of streambanks have been bermed
0 feet of clay exposures
50.01 acres of inadequate vegetation
5,584 feet of road within 300 feet of stream
7.94% of streambanks are proposed for planting

Summary of Recommendations Management Unit 2	
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	No recommendations at this time.
Water Quality	Removal of dump sites.
Further Assessment	Consider hydraulic analysis of bridge openings.

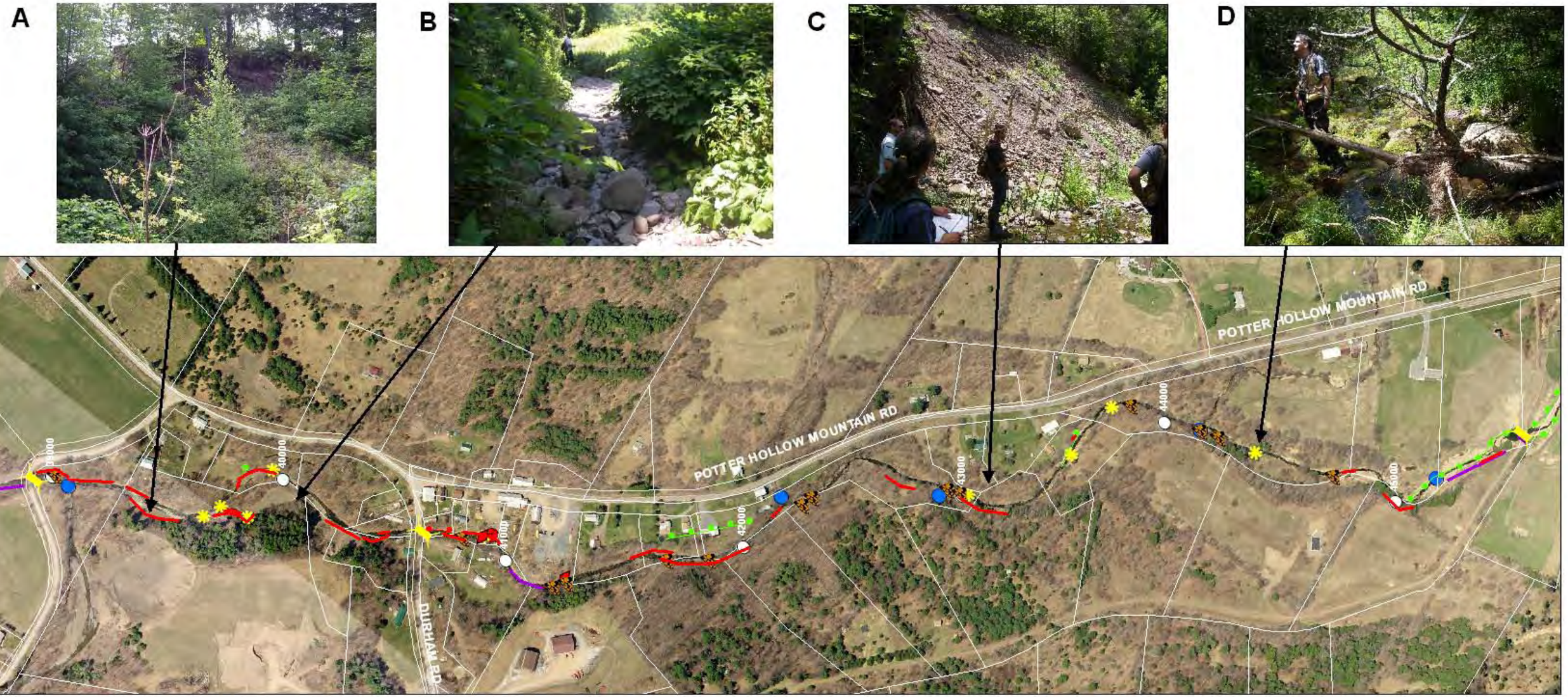
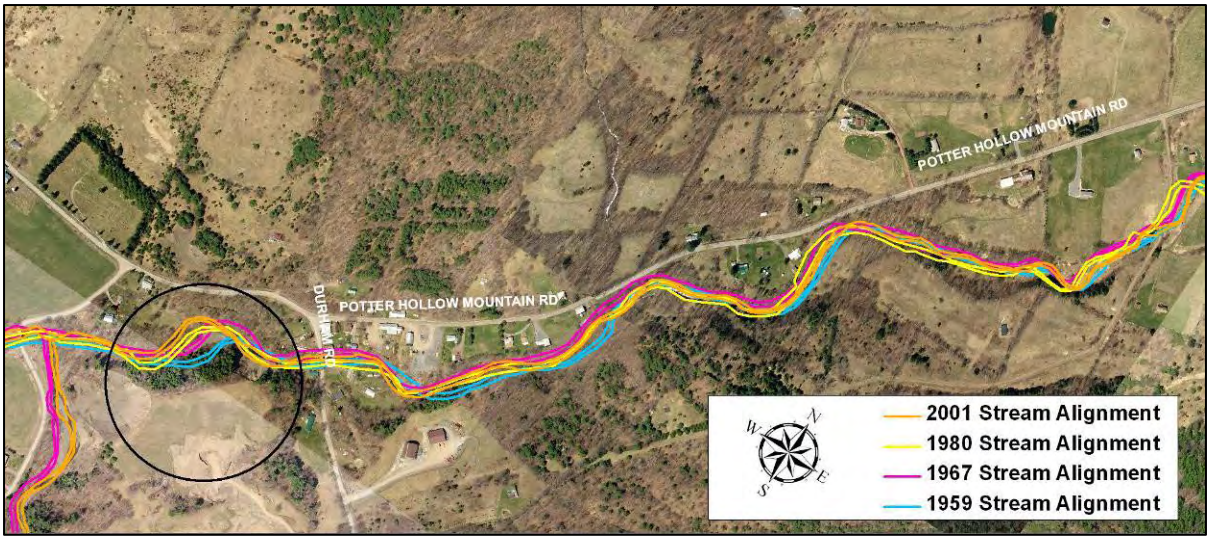


Figure 4.2.1 Management Unit 2 - 2006 aerial photography with 2008 stream feature inventory.

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 not changed significantly from 1959 to 2001 along this management unit; the channel has remained fairly stable. However, there has been lateral migration (between Stations 40400 and 39500) and the formation of a secondary channel (between 2001 and 2006) along the downstream portion of this management unit as indicated on the alignment map above. Along this stretch of stream there is an active gravel mine that didn't appear to become active until sometime between 1967 and 1980. The activity associated with this gravel mine has contributed to streambank instability along this stretch of stream.

As of 2007, according to available NYS DEC records dating back to 1998, there have been four stream disturbance permits issued in this management unit. Following the 1996 flood, two permits were issued for the repair and clean-up of flood damage. In 1998, a permit was issued to the Town of Conesville to install rip-rap along the streambank behind the town garage. In 2005, a permit was issued to Schoharie County to repair scour damage to County Bridge 17 (Beaver Hill Road).

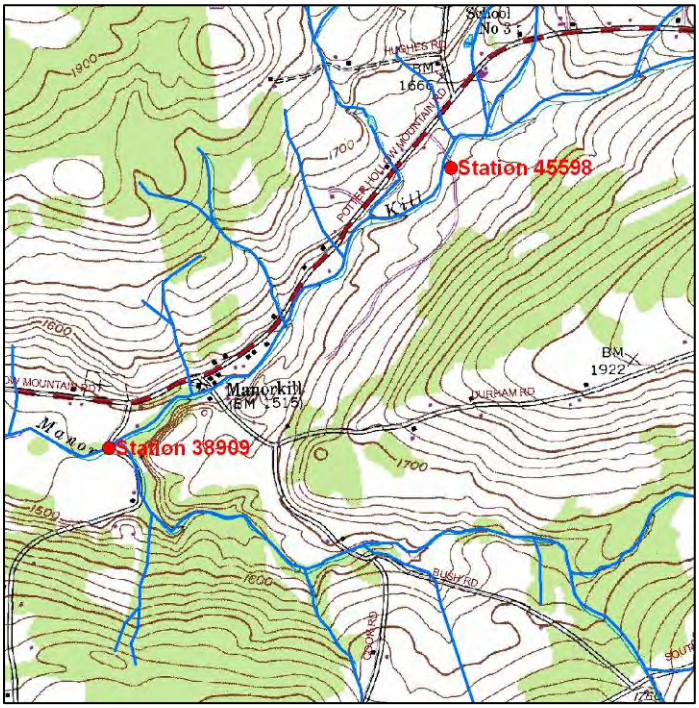
Stream Channel and Floodplain Current Conditions (2008)

Revetment, Berms and Erosion

The 2008 stream feature inventory revealed that 21% (2,789 ft.) of the streambanks exhibited signs of active erosion along the 13,378 ft. of total streambank length in the unit (Fig. 4.2.1). *Revetment* has been installed on 1.2% (154 ft.) of the streambanks. Approximately 2.3% (390.2 ft.) of the streambanks have been bermed.

Stream Channel Conditions (2008)

The following description of stream channel conditions references insets in foldout, Figure 4.2.1. 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 – Livingstonville Quadrangle contour interval 20ft

Management unit #2 began at Manor Creek Road. The drainage area ranged from 3.36 mi^2 at the top of the management unit to 11.25 mi^2 at the bottom of the unit. The valley slope was 1.97%.

Valley morphology in this management unit was relatively unconfined with a broad glacial and *alluvial* valley flat in the upstream portion of this management unit. As the stream meandered to the right (near station 44000), morphology was influenced by the encroachment of Potter Hollow Mountain Road until the stream meandered to the left,

moving away from the road (near station 39800). Generally, stream conditions in this management unit were somewhat unstable, with approximately 2,789 feet of erosion. There were 23 eroding banks documented in this management unit, including four mass failures. Management efforts in this unit should focus on preservation of existing wetland and forested areas and improvements to the riparian buffer by planting *herbaceous* areas with native trees and shrubs.

Culvert and Bridge at Station 45598

This management unit began at the Manor Creek Road bridge (Station 45598). One large culvert conveyed flow under the private bridge; it was supported by boulder sized stacked rock abutments. There was water ponding upstream and downstream of the bridge at the time of the assessment, with no flow beyond the downstream pond. The pond downstream of the bridge appeared to have been dredged and maintained. While most flows may pass freely through this bridge, flood flows may be constricted, potentially contributing to backwater. If this bridge is replaced in the future, it is recommended that it be constructed with the appropriate bridge width that will provide the capacity to convey flood flows.

Downstream of the bridge, there was a berm (Stations 45502 - 45256) along approximately 246 feet of the left streambank. Berms such as this, while created with the best of intentions, tend to raise flood elevations and increase the erosive power of the stream. Along the upstream portion of this berm, there was erosion (Stations 45487 - 45395) for approximately 92 feet, exposing roots and compromising trees. It is recommended that berms be evaluated for their influence on floodplain connectivity and stream entrenchment. In some cases, removal should be considered where there are significant negative impacts.

Riparian Planting Site at Stations 45580-45072

Algae at Station 45348

Also downstream of the bridge, there was a proposed riparian planting site (Stations 45580 - 45072) along approximately 510 feet of the right streambank. This site had herbaceous vegetation to the edge of the stream, and appears to be maintained as a hay field. At the time of the assessment, subsurface flow became surface flow along the upstream portion of this planting site. A vigorous buffer with mature trees is important at this site because it may also filter nutrients from the adjacent fields. Nutrient inputs appear to be a threat to water quality along this stretch of stream as evidenced by the significant algal growth (Station 45348) within the stream channel. Recommendations for this site include planting 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 will increase the buffer functionality and protect water quality through this reach by slowing stormwater runoff and filtering pollutants associated with nearby land uses. Along this planting site, a small unnamed intermittent tributary (Station 45217) entered along the right streambank providing drainage for the adjacent agricultural field.

As the stream meandered to the right, there was erosion (Stations 45083 - 44941) on the left bank. Streambank erosion often occurs on the outside of meander bends where the stream velocity is greatest during high flows. Along this section of stream, during high flows the toe of the bank is undermined, which has compromised the steep slope and resulted in an erosion area of approximately 3,525 ft^2. There are several mature trees that have been compromised or have fallen along this erosion site. At the top of the bank, there was an open field with a narrow wooded

Erosion at Stations 45083 - 44941

Erosion at Stations 44794 - 44741

buffer. Although this bank was a significant erosion site, it appeared to be slowly recovering, with herbaceous vegetation, including grasses and ferns, becoming established on the face of the bank. However, 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. Prior to proceeding with any work, this site would require a more detailed site assessment.

As the stream meandered to the left, there was minor hydraulic erosion (Stations 44794 - 44741) along the right streambank. The streambank had a mixture of herbaceous and woody vegetation along the face of the bank, and a mature forested buffer at the top of the bank. This site may self-recover over time. Downstream of the eroding bank there was a center *bar*: a location within the stream channel in which sediment accumulates and occupies a significant portion of the channel. The center bar, with well-established herbaceous vegetation, stretched for approximately 25 feet within the stream channel.

Continuing downstream, a tree had fallen (Figure 4.2.1, Inset D, Station 44383) from the right streambank across a portion of the stream channel. Some woody debris has accumulated along the fallen tree. At low flow, the tree and associated debris caused a minor obstruction to flow, but it may pose a more significant obstruction at higher flows. It appeared to be contributing to upstream scour along the right bank. However, woody debris is beneficial to a stream system, it provides critical habitat for fish and insects, and adds essential organic matter that will benefit organisms downstream.

Tributary at Station 44143

Further downstream, there was a vegetated point bar (Stations 44231 - 44152) along the left bed. At the time of the assessment, there was a small secondary channel flowing along the left side of the point bar. Opposite this point bar,

an unnamed intermittent tributary (Station 44143) entered from the left streambank. 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 for other recreational activities.

Point bar at Station 43862

As the stream meandered to the left, there was a point bar (Station 43862) with established herbaceous vegetation along the left stream bed. Point bars commonly form on the inside of meander bends, where stream velocity is slower during high flows, allowing sediment to drop out of the water column and settle along the stream bed. Also along the left streambank, there was a channel *divergence* (Station 43868) 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 converges (Station 43686) with the main channel approximately 182 feet downstream.

Continuing downstream, there was a proposed riparian planting site along the right streambank. Along the upstream portion of the planting site (Stations 43623 - 43479), there was minor erosion (Station 43586) for approximately 20 feet, where herbaceous vegetation is mowed to the edge of the stream. Along the downstream end of the site, there was a small dam (Station 43539), constructed of cobble. The dam appeared to be maintained in order to create a shallow pool adjacent to the yard, and was contributing to upstream scour of the streambank. Recommendations for this site include discontinued mowing to the stream's edge, planting native sedges along the toe of the bank, and planting native trees and shrubs along the streambank and the upland area. Buffer width should be increased by the

Riparian Planting Site at Stations 43623 - 43479

greatest amount agreeable to the landowners.

Japanese knotweed at Station 43195

Further downstream, the first occurrence of Japanese knotweed (Station 43291) on the Manor Kill was observed. Continuing downstream there were additional stands of Japanese knotweed along approximately 46 feet of the right stream bank (Stations 43195 - 43149) and approximately 76 feet of the left streambank (Stations 43112 - 43036). 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 (Section 2.7), these methods should be used with caution and carefully executed to avoid further spread of Japanese knotweed.

As the stream *meandered* to the right, there was a *mass failure* along the left streambank (Figure 4.1.1, Inset C, Stations 43193 - 42999). Streambank erosion often occurs on the outside of meander bends where the stream velocity is greatest during high flows.

Woody Debris at Station 43016

Along this section of stream, the *thalweg* flows up against the toe of the bank undermining the steep slope, resulting in an erosion area of approximately 6,786 ft^2, exposing mixed till and compromising mature trees along the bank. Along the downstream portion of the mass failure, a young tree had fallen across the stream channel causing a minor obstruction (Station 43016) at low

flows. During higher flows, it likely poses a more significant obstruction contributing to backwater and upstream *aggradation*, or excess sediment deposition.

Erosion at Stations 42815 - 42692

As the stream gently meandered to the left, there was a point bar (Stations 42997 - 42498) along approximately 49 feet of the left stream bed. Continuing downstream, a small unnamed intermittent tributary (Station 42916) entered along the left streambank.

Further downstream, there was erosion (Stations 42815 - 42692) along approximately 123 feet of the left streambank. Along the upstream portion of the erosion there was a successional old field along the top of the bank; continuing downstream the top of the bank was forested. The toe of the bank was undermined causing the top of the bank to slump over, exposing roots and compromising trees. Along the downstream portion of the erosion site there was a fallen tree across the channel, which was not causing an obstruction at low flow, but may pose a more significant obstruction during higher flows. There were multiple stands of knotweed along the left and right banks along this stretch of stream.

As the stream meandered to the left, there were two channel divergences (Stations 42614 and 42542) along the left streambank of the main channel. At the time of the assessment, there was very low surface flow and at times flow was subsurface in one of the channels. These secondary channels most likely serve as flood chutes during periods of high flow; they converged (Stations 42511 and 42445) with the main channel approximately 100 feet downstream.

Center Bar at Stations 42347 - 42300

Continuing downstream, the stream was experiencing *aggradation*, the process by which streams are raised in elevation by the deposition of material eroded and

Erosion at Stations 42216 - 42164

transported from other areas, and a center bar (Station 42347 to 42300) had formed within the stream channel. Just downstream of the center bar, an intermittent tributary (Station 42237) entered along the right bank. This tributary was classified C by the NYS DEC, indicating that the best uses for this stream are supporting fisheries and other non-contact activities. The tributary confluence with the Manor Kill was relatively steep and appeared to contribute to downstream erosion (Stations 42216 - 42164) along approximately 52 feet of the right streambank. There was herbaceous vegetation on the face of the bank and a few young trees at the top of the bank, beyond which there was mown lawn and a barn. Although this site was not identified as a proposed planting site, recommendations for this site include the discontinuation of mowing to the stream's edge and planting native trees and shrubs along the upland area to augment the existing buffer. Prior to proceeding with any vegetative plantings, the condition of the eroding bank should be given careful consideration when identifying the appropriate species and locations for plantings.

As the stream gently meandered to the right, there was minor erosion (Stations 42007 - 41807) along approximately 200 feet of the left streambank. The face of the bank was vegetated with herbaceous vegetation, beyond which there was a closed northern hardwood forest. The streambank was undercut along the downstream portion of the erosion. This erosion site may be a good candidate for remediation using vegetative toe and bank protection, but may self recover with time. Prior to proceeding with any work, this site would require a more detailed site assessment.

Erosion at Stations 41805 - 41651

Just downstream, there was more significant erosion (Station 41805 – 41651) of

the left streambank for approximately 154 feet. Along the upstream portion of the erosion site, the bank was undercut, roots were exposed and some young trees had fallen; it was forested at the top of the bank. There was herbaceous vegetation at the toe of the bank and some on the face of the bank. Japanese knotweed persisted through this stretch of stream, and there were aggradational conditions (center bar) within the stream channel.

Opposite the erosion sites, there was a proposed riparian planting site (Stations 42094 - 41763); a successional old field with a thin line of trees providing a narrow buffer between the field and the stream's edge. Recommendations for this site include augmentation of 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 will increase the buffer functionality and protect the stream from nearby land uses. Just downstream, along approximately 170 feet of the right streambank, there was an erosion site (Stations 41705 - 41534) with mowed lawn to the top of the bank; some areas had a thin line of trees and shrubs. There was also a small rock wall at the top of the bank for approximately seven feet.

Riparian Planting Site at Stations 42094 - 41763

As the stream gently meandered to the right, there was a side bar (Stations 41297 - 41244) with herbaceous vegetation along the left streambank. Opposite the side bar, there was a dump site (Station 41291) with remnants of a concrete foundation and scrap metal. This dump site was relatively close to the stream's edge, and the stream may mobilize some of the metal material during high flows. It is recommended that the scrap metal and any additional hazardous material be removed from the dump site.

Concrete obstruction at Stations 41233 - 41178

Along the left streambank, there were large concrete pieces dumped along the toe of the streambank, with herbaceous vegetation established throughout. Downstream of this revetment (Stations 41239 - 41184), concrete remnants had washed into the channel; these concrete blocks appeared to contribute to upstream aggradation causing stream flow to go subsurface. Water reappeared further downstream where the stream bed consisted primarily of natural material.

As the stream meandered to the right, there was a berm (Stations 41184 - 41040) along approximately 144 feet of the left streambank. Generally, it is recommended that berms be evaluated for their influence on floodplain connectivity and stream entrenchment. Removal should be considered where there is significant negative impact. This berm appears to be relatively old with trees and shrubs established along the length of the berm, therefore removal is not recommended.

Berm at Stations 41184 - 41040

Continuing downstream, there was erosion (Station 40950 to Station 40787) along approximately 163 feet of the right streambank. There was herbaceous vegetation along the eroding bank with a parking lot at the top of the streambank beyond a narrow herbaceous buffer. There was also a utility crossing (Station 40898) along the eroding bank. Recommendations for this site include discontinued mowing to the top of the streambank and planting of native trees and shrubs along the upland area to create a deep-rooted wooded buffer to filter runoff from the parking lot and provide increased stability to the streambank. Prior to proceeding with any vegetative plantings, the condition of the eroding bank should be given careful consideration when identifying the appropriate species and locations for plantings.

Erosion at Stations 40950 - 40787

Dump Site at Station 40863

Along this eroding bank, concrete was dumped in the stream channel (Station 40861) and a mixture of concrete, metal and other debris was dumped along the streambank (Station 40863). The concrete within the stream channel posed an obstruction to flow and caused upstream aggradation. Discontinuing to actively dump material along the bank and within the stream channel is recommended. Recommendations also include removal of all hazardous material and any material along the streambank that may be mobilized during a flood.

Continuing downstream, there was minor hydraulic erosion along approximately 88 feet (Stations 40796 - 40708) of the left streambank. There was a mown lawn with a house at the top of the bank that may be compromised if the erosion persisted or worsened. However, the bank appeared to be self-recovering with shrubs and young trees along the erosion site. This site may be a good candidate for buffer augmentation with native tree and shrub plantings. Along the right, the streambank was stabilized with rip-rap (Station 40734 to Station 40635) comprised of cobbles and small boulders. The rip-rap was in fair structural and functional condition. Japanese knotweed was persistent through this stretch of stream.

Further downstream, there was a bridge (Station 40631), with excess sediment deposition upstream of the bridge. Aggradation such as this is 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. While bankfull flows may flow freely through this bridge, higher flows may backwater, resulting in the upstream aggradation. If this bridge is replaced in the future, it is recommended that a hydraulic analysis be conducted in order to determine the appropriate bridge width that will

Bridge at Station 40631

provide the capacity to convey flood flows through the opening.

Erosion at Stations 40494 - 40454

Downstream of the bridge there was erosion (Stations 40494 - 40454) along the right streambank. Flow through here had caused undercut banks, exposing roots and compromising mature trees. Opposite this erosion site, there was minor erosion (Stations 40493 - 40388) along the left streambank. Both of these streambanks had a narrow wooded buffer between the adjacent mown lawn and residential trailers.

As the stream meandered to the right, the minor hydraulic erosion on the left streambank was followed by a *mass failure* (Stations 40414 - 40265). Streambank erosion often occurs on the outside of meander bends where the stream velocity is greatest during high flows; along this section of stream, the thalweg flows up against the toe of the bank undermining the steep slope, resulting in an erosion area of approximately 7,431 ft^2, exposing mixed till and compromising mature trees along the bank. At the top of the bank, there was a gravel mine. Along the upstream and downstream portions of the erosion site, there was a narrow wooded buffer between the gravel mine and the eroding bank; however, the majority of the eroding bank has no buffer or a thin line of trees. Continued mining activity may contribute to the streambank instability along this site.

Mass Failure at Stations 40414 - 40265

Downstream of the mass failure, there was a channel *divergence* (Station 40207) where a secondary channel (Figure 4.2.1, Inset B) split off from the main channel; it converges (Station 39662) with the main channel approximately 545 feet downstream. There was Japanese knotweed along both banks of the secondary channel. Along the left streambank of the secondary channel, there was erosion (near Station 39900) that had

Erosion near Station 39900

compromised mature trees causing them to fall across the channel. These trees would pose a significant obstruction during high flows. At the time of the assessment, there was subsurface flow along the upstream portion of the secondary channel; surface flow began at the woody debris obstruction. Flow in the main channel was also subsurface downstream of the mass failure. Along this erosion site, a low terrace with herbaceous and shrubby vegetation had formed, evidence that the bank may be starting to self-recover. However, above the terrace, the streambank continued to slump. There is a forested buffer, approximately 150 – 200 feet wide, between the gravel mine and the eroding streambank. Loss of this buffer and continued mining activity may contribute to further instabilities along this stretch of stream.

As the main channel meandered to the left, there was erosion (Stations 39970 - 39812) along approximately 158 feet of the right streambank, causing exposed roots, an undercut bank, and compromising small trees. Along the upstream portion of the erosion site, there was a young forest; continuing downstream, there was herbaceous vegetation mowed to the edge of the bank. This area was identified as a potential riparian planting site (Station 39867 – 39790). Recommendations for this site include planting native trees and shrubs along the streambank and the upland area, and reinforcing the toe of the bank by planting sedge species. Buffer width should be increased by the greatest amount agreeable to the landowners. Increasing the buffer width to at least 100 feet will increase the buffer functionality and protect the stream from nearby land uses. Due to the erosion along this site and the potential need for bank grading, a more detailed site assessment may

Riparian Planting Site at Stations 39867 - 39790

Erosion at Stations 39838 to 39801

be necessary prior to proceeding with any plantings.

Just downstream, there was another erosion site (Stations 39838 - 39801) along approximately 37 feet of the right streambank, exposing roots and compromising trees. It appeared as though the channel along this erosion site had been historically managed through dredging of the streambed material and deposition of the dredged material along both sides of the stream channel. Japanese knotweed persisted along this stretch of the stream. Downstream of the eroding bank, flow returned to the channel at the time of the assessment.

Continuing downstream, there was a channel divergence (Station 39568) along the left, where a flood chute split off from the main channel. Flow was subsurface for much of the channel length; along the downstream portion of the flood chute flow returned to the surface. This secondary channel converged (Station 39395) with the main channel approximately 173 feet downstream from the channel divergence. At this location, the flood chute continued with a second divergence from the main channel that converged (Station 39174) approximately 221 feet downstream. Along the left bank of the secondary channel there was a mass failure (Figure 4.2.1, Inset A, Stations 39532 - 39316). This resulted in an erosion area of approximately 6,490 ft^2 that had compromised mature trees along the bank. Although this bank was a significant erosion site, it appeared to be slowly recovering, with herbaceous vegetation, shrubs and young trees becoming established on the face of the bank. However, if this secondary channel became the main channel or carried significant flow during high flood events, it would further compromise the mass failure. The instability along this stretch of stream was also

Convergence at Station 39395

influenced by the adjacent gravel mine. It is recommended that mining of gravel close to the stream's edge be discontinued, allowing a vegetated buffer to regenerate naturally. Opposite the mass failure and continuing downstream, the right streambank was experiencing hydraulic erosion in three locations totaling approximately 388 feet.

Mass Failure at Stations 39532 - 39316

Downstream a sizable unnamed tributary (Station 39073) enters from the left streambank. Although there was no flow at the time of the assessment, this tributary drains the slopes of South Mountain 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 loses 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.

Management Unit 2 ended at the Beaver Hill Road bridge (Station 38909). Downstream of the tributary and upstream of the bridge, full channel aggradation (Station 39020) was observed. While the bridge opening seemed to provide an adequate span for low flows, higher flows appear to backwater, reducing stream velocity, which results in upstream aggradation. If this bridge is replaced in the future, it is recommended that it be constructed with the appropriate bridge width that will provide the capacity to convey flood flows through the opening. Hydraulic analysis should be conducted in order to determine the appropriate bridge width that will provide the capacity to convey water and sediment flow through the opening.


Bridge and Aggradation at Stations 38909 &39020

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 bridges. Generally, the stream channel was well connected to its floodplain and there were few major sediment sources in the unit. Evidenced by lack of significant aggradation the stream appeared to be conveying its sediment load effectively throughout most of this management unit. However, hydraulic constrictions (undersized bridges and culverts) in the management unit should be addressed.

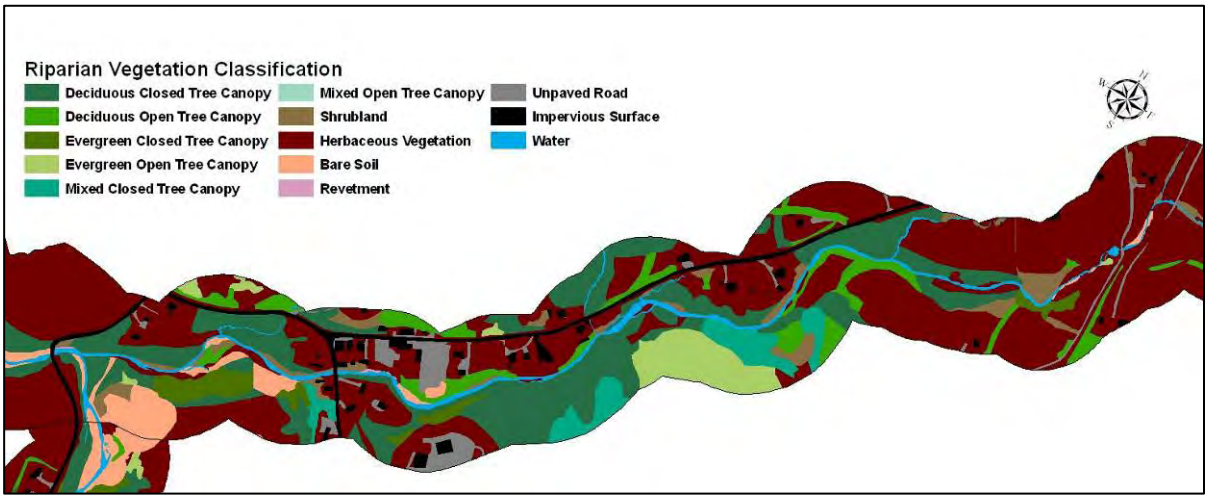
Riparian Vegetation

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 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 and allow 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 four riparian improvement planting sites documented within this management unit; proposed planting sites cover approximately 7.94 percent of the streambanks in this unit.

Japanese knotweed at Station 42469

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, 54 Japanese knotweed occurrences, along an estimated length of 2,816.50 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 downstream management units.

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

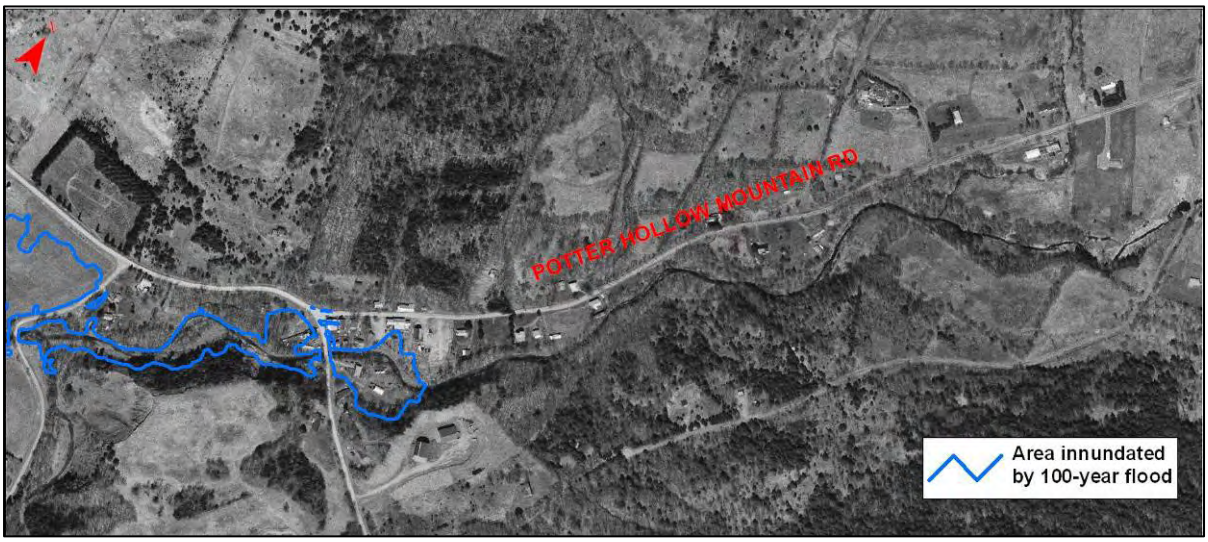


Riparian vegetation classification map based on aerial photography from 2006

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 (44.57%) followed by forested (40.06). *Impervious* area (4.64 %) 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

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.



100-year floodplain boundary map

According to the current floodplain maps (above), eight existing structures in this unit appeared to be situated within the estimated 100-year floodplain. For this management unit, floodplain map coverage did not include the upstream portion of the Manor Kill. It is recommended that hydraulic analysis be completed to create floodway and floodplain maps from the end point of existing maps upstream to the headwaters wetland complex where the

main stem begins. 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. For much of this unit, flow was subsurface at the time of the assessment, which eliminates habitat for a variety of aquatic organisms and creates a blockage for fish passage to upstream and downstream portions of the stream that had surface flow. Canopy cover to provide shading for the stream channel was absent along a significant portion of the stream, which has a negative impact on the quality of habitat where there was surface flow. There were some areas of woody debris accumulation observed in the unit. Woody debris provides critical habitat for fish and insects, and adds essential organic matter that will benefit organisms downstream.

In 2008, researchers from SUNY Cobleskill conducted macroinvertebrate and fish surveys along the Manor Kill. There was one sampling site within Management Unit 2. 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 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

Manor Kill. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly degrade water quality. However, there were no stormwater culverts observed in this management unit in 2008.

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, one homeowner within the drainage area of this management unit had made use of these programs to replace or repair a septic system.

References

NYSDEC, 1994. New York State Department of Environmental Conservation. Water Quality Regulations: Surface Water and Groundwater Classifications and Standards, NYS Codes, rules and regulations, Title 6, Chapter 10, Parts 700-705.

ACE, 1998-1999 (updated 2005) National Inventory of Dams Data Dictionary. Army Corps of Engineers. 1998-1999, updated 2005. http://crunch.tec.army.mil/nid/webpages/nid.cfm

Koltun, G.F., Landers, M.N., Nolan, K.M. & Parker, R.S. (1997) Sediment transport and geomorphology issues in the water resources division. In *Proceedings of the U.S. Geological Survey (USGS) sediment workshop: expanding sediment research capabilities in today's USGS, February 4-7, 1997, Reston, VA. and Harpers Ferry, WV.* Reston, VA: US Geological Survey.