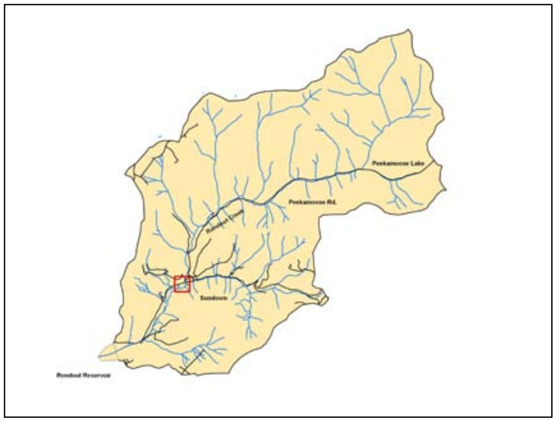
Rondout Creek Management Unit 7



<u>Stream Feature Statistics</u>

- 9% of stream length is experiencing erosion
- 18 % of stream length has been stabilized
- 2.34 acres of inadequate vegetation within the 100 ft. buffer
- 470 ft. of stream is within 50 ft. of the road
- 2 houses located within the 100-year floodplain boundary

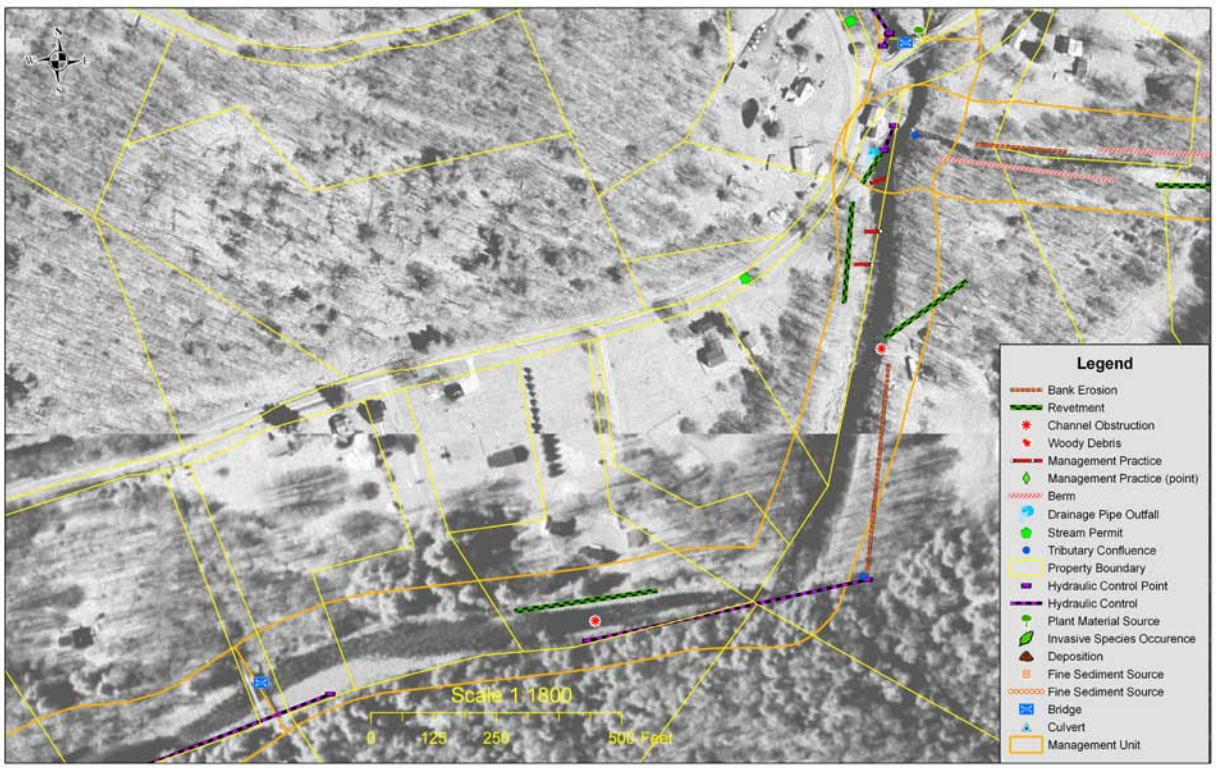


Figure 1 Stream Feature Inventory 2008

Management Unit 7
Between Station 16,300 and Station 18,500

Management Unit Description

This management unit begins at the Ulster County Route 42 bridge crossing in Sundown, continuing approximately 2,234 ft. to a foot bridge at the end of a private dirt road. The drainage area ranges from 33.3 mi^2 at the top of the management unit to 26.3 mi^2 at the bottom of the unit. The valley slope is 1.2 %. The average valley width is 908.0 ft.

Summary of Recommendations Management Unit 7	
Intervention Level	Assisted self-recovery from Stn 17400 to Stn 18000 to address bed deposition and bank erosion
Stream Morphology	Conduct hydraulics study of management unit. Address overwidened channel in the middle of the management unit contributing to bedload deposition, increasing stress on an eroding bank.
Riparian Vegetation	Improve vegetative cover at revetment in vicinity of confluence of EB Rondout; install bioengineering practices at Stn 17400 to Stn 18500
Infrastructure	Monitor condition of stream barbs at Stn 18300
Aquatic Habitat	Conduct fish habitat and population study
Flood Related Threats	Develop strategy for addressing “berm” piles on right bank, berms on left, at Stn 18200; Install bioengineering practices to mitigate bank erosion, Stn 17400 to Stn 18000. Conduct an updated hydraulics study of the management unit (flood study).
Water Quality	Address fine sediment entrainment from bank erosion at Stn 17400 to Stn 18000
Further Assessment	Conduct detailed geomorphic and hydraulic assessment of reach from Stn 17400 to Stn 18500; Monitor and evaluate condition and function of stream barbs at Stn 18300, and of rip-rap at Stn 16300.

Historic Conditions

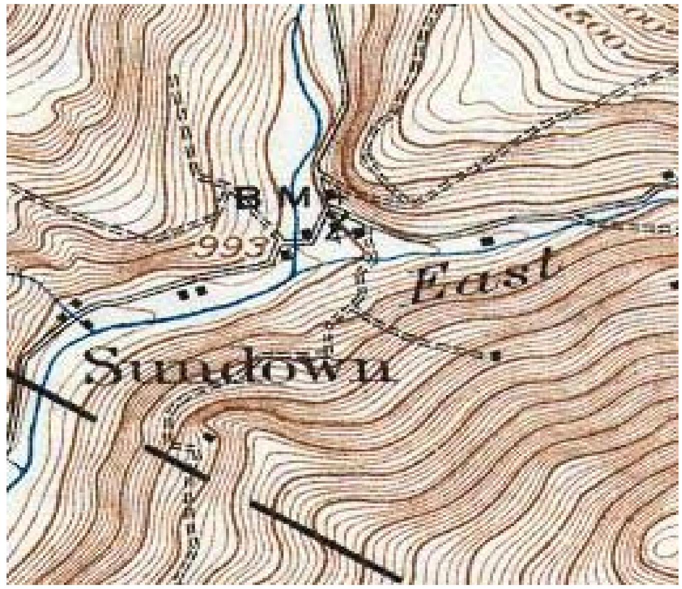


Figure 2 Excerpt from 1905 USGS topographic map in MU7

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 Rondout hydrology and drainage patterns. It is likely that the confluence of Sundown Creek with the Rondout was, for some period, at the bottom of a lake created by an impoundment of ice somewhere further downstream. In some places in Sundown Creek, very fine eroded sediments that accumulated on the floor of this glacial lake can still be observed. The valley floor in MU7 appears to have been heavily managed since European settlement; Figure 2 indicates that, before the twentieth century, the channel alignment may have been straighter up Sundown Creek (know at this time as the East Branch of the Rondout Creek) than up the Peekamoose Valley. Alluvial fans like that found at this confluence region tend to be highly changeable, with extensive channel shifting. The historical channel overlay shown in figure 4 below, however, indicates that while bank erosion and flooding may be endemic here, the channel position has remained relatively stable, with mature forest cover on both right and left banks for much of the reach.

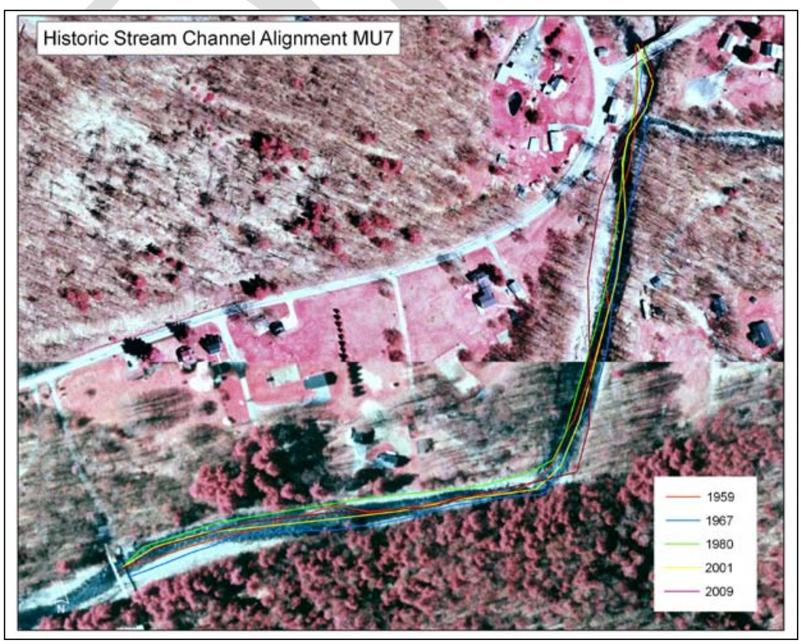


Figure 3 Historical channel alignments from five selected years

Current Stream Channel and Floodplain Conditions

Figure 4 Complex hydraulics and sediment transport in MU7

Revetment, Berms and Erosion

The 2009 stream feature inventory revealed that 9 % (415 ft.) of the stream length exhibited signs of active erosion along 2,234 ft. of total channel length (Fig.1). Revetment has been installed on 17.12 % (766 ft.) of the stream length. No berms were identified in this management unit at the time of the stream feature inventory.

Stream Morphology

The following description of stream morphology references insets in the foldout Figure 17. "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 5 The confluence of Sundown Creek (East Branch of the Rondout)

As the Rondout Creek exits from under the Ulster County Route 42 Bridge, the channel is fairly entrenched, and is turned to the right as it approaches the confluence of Sundown Creek on the left (Fig. 5). Sundown Creek is described Sections 4.18 through 4.20. Historically the confluence may have been 1000 ft. further downstream, where the channel meets the left valley wall. A house

Figure 6 House on ledge

sits on the right immediately opposite the confluence, on ledge that receives the direct force of high flows from Sundown Creek. Sundown Creek is flashy, but delivers only moderate sediment loads due to the bedrock channel bed and extensive bank revetment along much of its length, except during exceptionally large floods.

Downstream of the ledge, however, the right bank is subject to erosion, and has been a chronic location for high flows to jump the channel and use the adjacent lawns and highway. This bank was recently armored from between Stations 17850 and 18350 as part of an *Emergency Watershed Protection* project, with a mixture of stacked, tiled and dumped rip-rap, and *stream barbs* were installed to slow velocities immediately adjacent to the bank, and to direct the force of the combined flows of Sundown Creek and the Rondout away from the bank. The stream barbs are only a few years old, and seem to be functioning as intended, protecting the bank. Scour holes have developed downstream and sediment is accumulating upstream of each barb, and vegetation is establishing near the waters edge. These rock structures should be monitored for several years, in conjunction with the conditions of the bed and banks downstream, as part of a hydraulics and sediment transport study of Management Units 7-10. Piles of cobble and gravel remain in the floodplain on the right around Station 18000. Their effect on floodplain flows should be assessed as part of the hydraulics study.

Figure 7 Revetment on right bank, with piped outfall from Ulster Rte 42 road drainage

Figure 8 Looking upstream. Barbs installed to deflect flows away from the right bank

With the flows directed across the

Figure 9 Bank erosion and loss of woody buffer

channel, the left bank has eroded into a stand of mature pines from Stations 18000 to 17400, entraining a great deal of large wood (some of which has deposited in downstream management units) and a lateral bar has formed on the right bank (See Figure 11, with person standing next to downed tree in center of photo for scale). As the channel widens due to the erosion, it no longer can transport the bedload supplied from upstream, and so the bed is aggrading here; this is exacerbated by the hard 90-degree turn in the channel alignment at Station 17400, as the channel hits the rock ledge of the valley wall, which produces backwatering at higher flows.

Figure 11 Looking upstream, aggradation

Figure 11 Logs placed to protect eroding bank

The landowner has piled rocks and downed tree trunks along the back of the bar on the upstream end of the eroded bank to provide some protection against further erosion. *Assisted restoration* is recommended for this site, stabilizing the eroding left bank with bioengineering practices, and narrowing the channel with plantings on the right bank/bar.

Over time this should reverse the aggradation in the channel which is increasing pressure on the eroding bank.

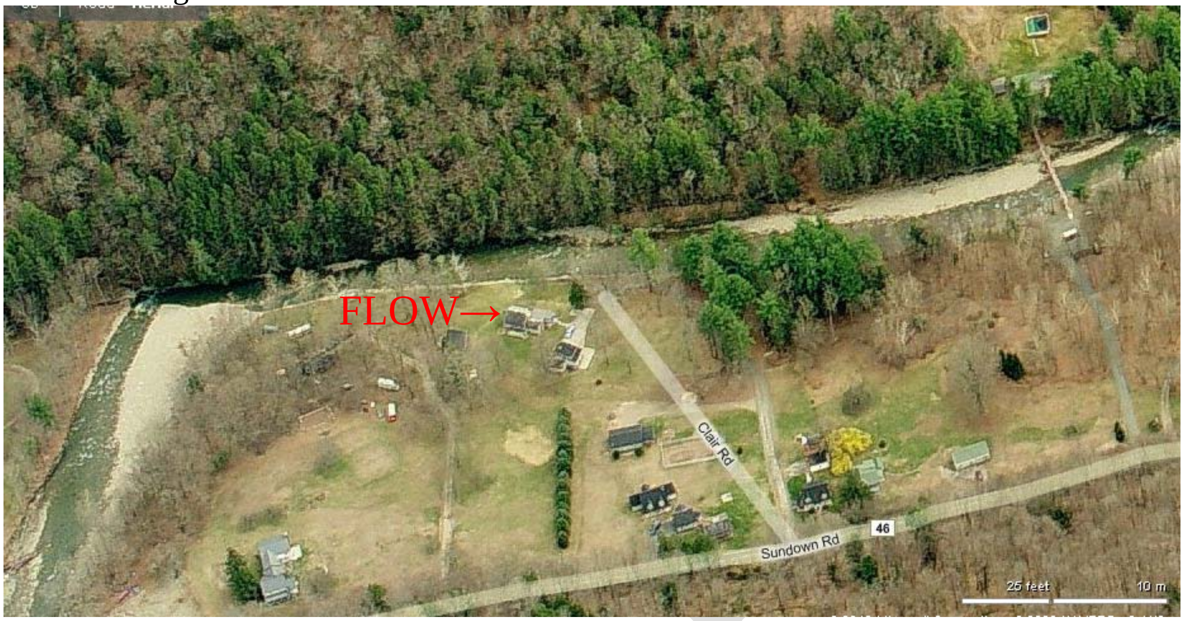


Figure 123 Ninety-degree turn in channel

At the downstream end of the erosion site (Station 17400), the channel is turned hard to the right by the left valley wall that frames the Sundown Creek delta. A small unnamed tributary enters from the left at the turn. A large point bar has developed on the inside of the turn, following the bank retreat on the left.

Figure 13 Channel turned to the right by the left valley wall, tributary confluence and point bar

Downstream of the turn, the channel runs parallel to Sundown Road, and hugs the rock ledge along the valley wall for the next 1700 ft., beyond the end of Management Unit 7. This section of stream is very straight, somewhat entrenched and with lateral bars at the upper end of the reach, and with a point bar developing where the channel begins to bend gently to the left in the vicinity of the footbridge at the end of the management unit.

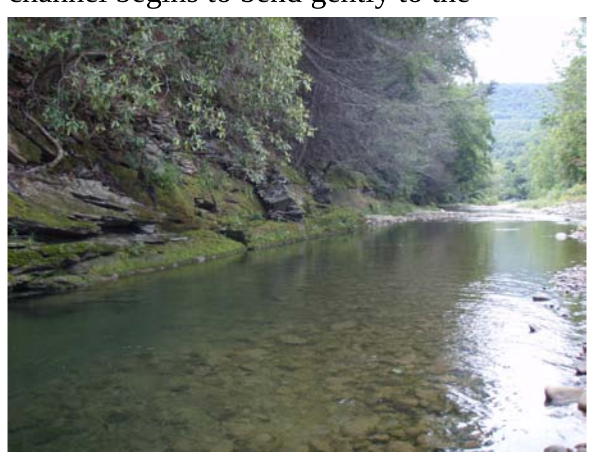


Figure 14 Bedrock control on left

Throughout this reach, the channel is controlled laterally on the left by bedrock, and rip-rap revetment has been installed in two locations on the right bank. The first is between Stations

16750 and 17100, and is in poor shape, but is still functional.

The second rip-rap has been placed fairly recently along the right abutment of the footbridge, at Station 16300, the end of Management Unit 7. This bank has experienced chronic erosion, as the channel tries to recover some sinuosity. This site should be monitored for continued threat of erosion.

Figure 15 Rip-rap and erosion at right pier of footbridge

It is recommended that a hydraulics study be conducted of the management unit (and to also include MUs 8, 9 and 10), to include an evaluation of the aggrading reach associated with the erosion on the left bank to determine how much channel narrowing would be required to return the reach to sediment competence and an assessment of the sediment transport dynamics within the channel.

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).

Figure 167 Looking downstream. Complex sediment transport dynamics in MU7

Sediment transport in Management Unit 7 is fairly complicated. Significant bed sediment is stored in braided reaches of Rondout Creek upstream of the Sundown Road Bridge. When this is mobilized by high flows, some of it is transported through the constriction posed by the bridge and enters MU7, where it immediately encounters the confluence of the Sundown Creek, which adds additional streamflow, sediment discharge and turbulence. The effect of the turbulence created by the confluence is that velocities on the mainstem upstream of the confluence are likely slowed, adding to the backwatering effect of the constriction created by the bridge. Just downstream of the confluence, a different story is going on; Sundown Creek does not appear to discharge an exceptionally large sediment supply, despite its steep gradient, because much of the bed of the stream has been scoured to bedrock, and because the banks for most of its length are stabilized by a healthy forest buffer. Discharging proportionately more water than sediment, Sundown Creek likely increases sediment conveyance downstream. The stream barbs installed a few years ago on the right bank directly opposite the confluence probably also accelerate sediment transport through this area by concentrating flows toward the middle of the channel, increasing the channel depth ---and therefore velocities-- there.

These increased velocities however, probably account in part for the erosion of the left bank just downstream. This bank erosion has resulted in an overly wide channel, lowering velocities significantly, and resulting in aggradation of the streambed. This situation is compounded by the evolving alignment of the channel, which as it moves to the left into the eroding bank, results in a harder right hand turn at the valley wall, creating a backwater effect upstream. This section of the management unit is under-competent and will require an intervention to narrow the channel, increase bankfull depths and restore sediment transport conveyance capacity.

Downstream of the turn, the channel reduces in width and also is entrenched, increasing the sediment conveyance capacity at higher flows for about 500 ft., but then begins to widen again as it approaches the footbridge, and deposition on lateral and point bars increases.

Riparian Vegetation

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 stream banks 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 it's dense canopy structure (many large, overlapping leaves), but stands are sparse at ground level, with much bare space between stem clusters, and without adequate root structure to hold the soil of streambanks. When the plants go dormant in the fall, no other vegetation is left to provide protection from soil erosion. The result can include rapid streambank erosion and increase surface runoff impacts.

An analysis of vegetation was conducted using aerial photography from 2001 aerial orthophotography and field inventories (Fig. 18). In this management unit, the predominant vegetation type within the 100 ft. riparian buffer is deciduous-closed tree canopy (28%) followed by herbaceous vegetation (21%). *Impervious* area (4%) within this unit's buffer is primarily roadways. No occurrences of Japanese knotweed were documented in this management unit during the 2009 inventory.

There are no wetlands within this management unit mapped in the National Wetland Inventory. 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, Wetlands and Floodplains for more information on the National Wetland Inventory and wetlands in the Rondout watershed).

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. 19). These locations need to be field-verified, but they indicate where plantings of trees and shrubs on and near stream banks may help reduce the threat of serious bank erosion, and 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*.

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. The upper Rondout Creek is scheduled to have its FIRMs updated with current surveys and hydrology and hydraulics analysis in the next few years.

During high flows, the alignment of Sundown Creek creates conditions for overtopping the bank at the confluence, and using Sundown Road as part of its floodplain. While only two homes appear to lie with the 100-yr floodplain boundary as defined by the FIRMs, many of the homes between the road and the stream here are vulnerable to these floodplain flows, which may follow unpredictable paths. For example, since records started being kept in 1938, there have been seven floods in the upper Rondout larger than the April 2005 flood, which overtopped its banks here. The 2005 flood was estimated as less than a 10-yr flood.

Bank Erosion

Much of the stream bank within this management unit is not stable; 18 % (415 ft.) of the stream length is experiencing erosion on one side or another. Another 18% has been stabilized, an indication of prior erosion problems.

Infrastructure

18 % (412 ft.) of the stream length in this management unit has been treated with some form of stabilization, including the logs piled around Station 18000. The revetment is in varying states of repair and functionality. Flow-deflecting stream barbs around Station 18000 should be monitored for ongoing effectiveness. Rubble piles in the floodplain at this site should be evaluated for their effect on future overbank flows, as part of the hydraulics study mentioned above.

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 7 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.

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 Ulster County Rte 42 is carried by one piped outfall into the Rondout Creek in this management unit, and 380 ft. of stream lies within 50 ft. of the road.

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 site in MU7, however, is largely composed of alluvial deposits, which in general contain a lower proportion of fine sediments than glacial till or lacustrine deposits. The rate of erosion does not appear to be particularly fast here, but the areal extent is quite large; consequently, the goal of mitigation of the fine sediment source represented by this bank is a moderately high priority.

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 two 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