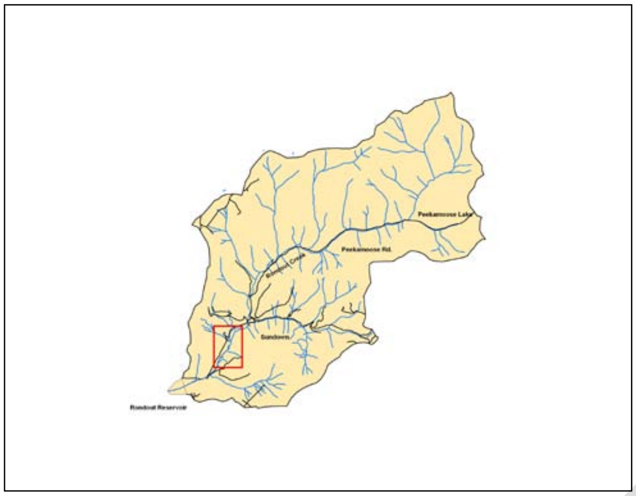
Rondout Creek Management Unit 6



Stream Feature Statistics

8 % of stream length is experiencing erosion

7.54 % of stream length has been stabilized

7.85 acres of inadequate vegetation within the 100 ft. buffer

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

1 house located within the 100-year floodplain boundary

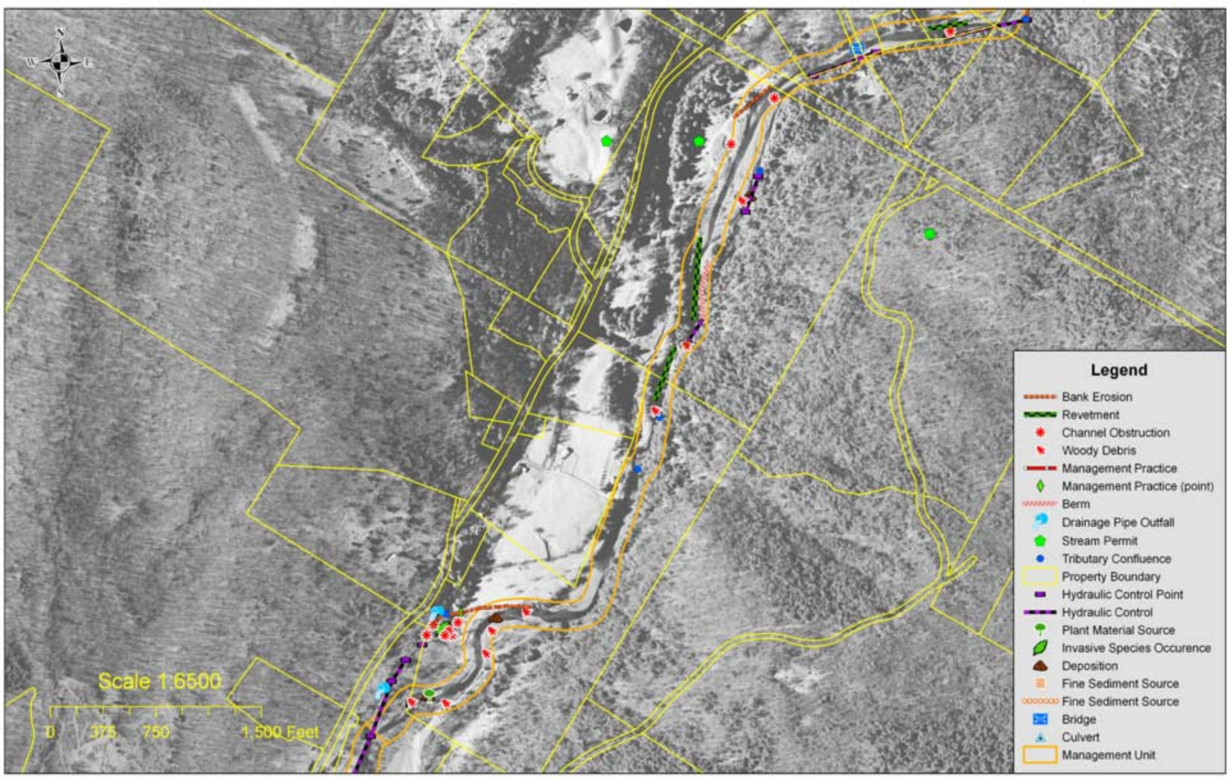


Figure 1 Stream Feature Inventory MU6

Management Unit 6
Between Station 9,600 and Station 16,300

Management Unit Description

This management unit begins at a foot bridge crossing at a private dirt road, continuing approximately 6,703 ft. to a confluence with an unnamed tributary. The drainage area ranges from 35.6 mi^2 at the top of the management unit to 33.3 mi^2 at the bottom of the unit. The valley slope is 0.86%. The average valley width is 852.2 ft.

Summary of Recommendations Management Unit 6	
Intervention Level	Full restoration, Stns 15600-14400 and Stns 12000-9600. Passive restoration, remainder
Stream Morphology	Reestablish primary channel threads with effective sediment conveyance; install channel blocks on the upstream ends of secondary channels, and bioengineering treatments on eroding banks
Riparian Vegetation	Install bioengineering treatments on restored banks in channel restoration areas; install bioengineering on eroding banks in middle reaches; remove invasives in demo project area
Infrastructure	Stabilize eroding embankment at Stn 10500
Aquatic Habitat	Conduct fish habitat and population study
Flood Related Threats	Restore sediment conveyance, stabilize road embankment
Water Quality	Stabilize eroding bank at station 10500 to mitigate fine sediment source
Further Assessment	Conduct detailed geomorphic and hydraulic assessment of full management unit; Monitor and evaluate condition and berms and revetment

Historic Conditions

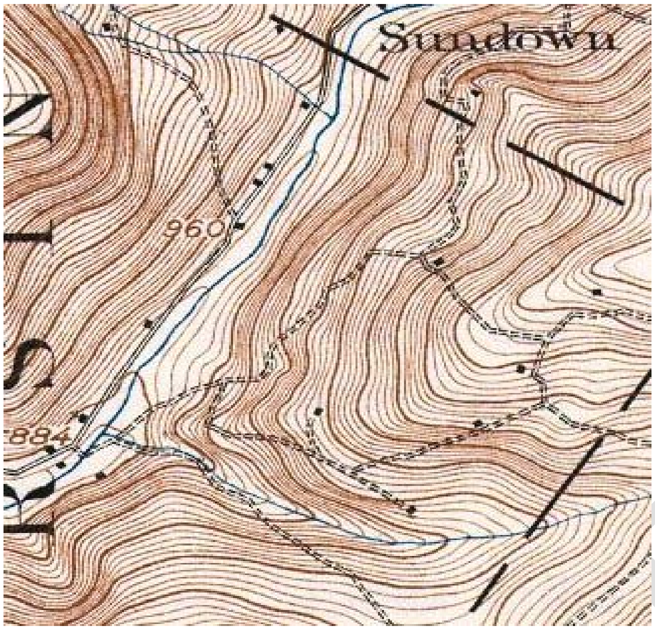


Figure 2 Excerpt of 1905 USGS topographic map MU6

As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 Geology of Upper 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

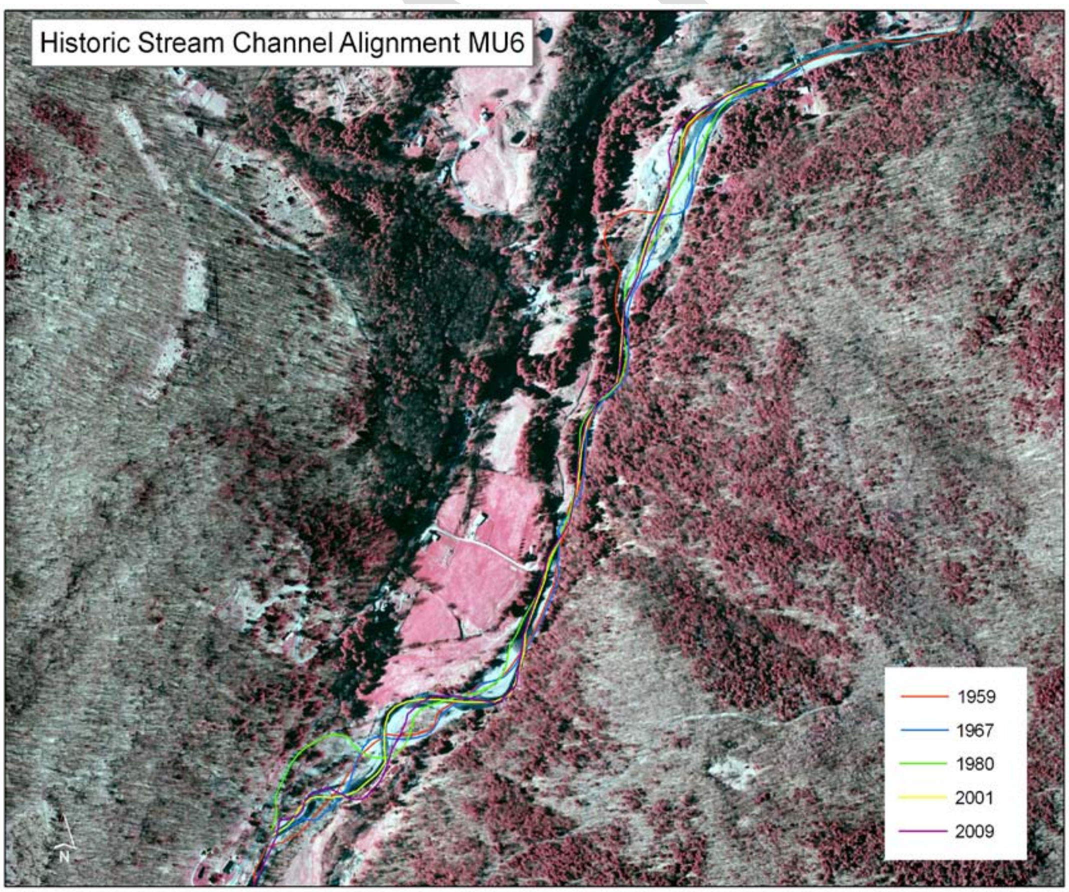


Figure 3 Historic channel alignments

Rondout hydrology and drainage patterns. The somewhat narrow valley floor here is an alluvial floodplain, deposited by the stream when, during large flood events, the quantity of material eroded out of upstream tributaries –particularly Stone Cabin Brook, High Falls Brook and Sundown Creek-- 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 has moved back and forth across this narrow valley floor floodplain numerous times. Just since 1959, the alignment of the channel in several places within the management unit has shifted dramatically, as shown in Figure 3.

In recent decades, landowners in this management unit have received numerous stream disturbance permits from NYSDEC for channel work after flood events (see Fig. 1). Gravel mining and removal of gravel bars can reduce the ability of the channel to pass its sediment load, causing aggradation of the bed and creating conditions for long-term channel instability.

Stream Channel and Floodplain Current Conditions

Revetment, Berms and Erosion

The 2009 stream feature inventory found that 8 % (1,086 ft.) of the streambank length exhibited signs of active erosion along 6,703 ft. of total channel length (Fig. 1). Revetment has been installed on 7.54% (1,011 ft.) of the stream length. 3.01 % of the stream banks had been bermed at the time of the stream feature inventory.

Stream Morphology

The following description of stream morphology references insets in the foldout Figure 15. "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.

Downstream from the high foot bridge crossing at the end of Management Unit 7, the channel gently bends with the valley to the left, continuing to run to the left along the valley floor. For much of the length of MU6, bedrock ledge is exposed in the left bank, and is sometimes also continues under the bed where the channel hugs the valley wall or a high terrace. Several unnamed, but not insignificant tributaries enter the valley floor from the right valley wall, and parallel the mainstem in the floodplain to the right. These small channels on the right side of the valley floor wind among extensive

Beginning around Stn 15600, bed aggradation is evident and the bankfull channel becomes overly wide for approximately 1200 ft. (Fig. 4), becoming four times wider at its broadest point. Numerous stream disturbance permits have been issued for work in this section of stream, and mining from gravel bars likely occurred here historically. Braided channels often result from overwidened channels, where depths are reduced and the stream lacks the power to transport bedload supplied from upstream. Often a vicious cycle results, where aggradation further reduces channel depths, further reducing

Figure 4 Braided channels in upper MU6

transport capacity and creating multiple mid-channel bars, and the channel shifts around through this deposited bedload, often re-establishing new streamcourses and side channels with each flood event, and resetting the revegetation of the bars so that a competent channel never evolves. The recovery of a well-vegetated, stable channel often does not occur in management timeframes.

Where they can, aggrading, braided and shifting channels often erode into adjacent floodplains where the streambank lacks mature woody vegetation and the strength provided by its dense root mass (see Fig. 5). This is occurring on the right bank from Station 15600 to Station 15250.

Over-widened, aggrading reaches tend to accumulate woody debris as well as bedload, slowing water velocities and further reducing the ability of the channel to transport sediment (see Fig. 6).

Figure 5 Erosion resulting from channel shifting

Figure 6 Woody debris accumulated on mid-channel bars in MU6

Figure 7 Potential restoration site

Recommendations for this site include *full restoration*, to be preceded by an assessment of hydraulics, sediment transport dynamics and channel morphology, to determine. Ideally this work would be done in conjunction with assessments needed to do similar work at the bottom of MU6. A single, narrower channel thread should be reestablished that effectively conveys sediment, and *bioengineering treatments* should be installed on the channel banks and floodplain to increase their resistance to erosion.

Continuing downstream, the aggraded section ends in a *headcut* around Station 14300, and then the bankfull channel narrows again for approximately 2500 ft., with intermittent berms (400 ft.) and bedrock ledge on the left, and two revetment placements (totaling approximately 1000 ft., varying in functional condition) on the right. These conditions improve the sediment transport capacity of the reach. However, a landslide on the left is bringing down some mature trees at Station 13600, and the right bank is experiencing moderate erosion near Station 13100, which is also introducing large woody material into the stream.

Figure 8 Left bank, mass wasting over bedrock toe; right bank, bank erosion introducing large pines into channel

Small unnamed tributaries enter from the left (Station 13000) and from the floodplain on the right (Station 12500).

At this point the channel begins to widen again, and for the remaining 3000 ft. of channel in MU6, the reach is aggrading, again producing braided, shifting channels and mid-channel bars (Fig. 9), approximately 135 ft. of bank erosion at a hayfield (Fig. 10) and numerous occurrences of large woody debris (Fig.11).

Figure 9 Aggradation and braided channels at the bottom of MU6

Figure 10 Erosion at hayfield along the right bank

Figure 11 Large woody debris jam, diverting streamflow

Figure 12 Erosion of embankment along Sundown Rd.

One of the channel threads is capturing increased flows, directing them to the right, and eroding a large glacial till embankment adjacent to Sundown Road (Fig.12), at Station 10500. The erosion has left a piped outfall carrying road drainage cantilevered over dumped rock, which provides some outfall protection. This channel also receives a small spring seep running along the road embankment from upvalley. The embankment is severely threatened, and the fine sediment in the bank represents a water quality concern.

Full restoration is recommended for this lower reach (Station 12000 to 9600). A primary channel should be designed to effectively convey sediment supplied from upstream; side channels should be left connected at their downstream end to serve as backwater habitats, but channel blocks installed at the upstream ends (including the channel threatening the road embankment); bioengineering practices should be installed along the eroding hayfield and at the road embankment, using locally harvested vegetation (willow, sycamore and sedge spp.). This site has been prioritized by stakeholders as a high priority for property protection, public safety and water quality considerations, and has been nominated as a demonstration project to serve as a training site for best stream management practices. See Section 6 for a more detailed description of the proposed demonstration project.

Near the bottom of MU6, the multiple channels rejoin in a series of convergences, several with headcuts just upstream, and concluding in a single channel runs along the right side of the valley floor, hugging bedrock ledge at the embankment of Sundown Road.

Sediment Transport

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

Management Unit 6 includes reaches at the top and bottom of the unit which have bankfull channels that are overly wide, resulting in aggradation, channel braiding and bank erosion. Large amounts of woody debris have snagged on the bars, accelerating aggradational processes. As a result this unit is acting as a *sediment storage reach*. In geologic time, this is how floodplains are built and sustained, and braided channels offer great habitat complexity. The removal of sediment from the system in these storage reaches can contribute to improved channel stability downstream.

In management timeframes, however, the result can be accelerated bank erosion into stable floodplains, increased suspended sediment loads, and a loss of ecological resilience. Because vegetation is slow to reestablish in these frequently disturbed settings, storage is not long-term; major flood events entrain these gravel bars and can move massive amounts of material downstream, sometimes with devastating consequences. Unlike in natural systems where the floodplain is usually forested, when homes, hayfields and roadways lie adjacent to the streams, channel shifting often occurs at an accelerated rate, turning it into a *sediment supply reach*. Managers need to balance the competing objectives of property and infrastructure protection, stream and floodplain system stability, and ecological health when deciding how to manage streams in developed floodplains. Any channel restoration activity undertaken in MU6 should retain significant storage capacity for gravel and cobble in the form of well-developed point bars. The sediment supply potential of existing eroding banks should be evaluated as part of any restoration plan, and sediment transport dynamics should be modeled as part of any channel restoration project. Where restoration is not undertaken, eroding banks should be monitored to track erosion rates.

Riparian Vegetation

Figure 13 Dense streamside vegetation keeps banks stable

One of the most cost-effective methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the bank, especially within the first 30 to 50 ft. of the stream. A dense mat of roots under trees and shrubs bind the soil together, and makes it much less susceptible to erosion under flood flows. 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.

Figure 14 Japanese knotweed stand, at right, an undesirable invasive plant

An analysis of vegetation was conducted using aerial photography from 2001 and field inventories (Fig. 16). In this management unit, the predominant vegetation type within the 100 ft. riparian buffer is evergreen-closed tree canopy (28%) followed by herbaceous vegetation (16%). *Impervious* area (<1%) within this unit's buffer is primarily unpaved roads. Although only one occurrence of Japanese knotweed was documented in this management unit totaling 3 ft^2 during the 2009 inventory, this unit has significant stands of Japanese barberry (*Berberis thunbergii*).

There are five 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 upstream most wetland is 2.2 acres in size, and is classified as riverine lower perennial, unconsolidated shore, and seasonally flooded (R2USC). Moving downstream, the next wetland in this unit is 2.8 acres in size, and is also classified as riverine lower perennial, unconsolidated shore, temporarily flooded (R2USA). The following wetland is 2.1 acres in size, and is classified as palustrine emergent, persistent, and seasonally flooded (PEM1C). The following wetland is 2.8 acres in size, and is classified as Riverine, lower perennial, unconsolidated bottom, and permanently flooded. The downstream most wetland is 2.5 acres in size and is classified as riverine lower perennial, unconsolidated shore, temporarily flooded (R2USA)

Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with shrub and tree plantings, to promote a more mature vegetation community along the streambank and in the floodplains. Potential riparian improvement planting sites were identified through a watershed-wide remote evaluation of current riparian buffer conditions and existing stream channel morphology (Fig. 17). 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. For technical and financial resources available to landowners to replant banks and floodplains, see Section 2.6, *Riparian Vegetation Issues in Stream Management.*

<u>Flood Threats</u>

Inundation

As part of its National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) performs hydrologic and hydraulic studies to produce Flood Insurance Rate Maps (FIRM), which identify areas prone to flooding. FEMA is currently contracting to produce new FIRMs for the upper Rondout Creek; an expected completion date is 2013.

There is one house within the 100-yr floodplain as it is currently mapped, but aggradation and channel shifting 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

Given the extent of braiding, most of the stream banks within the management unit that aren't reveted or defined by bedrock ledge should be considered unstable; 8 % (1,086 ft.) of the streambank length is experiencing observable erosion.

Infrastructure

7.54 % of the stream length in this management unit has been treated with some form of revetment, with small sized rip-rap being the dominant material used.

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 6 has been identified as supporting trout spawning, affording it a high level of protection.

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 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 Sundown Road in Management Unit 6 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 MU6, however, are largely composed of alluvial deposits, which in general contain a lower proportion of fine sediments than glacial till or lacustrine deposits. The exceptions are the bank erosion at Stations 13600 and 10500, both of which are glacial till banks and do contribute fine sediments. The goal of mitigation of the fine sediment source represented by the latter bank would be additional to the mitigation of the risk posed to Sundown Road 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 is one house 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