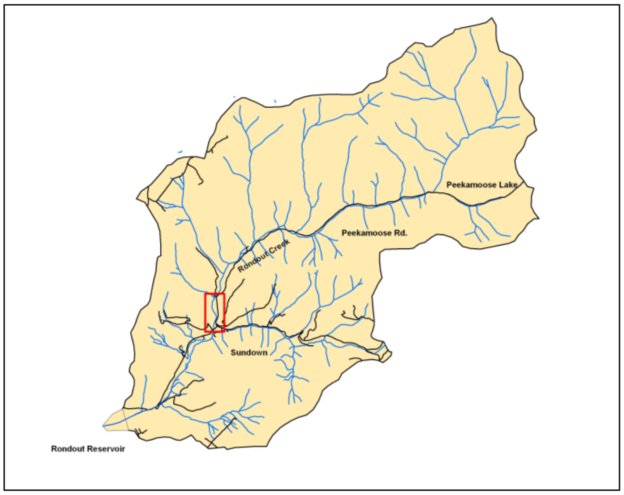
Rondout Creek Management Unit 8



Stream Feature Statistics

8 % of stream length is experiencing erosion

7.3 % of stream length has been stabilized

2.64 acres of inadequate vegetation within the 100 ft. buffer

675 ft. of stream is within 50 ft. of the road

5 houses located within the 100-year floodplain boundary

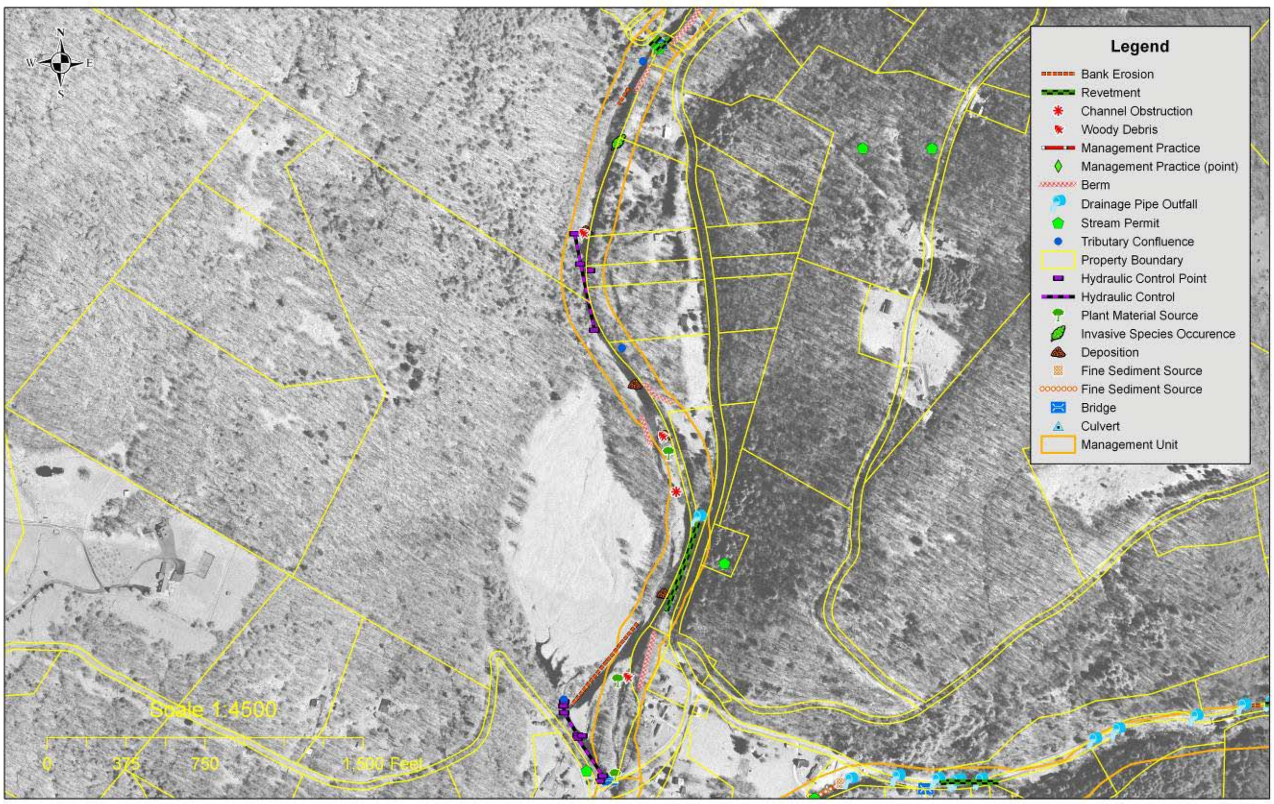


Figure 1 Management Unit 8 Stream feature inventory

Management Unit 8
Between Station 18,500 and Station 22,300

Management Unit Description

This management unit begins at a bridge crossing on Balace Road, continuing approximately 3,815 ft. to a bridge crossing at Sundown Road. The drainage area ranges from 26.3 mi^2 at the top of the management unit to 25.1 mi^2 at the bottom of the unit. The valley is a glacially scoured, U-shaped trough, with a slope of 1.1 %. The average valley width is 974.3 ft.

Stream conditions are variable in this management unit, with significant bank erosion, unstable sections of bed aggradation, and historic channel management of sidecast berms and overwidening in some places.

Summary of Recommendations Management Unit 8	
Intervention Level	Assisted self-recovery at Stn 22000; Full restoration between Stns 18800 and 19300.
Stream Morphology	Establish single, competent channel at full restoration site; evaluate sediment transport dynamics throughout reach.
Riparian Vegetation	Improve riparian buffer at Stn 20200, and at full restoration site. Additional buffer plantings as appropriate.
Infrastructure	Monitor changes in channel profile along newly installed stacked-rock wall.
Aquatic Habitat	Watershed fishery study is recommended.
Flood Related Threats	Conduct an updated hydraulics study of the management unit (flood study).
Water Quality	Evaluate resident eligibility and interest in CWC Septic Repair and Replacement Program.
Further Assessment	Evaluate unnamed tributary at Stn 22200 as a significant source of bedload. Conduct hydraulics and sediment transport study (MUs 7-10)

Historic Conditions

As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 Geology of Rondout Creek, for a description of these deposits. These deposits make up the soils in the high banks along the valley walls on the Rondout mainstem and its tributaries. These soils are eroded by moving water, and are then transported downstream by the creek. During the periods when the forests of the Rondout watershed were heavily logged for timber, firewood and to make pasture for livestock, the change in cover and the erosion created by timber skidding profoundly affected the Rondout hydrology and drainage patterns. The valley floor here is an *alluvial floodplain*, deposited by the stream when, during large flood events, the quantity of material eroded out of the major tributaries – particularly Sundown Creek downstream and Stone Cabin Brook upstream-- overwhelmed the Rondout's ability to transport it. In the roughly one hundred and twenty centuries since the retreat of the glaciers, the position of Rondout Creek probably moved back and forth across this valley floor floodplain numerous times.

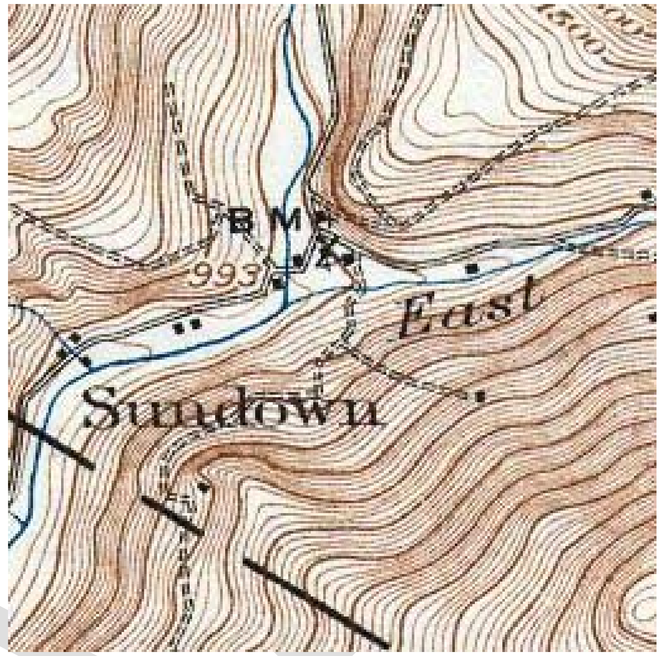


Figure 2 Excerpt of 1905 USGS topographic map MU8

Stream Channel and Floodplain Current Conditions

Revetment, Berms and Erosion

The 2008 stream feature inventory revealed that 8 % (593 ft.) of the stream length exhibited signs of active erosion along 3,815 ft. of total channel length (Fig. 1). Revetment has been installed on approximately 7.3 % (556 ft.) of the stream length, associated with the Balace Rd. bridge and the road embankment at Ulster County Rte. 42. At the time of the stream feature inventory 9.2% of the stream banks had been bermed. Bank erosion was occurring on 8 % (593 ft.) of the stream.

Stream Morphology

The following description of stream morphology references insets in the foldout Figure 10. "Left" and "right" references are oriented looking downstream, photos are also oriented looking downstream unless otherwise noted. Stationing references, however, proceed upstream, in feet, from an origin (Station 0) at the confluence with the Rondout Reservoir. Italicized terms are defined in the glossary. This characterization is the result of surveys conducted in 2008 and 2009.

Figure 3 Abutment at Balace Road bridge

Management Unit 8 begins at the Balace Road bridge crossing, which has a span adequate to pass the bankfull flow, but which presents an obstruction to flows across the floodplain on the left (likewise, berms upstream of the bridge have been installed to restrict flows from the floodplain). The stream hugs the right valley wall here, and there is no significant floodplain here. Typically in such a situation, flows larger than the 2-yr flood will backwater upstream of the bridge, and scour downstream of the bridge. This can result in bank erosion downstream of the bridge, as well as aggradation both further upstream and further downstream; both are evident here.

The newly-reconstructed bridge is well armored on both abutments, upstream and downstream (Fig. 3). Approximately 130 ft downstream of the bridge, an unnamed tributary enters from the valley wall on the right, at Station 22200, which appears to be a fairly significant source of *bedload* during large flow events. Further study of this tributary is recommended.

As upstream of the bridge, a berm on the left bank restricts flows across the floodplain here for 134 ft., directly opposite the tributary confluence.

Figure 4 High-bedload tributary

Just downstream and opposite the berm at Station 22000, the right bank is eroding for a length of about 93 ft. This bank, which is predominantly glacial till, is being eroded by entrainment of soil at the toe of the bank. A house sits on a terrace at the top of the bank, less than 50 ft. from the edge of the bank, which has a single line of mature trees, and the erosion threat to this property is a high priority for mitigation. The site should be surveyed and evaluated to determine the appropriate treatment, which would likely include soil bioengineering bank treatments combined with toe protection.

Figure 5 Berm

Figure 6 Erosion at Stn 22000, right bank

Downstream of the bank erosion, both the channel and floodplain begin to widen, with evidence of historic channel excavation, and there is evidence of aggradation in the bed for about 750ft. A narrow, forested floodplain bench develops at the base of the right valley wall. At the downstream end of this reach, the aggradation is exacerbated by a channel constriction controlled by bedrock in the right bank and in the bed, and by boulder obstruction around Station 21260, the backwater producing a 300' ft. long lateral cobble bar upstream of that point. A significant volume of bedload is stored in this bar.

Figure 7 Long lateral cobble bar, looking upstream

On the left, a small channel carrying flows from the roadside drainage of County Route 42 and tributaries on the left valley wall winds across the generally forested floodplain, through several residential properties, confluencing with the Rondout at Station 20700. Numerous occurrences of the invasive shrub, Japanese barberry (*Berberis thunbergii)* were noted on the floodplain. The presence of barberry, while generally not directly affecting conditions within the channel, reduces the biodiversity and ecological integrity of the floodplain.

Figure 8 Stream channel crossing the valley floor upstream of the Sundown bridge

Figure 9 Sidecast berm

The bedrock ledge on the right valley wall continues for about 470 ft., until the valley wall pulls away to the right at a residence, and the channel crosses the valley floor diagonally to the left valley wall. As the valley widens, the channel also widens and is fairly well-connected with its floodplain throughout the remainder of the management unit, although there are two relict and marginally functional *sidecast berms*, each about 150 ft. in length, on either side of the channel here. A healthy forested riparian buffer runs along most of the edge of a hayfield on the right, and also along the left until Station 20400, where the floodplain is mowed lawn adjacent to a residence. Since the initial stream assessment, adjustment to the channel between station 20400 and 20100 has occurred along the mowed lawn. Two mature trees were severely undercut and toppled into the creek at station 20300. It is recommended that the trees be removed from the active stream channel, as they are blocking a significant portion of the bankfull channel; and that the landowner seeks technical assistance for restoring a woody buffer along the stream. As the channel reaches the valley wall to the left at the road embankment, it is turned back to the right, and runs for about 550 ft between the county road on the left and the hayfield on the right. A FEMA-funded project repaired the road embankment here in 2008 with the installation of a stacked rock wall along approximately 330 ft. of Ulster County Rte. 42.

Throughout much of this reach, backwatering of high flows by the bridge at Sundown Road, and perhaps historic channel management (channel excavation and widening), have created aggradational conditions, and significant *point bars*, *lateral bars* and *center bars* have deposited throughout the reach. These depositional areas collect woody debris, increasing deposition in a vicious cycle, and causing *braiding*, or multiple stream channels, which can result in lateral channel migration and bank erosion. For instance, at Station 19300, the channel has diverged into two threads, with the right channel becoming predominant over time, and creating significant erosion of the streambank along the hayfield. In addition, this channel approaches the bedrock terrace at the southwest end of the hayfield at a right angle, requiring a sharp turn to the left as it enters the bridge at Sundown Road. This very tight radius of curvature contributes significantly to the backwatering upstream and the associated bedload deposition. A small tributary, with no significant bedload supply, enters from the right at Station 18800 (this stationing is extrapolated; the channel has evolved here since the stationing was made, and the right channel thread, running along the hayfield, is now primary). Management Unit 8 ends at the Sundown Road Bridge (#3346720). As of this writing, a large tree just upstream of the bridge has been undermined, leans across the channel, and represents some risk of posing an obstruction to the next major flood flows. The tree was removed by Ulster County Department of Roads & Bridges in April, 2010 before larger flows were received.

Full restoration is recommended at this site, reestablishing a channel with a larger radius of curvature and avoiding the hard turn at the terrace upstream of the bridge, as conditions contributing to aggradation and erosion at this site are not likely to self-correct in the near term. The restored channel should be dimensioned with a width-to-depth ratio that will maintain effective transport of the bedload through the reach to avoid future aggradation. The bridge at Sundown Road was designed to receive the channel with an oblique (as opposed to perpendicular) orientation) and therefore can accommodate these changes. Vegetation material (*Salix and Platanus spp*) available on site should be harvested and reused in bioengineering treatments of the channel margins and riparian areas. Secondary channels should be backfilled, or minimally blocked at their upper ends, and several flow deflector vanes should be installed on the right bank of the restored channel to limit channel migration while vegetation reestablishes. This restoration should be preceded by a hydraulics study of Management Units 7, 8, 9 and 10, to include sediment transport analysis, and should be followed with several years of project monitoring to ensure project performance and habitat quality. Because dysfunctional berms can actually increase the risk of inundation threats on the floodplain, the hydraulics study should evaluate the functionality of the relict berms in the unit and recommend whether they should be eliminated, restored in place or setback.

The exposed bank at this erosion site also shows evidence of repeated historic channel shifting, with numerous alternating layers of organic matter and alluvial deposits. It is recommended that the organic matter in these layers be carbon dated to determine the rate of vertical accretion of this floodplain.

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).

Management Unit 8 is currently functioning as a *storage reach* for sediment, partly due to the channel constriction and backwatering at its downstream end, and partly due to how Management Units 9 and 10 are being managed to act as *transport reaches*. Any stream system with a significant supply of bedload sediment will need to develop storage reaches somewhere in the system. Storage reaches act as “shock absorbers” when large loads of sediment are contributed by the steep tributaries on the sideslopes during major flood events, storing bedload in depositional features like point bars. Smaller floods --large enough to mobilize the bed in the valley, but not large enough to mobilize the beds of sideslope tributaries-- then gradually transport material stored on the point bars downstream.

Bedload storage is appropriate for this management unit, particularly in its lower half, because the widening of the valley allows increased floodplain access for higher flows, the curvature the stream allows for the development of point bars, and the channel constriction posed by the bridge encourages deposition upstream. The risk of catastrophic channel shifting is higher in storage reaches, however, because the depositional areas that store the sediment also collect large woody debris. While large woody debris plays an important role in building floodplains and creating diversity of stream habitat, and while deposition of wood on the floodplain is preferable to it becoming jammed at undersized bridge openings and creating catastrophic flooding, when it is deposited on point bars it can potentially redirect primary channel flow to the left or right and result in bank erosion. Consequently, if a reach is going to be managed to store sediment, this goal must be balanced with other goals, such as protection of property and infrastructure.

<u>Riparian Vegetation</u>

One of the most cost-effective methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the bank, especially within the first 30 to 50 feet of the stream. A dense mat of roots under trees and shrubs bind the soil together, and makes it much less susceptible to erosion under flood flows. Mowed lawn does not provide adequate erosion protection on stream banks because it typically has a very shallow rooting system. Interplanting with native trees and shrubs can significantly increase the working life of existing rock rip-rap placed on streambanks for erosion protection. Riparian, or streamside, forest can buffer and filter contaminants coming from upland sources or overbank flows. Riparian plantings can include a great variety of flowering trees and shrubs, native to the Catskills, which are adapted to our regional climate and soil conditions and typically require less maintenance following planting and establishment.

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 result can include rapid streambank erosion and increase surface runoff impacts.

An analysis of riparian vegetation along the Rondout Creek was conducted using aerial photography and field inventories (Fig. 11). In this management unit, the predominant vegetation type within the 100 ft. riparian buffer is deciduous-closed tree canopy (32%) followed by deciduous-open tree canopy (20%). *Impervious* area (3%) within this unit's buffer is primarily Peekamoose Road. No occurrences of Japanese knotweed were documented in this management unit during the 2009 inventory, but numerous occurrences of the invasive shrub, Japanese barberry (*Berberis thunbergii)* were noted on the floodplain to the left in the upper half of the unit. The presence of barberry, while generally not directly affecting conditions within the channel, reduces the biodiversity and ecological integrity of the floodplain.

There are 3 wetlands within this management unit mapped in the National Wetland Inventory (see *Section 2.5, Wetlands and Floodplains* for more information on the National Wetland Inventory and wetlands in the Rondout watershed). 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 (See Section 2.5 for wetland type descriptions and regulations). The northern most wetland is 0.47 acres in size, and is classified as palustrine, scrub-shrub, cobble-gravel, and temporarily flooded-tidal (PSS1A). The next wetland is 1.14 acres, and classified as riverine upper perennial, unconsolidated shore, and temporarily flooded (R3USA). The southernmost wetland in this management unit is also classified as riverine upper perennial, unconsolidated shore, and temporarily flooded (R3USA), and is 0.22 acres.

Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with tree plantings, to promote a more mature vegetation community along the streambank and in the floodplains. Sites where riparian plantings could improve bank stability were identified through a watershed-wide remote evaluation of current riparian buffer conditions and existing stream channel morphology (Fig. 12). These locations indicate where plantings of trees and shrubs on and near stream banks can help reduce the threat of serious bank erosion, and can help improve aquatic habitat as well. In some cases, eligible locations include stream banks where rock rip-rap has already been placed, but where additional plantings could significantly improve long-term stream channel stability, as well as biological integrity of the stream and floodplain. These are only *potential* planting sites, and landowners prefer to keep areas mowed or otherwise cleared for many reasons. In some cases, these sites may not be effectively treated with riparian enhancement alone, and full restoration efforts would include channel restoration components in addition to vegetative treatments.

Recommendations for this unit include exploring with landowners the benefits of protection and restoring forested riparian buffers as part of any channel restoration or berm removal, and at sites identified as having inadequate riparian vegetation (e.g., Station 20200). Specifically, the bank erosion site at Station 22000 should be stabilized with soil bioengineering methods and toe protection. For technical and financial resources available to landowners to replant banks and floodplains, see Section 2.6, *Riparian Vegetation Issues in Stream Management*.

Flood Threats

Inundation

As part of its National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) performs hydrologic and hydraulic studies to produce Flood Insurance Rate Maps (FIRMs), which identify areas prone to flooding. There are 5 houses marginally within the 100-yr floodplain as it is currently mapped, but channel shifting and berm degradation casts significant doubt on the 100-yr flood boundaries as mapped. Development of new, more accurate FIRMs for the Rondout creek is expected in the next several years.

Bank Erosion

Most of the stream banks within the management unit are considered stable, but 8 % (593 ft.) of the stream length is experiencing erosion, in two locations. *Assisted restoration* is recommended at the erosion site at Station 22000, while *full restoration* is recommended for the eroding bank between Stations 18800 and 19300.

Infrastructure

In Management Unit 8, approximately 7.3 % (556 ft.) of the stream length in this management unit has been treated with some form of revetment, all of which is associated either with the bridge abutments near the top of the management unit (rip-rap) or with the road embankment near the bottom of the unit (stacked rock wall). This revetment is new in both locations and is functioning well to protect the associated infrastructure. The channel profile along the stacked rock wall should be monitored for aggradation or degradation.

Aquatic Habitat

Aquatic habitat is one aspect of the Rondout Creek ecosystem. While ecosystem health is includes a broad array of conditions and functions, what constitutes “good habitat” is specific to individual species. When we refer to aquatic habitat, we often mean fish habitat, and specifically trout habitat, as the recreational trout fishery in the Catskills is one of its signature attractions for both residents and visitors. Good trout habitat, then, might be considered one aspect of “good human habitat” in the Rondout Creek valley.

Even characterizing trout habitat is not a simple matter. Habitat characteristics include the physical structure of the stream, water quality, food supply, competition from other species, and the flow regime. The particular kind of habitat needed varies not only from species to species, but between the different ages, or life stages, of a particular species, from eggs just spawned to juveniles to adults.

In general, trout habitat is of a high quality in the upper Rondout Creek. The flow regime of the Creek is unregulated, the water quality is generally high (with a few exceptions, most notably low pH as a result of acid rain; see Section 3.1, *Water Quality*), the food chain is healthy, and the evidence is that competition between the three trout species is moderated by some *partitioning* of available habitat among the species (M. Flaherty, personal communication). It is no surprise then that Management Unit 8 has been identified as supporting trout spawning, one of the highest use designations possible for waters in New York, affording it a high level of protection.

While much of the riparian corridor on the left has been developed in low density residential lots, the right side of the channel is in generally fairly undisturbed forest or hayfield. Historical channel and floodplain management, however, have modified the physical structure of the stream in some locations, resulting in the filling of pools, the loss of streamside cover and the homogenization of structure and hydraulics. As physical structure is compromised, interspecies competition is increased. It is recommended that a population and habitat study be conducted on the upper Rondout Creek, with particular attention paid to temperature, salinity, riffle/pool ratios and quality and in-stream and canopy cover.

Water Quality

The primary potential water quality concerns in the Rondout as a whole are the contaminants contributed by atmospheric deposition (nitrogen, sulfur, mercury), those coming from human uses (nutrients and pathogens from septic systems, chlorides (salt) and petroleum by-products from road runoff, and suspended sediment from bank and bed erosion. Little can be done by stream managers to mitigate atmospheric deposition of contaminants, but good management of streams and floodplains can effectively reduce the potential for water quality impairments from other sources.

Storm water runoff can also have a considerable impact on water quality. When it rains, water falls on roadways and flows untreated directly into the upper Rondout Creek. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly degrade water quality. Road drainage from Ulster County Rte 42 in the upstream sections of Management Unit 8 is carried by smaller channels and one piped outfall that enter into the Rondout Creek in this management unit.

Sediment from stream bank and channel erosion pose a potential threat to water quality in the upper Rondout Creek. Clay and sediment inputs into a stream may increase *turbidity* and act as a carrier for other pollutants and pathogens. The bank erosion sites in MU8, however, are largely comprised of alluvial deposits, which in general contain a lower proportion of fine sediments than glacial till or lacustrine deposits. The exception is the bank erosion at Station 22000, which is a glacial till bank and does contribute fine sediments. The rate of erosion does not appear to be particularly fast here, and the areal extent is not large; consequently, the goal of mitigation of the fine sediment source represented by this bank would be secondary to the risk posed to the home adjacent to the bank.

Nutrient loading from failing septic systems is another potential source of water pollution. Leaking septic systems can contaminate water making it unhealthy for swimming or wading.

There are five houses located in relatively close proximity to the stream channel in this management unit. These homeowners should inspect their septic systems annually to make sure they are functioning properly. Each household should be on a regular septic service schedule to prevent over-accumulation of solids in their system. Servicing frequency varies per household and is determined by the following factors: household size, tank size, and presence of a garbage disposal. Pumping the septic system out every three to five years is recommended for a three-bedroom house with a 1,000 –gallon tank; smaller tanks should be pumped out more often.

The New York City Watershed Memorandum of Agreement (MOA) allocated 13.6 million dollars for residential septic system repair and replacement in the West-of-Hudson Watershed through 2002, and the program was refunded in 2007. Systems eligible include those that are less than 1,000-gallon capacity serving one-or-two family residences, or home and business combinations, less than 200 feet from a watercourse. Permanent residents are eligible for 100% reimbursement of eligible costs; second homeowners are eligible for 60% reimbursement. For more information, call the Catskill Watershed Corporation at 845-586-1400, or see http://www.cwconline.org/programs/septic/septic_article_2a.pdf