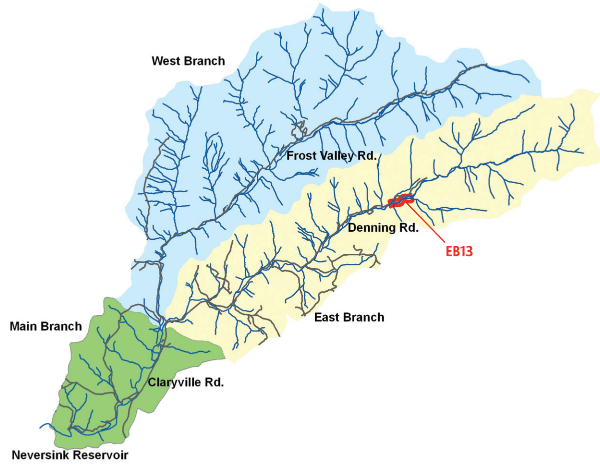
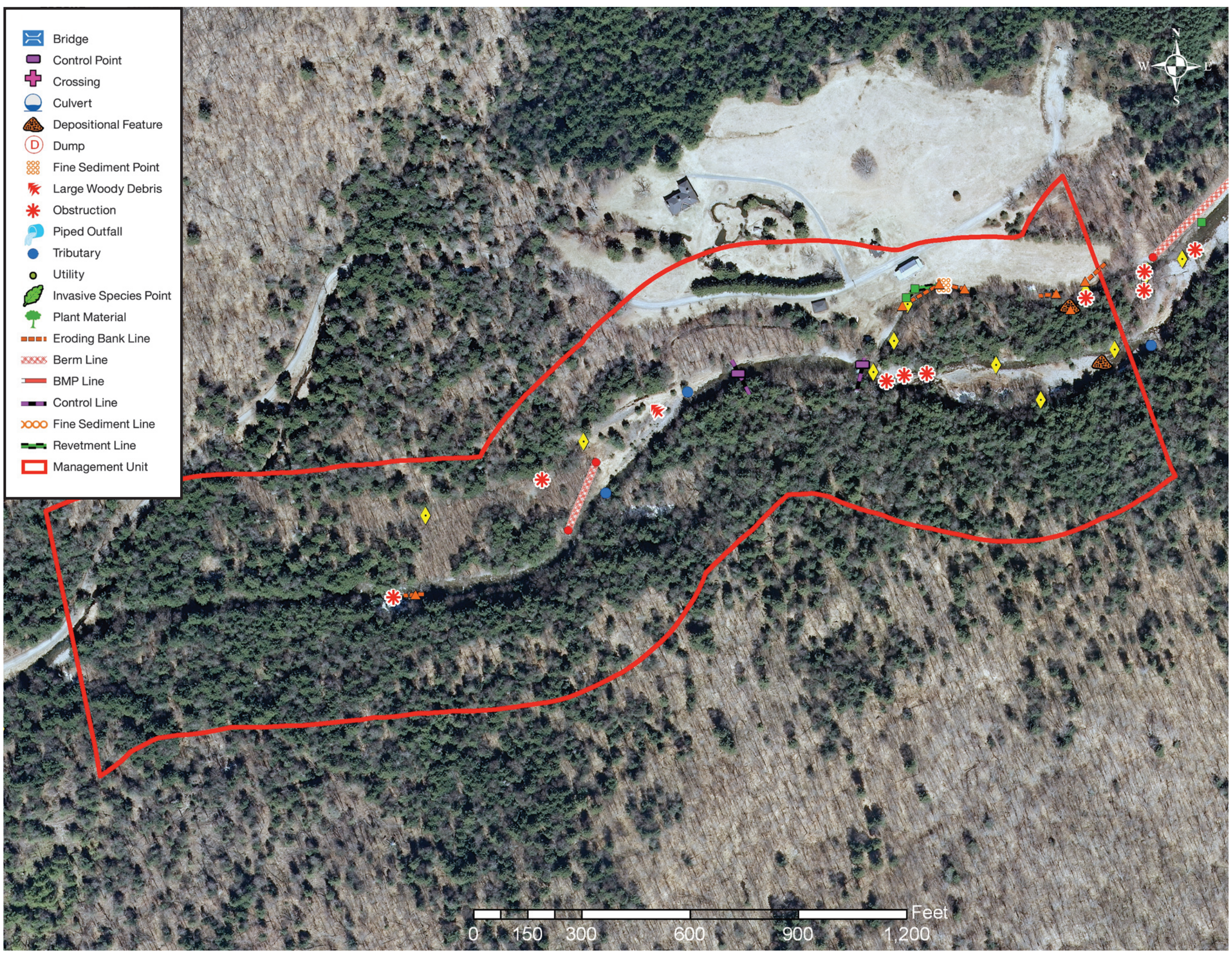
Neversink River East Branch

MANAGEMENT UNIT 13

- 6 % of stream length is experiencing erosion
- 1.63 % of stream length has been stabilized
- 7.23 acres of inadequate vegetation within the riparian buffer
- None of stream is within 50 ft. of the road
- No houses are located within the 100-year floodplain boundary





Stream Feature Inventory 2010 (Figure 1)

Management Unit Description

This management unit begins at a confluence with Flat Brook, continuing approximately 3,237 ft. to a confluence with Tray Mill Brook. The drainage area ranges from 10.70 mi^2 at the top of the management unit to 12.20 mi^2 at the bottom of the unit. The valley slope is 1.77%. The average valley width is 1090.32 ft.

Summary of Recommendations
East Branch Management Unit 13

Intervention Level	Assisted restoration of the bank erosion site between Station 46900 and Station 46850. (BEMS NEB13_46800) (continues from EBMU14) Assisted restoration of the bank erosion site between Station 46790 and Station 46750. (BEMS NEB13_46700) Assisted restoration of the bank erosion site between Station 46500 and Station 46310. (BEMS NEB13_46300) Passive restoration of the bank erosion site between Station 44630 and Station 44590. (BEMS NEB13_44500)
Stream Morphology	Assess sediment deposition resulting from the accumulation of large woody debris supplied by the watershed upstream. Conduct baseline survey of channel morphology.
Riparian Vegetation	None.
Infrastructure	None.
Aquatic Habitat	Fish population and habitat survey.
Flood Related Threats	None.
Water Quality	None.
Further Assessment	Long-term monitoring of erosion sites.

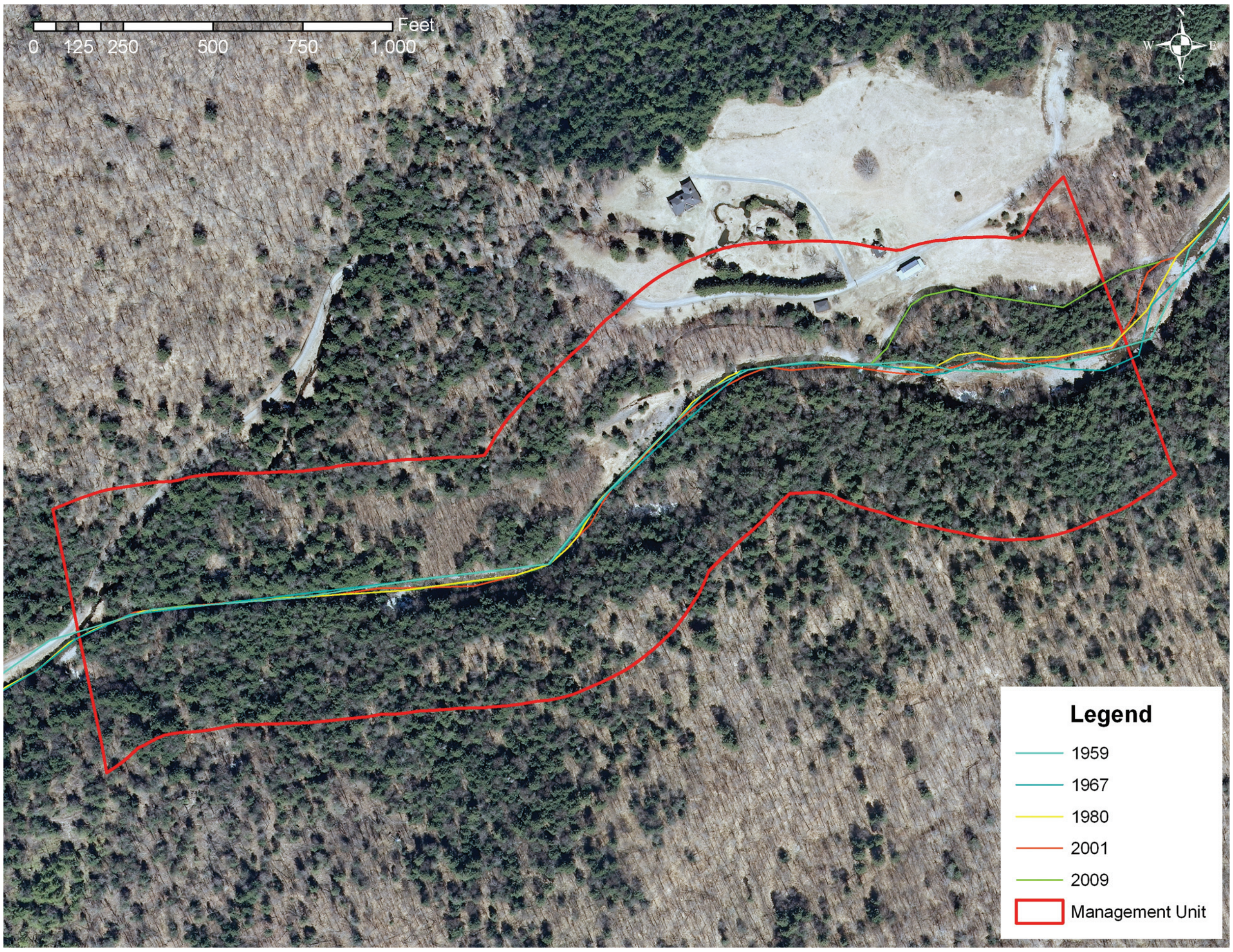
Historic Conditions

As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 *Geology of Upper Neversink River,* for a description of these deposits. These deposits make up the soils in the high banks along the valley walls on the Neversink mainstem and its tributaries. These soils are eroded by moving water, and are then transported downstream by the River. During the periods when the forests of the Neversink watershed were heavily logged for bark, timber, firewood and to make pasture for livestock, the change in cover and the erosion created by timber skidding profoundly affected the Neversink hydrology and drainage patterns.

Excerpt from 1875 Beers Map (Figure 2)

The 1875 Beers Atlas of this area indicates that by that time, the stream had been harnessed for manufacturing, primarily saw mills, woodworking shops and tanneries *(Figure 2).* Raceways were built in the floodplains to divert water to ponds for use as needed. Floodplains were profoundly altered in the process, as these watercourses also became areas of preferential channelized flow when floodwaters inundated the floodplains. When woody debris jams blocked the primary channels, these raceways sometimes eroded out to become major secondary channels, or even took over the full flow to become a new primary watercourse.

During large runoff events, floodplains adjacent to the confluence of major tributaries receive large slugs of material eroded out of the steep streams draining the valley walls. overwhelmed the Neversink's ability to transport it, creating an alluvial fan. Like changes in the floodplains made by humans, these episodes can result in catastrophic shifts in channel alignment. In the roughly one hundred and twenty centuries since the retreat of the glaciers, the position of Neversink River has moved back and forth across its floodplain numerous times in many locations. While a comparison of historical channel alignments *(Figure 3, following page)* and in-stream observations made during a stream feature inventory in 2010 *(Figure 1, page 1)* indicate some lateral channel instability at points, only 2 NYS Article 15 stream disturbance permits have been issued in this management unit, according to records available from the NYSDEC DART database (**http://www.dec.ny.gov/cfmx/extapps/envapps/**).



Historical channel alignments from five selected years (Figure 3)

Stream Channel and Floodplain Current Conditions

The following description of stream morphology references stationing in the foldout Figure 4. "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 Neversink Reservoir. Italicized terms are defined in the glossary. This characterization is the result of surveys conducted in 2010.

This management unit begins at Station 46900 with the continuation of the erosion of the right bank from EBMU14 for approximately 60 feet to Station 46850 (BEMS NEB13_46800). The densely forested riparian buffer which characterizes most of East Branch of the Neversink upstream of this point transitions to open fields of herbaceous vegetation on the right bank at Station 46930. The hydraulic erosion at this site is the result of the grass and herbaceous vegetation not providing adequate stability to the stream bank under high flows. *(A71)*. A riparian buffer including woody vegetation can strengthen the stream bank and slow erosive forces of higher flows during flood events. Recommendations for this bank erosion site minimally include assisted restoration with riparian planting techniques to restore the forest connectivity and stabilize the bank.

Grass and herbaceous vegetation not providing adequate riparian buffer (A71)

Directly downstream of the erosion on the right bank is a significant accumulation of woody debris at Station 46850 that is causing a channel wide obstruction and instability. *(A64)*. Scour is occurring directly downstream of the obstruction because the water faces an abrupt vertical drop as it flows over the debris. This continuous scour is resulting in a headcut which is actively migrating upstream, and will continue to do so until it meets a substrate that is not erodible. *(A73)*. The obstruction decreases the channel's ability to move sediment through this reach, resulting in the formation of a cobble side bar along the right bank at Station 46790. *(A67)*. The debris obstruction is also causing a portion of the flow to re-route

Obstruction causing erosion on right bank (A64)

Headcut migrating upstream (A73)

Cobble side bar on right bank forming because of obstruction (A67) to the left, resulting in erosion along approximately 40 feet of the left bank between Station 46790 and Station 46750 (BEMS NEB13_46700). Recommendations for this site would include assisted restoration for the removal of the woody debris obstruction. Since the obstruction is causing the redirection of flow against the left bank, removing it will take stress off of the eroding bank by allowing the flow to take an unobstructed route through the channel.

Continuing downstream, significant bank erosion begins on the right bank on the outside of a meander bend at Station 46500. *(A83)* This hydraulic erosion continues downstream for approximately 188-feet to Station 46310 (BEMS NEB13_46300), a portion of which is a source of fine sediment in the form of lacustrine clay. *(A78)* The only vegetation established on the top of this eroding bank is mowed grass which provides

Erosion on right bank (A83)

Lacustrine clay (A78)

Mowed grass field not providing bank stabilization (A84) virtually no sediment stabilization or resistance to fluvial erosion. *(A84)* There is a barn approximately 50-feet from the edge of the stream bank that will be in danger if this erosion continues. In order to protect this barn, Gabion baskets have been placed relatively recently along the 105-feet of the eroding right bank that is directly adjacent. *(B27)* Gabion baskets are very susceptible to failure during high flows, as larger rocks moved by the stream can continuously hit the cage and cause structural weaknesses. The combination of stresses caused by stream flow and sediment movement can cause tearing of the basket and release of the rock inside, resulting in the structure no longer functioning for its intended purpose.

Gabion baskets placed on right bank to protect barn (B27)

Recommendations for this site include *assisted restoration* with riparian planting techniques to restore the forest connectivity and stabilize the bank. A riparian buffer including woody vegetation can strengthen the stream bank and slow erosive forces of higher flows during flood events. The gabion baskets along this bank should be replaced with bioengineering techniques to expedite bank stabilization.

Headcut migrating upstream (B30)

The next 200-feet of stream length in this management unit is characterized by headcuts, most notably occurring at Station 46330 *(B30)* and Station 46230 *(B32)*. The headcuts are actively migrating upstream, and will continue to do so until they meet a substrate that is not erodible. At Station 46130 the main channel converges with the side channel from the left that diverged in EBMU14 at Station 47025. *(A90)* This side channel is a 700-foot aggradational reach with a 400-foot long center bar that is caused by multiple large woody debris obstructions near the downstream end. *(A100)* At the time of this walkover, flows were exclusive to the channel on the right of the bar. However, there

Headcut migrating upstream (B32)

was evidence of several smaller braided channels on the left and through the center bar. Lack of leaf litter accumulation in these channels indicates that they received significant flow at some point this year.

Downstream of the convergence there are two wooden dams that have been installed at Station 46110 *(B34)* and Station 45760. *(B46)* These dams measure 88-feet and 105-feet across, respectively, and are both in fair structural condition. They were most likely installed in order to improve trout habitat, as they add diversity to what would otherwise be a relatively uniform flow regime. Both of the dams create a 2-foot drop in stream elevation which results in a deep scour pool below.

A small tributary flows into the main channel through the right floodplain at Station 45600. This tributary was flowing subsurface during the time of this walkover. *(B49)*. The channel maintains good connectivity with the right floodplain through the remainder of this management unit. Large tree trunks were deposited on the right floodplain at Station 45520, suggesting that this area is inundated enough under high flows that the transportation of large woody materials is possible. *(B50)* Significant flood chutes are evident beginning at Station 45300 and continue through the right floodplain for the remainder of EBMU13. *(B52)* Leaf litter had been washed from these flood chutes prior to the 2010 walkover, indicating that they are active under high flows.

An old stone berm begins on the right bank at Station 45300 and continues until 45100, averaging 6-feet in width. *(A112)* It was most likely intended to prevent higher flows from leaving the main channel. This berm is overgrown with mature trees

Looking upstream at main and side channel convergence (A90)

Center bar caused by multiple obstructions downstream (A100)

Looking upstream at wooden dam at station 46,110 (B34)

Looking upstream at wooden dam at station 45,760 (B46)

Small tributary with subsurface flow (B49)

Large tree material deposited on right flood plain (B50)

Flood chute on right flood plain (B52)

Stone berm on right bank (A112)

and does not appear to have been maintained in many years. A small spring seepage flows into the main channel at Station 45260, providing cold water and thermal refuge to this reach.

At Station 45560 fallen trees on the right bank have formed an obstruction to higher flows *(A122)*. These obstructions redirect stream flow into the right bank, resulting in 55-feet of erosion and under cutting of the bank from Station 44630 to Station 44590 (BEMS NEB13_44500). *(A117)* Large rocks are beginning to deposit at the toe of this eroding bank, though it is possible for this bank to stabilize without treatment (passive restoration). However, it is recommended that this site be monitored for changes in condition.

Fallen trees on right (A122)

EBMU13 ends at Station 43650, where Flat Brook enters through the right floodplain.

Large rocks depositing at toe of eroding bank (A117)

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 for more details on Stream Processes).

This management unit represents the continuation of a series of sediment storage reaches occasionally punctuated by short transport reaches from the upstream end of the East Branch. Relatively good floodplain connectivity is maintained throughout EBMU13. The densely forested portion of the watershed upstream of this management unit serves as a continuous source of large woody material that is transported downstream and deposited during flood events. This large woody debris often serves as an obstruction to sediment transport, resulting in the aggradation of bed material. Sediment is stored where large woody debris has accumulated in the management unit, and is transported relatively effectively in most other locations. Transport reaches are in a state of *dynamic equilibrium,* effectively conveying sediment supplied from upstream during each flow event. Storage reaches act as a "shock absorber", holding bedload delivered during large flow events in depositional bars and releasing it slowly over time in more moderate flood events. These depositional areas are very dynamic, with frequent lateral channel migration through bank erosion, *avulsions* and woody debris accumulations. This is one process by which floodplains are created and maintained. Sediment storage reaches can result from natural conditions or as the unintended consequence of poor bridge design, check dams or channel overwidening. While such unpredictable conditions represent risks for nearby property owners, these dynamic disturbance regimes produce unique and diverse habitat patches, attracting equally diverse plant communities and wildlife.

To better understand sediment transport and sediment transport dynamics a baseline survey of channel form and function is recommended for this management unit.

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 narrow stems, and without adequate root structure to hold the soil of stream banks. The result can include rapid stream bank erosion and increase surface runoff impacts.

An analysis of vegetation was conducted using aerial photography from 2009 and field inventories *(Figure 5)*. In this management unit, the predominant vegetation type within the riparian buffer is evergreen-closed tree canopy (47.29%) followed by mixed-closed tree canopy (27.39%). *Impervious* area makes up 0.21% of the total area in this unit. Nooccurrences of Japanese knotweed were documented in this management unit during the 2010 inventory.

There are 1.06 acres of wetland (1.98% of EBMU13 land area) 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 Neversink 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 wetlands in EBMU13 consist of freshwater-forested shrub (0.56 acres), and freshwater-emergent wetlands (0.50 acres).

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 (FIRM), which identify areas prone to flooding. No building structures are located in the 100-year floodplain in EBMU14. The upper Neversink River is scheduled to have its FIRMs updated with current surveys and hydrology and hydraulics analysis in the next few years, and the mapped boundaries of the 100-year floodplain are likely to change.

High flows are confined on the left bank of this management unit, but good floodplain connectivity does exist on the lower elevations of the right bank where the Alexander Tison Preserve is located. The risk of flood inundation is relatively high in this area, threatening the infrastructure on this property. FEMA provides guidance to homeowners on floodproofing at: **http://www.fema.gov/library/viewRecord.do?id=1420**

BANK EROSION Due to a number of conditions in EBMU13, stream banks at several locations within this management unit are at risk of erosion. Four areas of erosion were documented during the stream feature inventory. For the first three, it is recommended that *assisted restoration* practices be applied to help restore bank stability. The first is a continuation of hydraulic erosion from EBMU13, running approximately 60-feet from Station 46900 to Station 46850. The second, 40 feet of erosion between Station 46790 and Station 46750 is being caused by the presence of large woody debris obstructions. The third bank erosion site is the most severe in this management unit and the only documented source of fine sediment, spanning 188-feet in length from Station 46500 to Station 46310. The final bank erosion site is 55-feet long between Station 44630 and Station 44590 and is a candidate for *passive restoration*.

INFRASTRUCTURE 0.25% (16 ft.) of the stream bank length in this management unit has been treated with some form of stabilization. The only revetment existing in EBMU14 is a gabion basket at Station 47200 on the right bank which looked to be newly placed and in good structural and functional condition. One berm was documented in this management unit between Station 47500 and Station 45150, totaling 6.92% (447.5 ft.) of the total length of stream bank. This old stone berm appeared to be unmaintained and overgrown with mature woody vegetation.

Aquatic Habitat

Aquatic habitat is an important aspect of the Neversink River ecosystem, providing recreational, aesthetic, and economic benefits to the community. While ecosystem health 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 Neversink River 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.

New York State Department of Environmental Conservation (DEC) classifies the surface waters in New York according to their designated usses in accordance with the Clean Water Act. The following list summarizes those classifications applicable to the Neversink River.

1. The classifications A, AA, A-S and AA-S indicate a best usage for a source of drinking water, swimming and other recreation, and fishing.
2. Classification B indicates a best usage for swimming and other recreation, and fishing.
3. Classification C indicates a best usage for fishing.
4. Classification D indicates a best usage of fishing, but these waters will not support fish propagation.

Waters with classifications AA, A, B and C may be designated as trout waters (T) or suitable for trout spawning (TS). These designations are important in regards to the standards of quality and purity established for all classifications. See the DEC Rules & Regulations and the Water Quality Standards and Classifications page on the NYSDEC web site for information about standards of quality and purity.

In general, trout habitat is of a high quality in the Neversink River. The flow regime above the reservoir 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. The East Branch of the Neversink River been given a "C(T)" class designation, supporting fishing and indicating the presence of trout. Trout spawning likely occurs in this management unit, but has not yet been documented in the DEC classification.

Channel and floodplain management can modify the physical structure of the stream in some locations, resulting in the filling of pools, the loss of stream side cover and the homogenization of structure and hydraulics. As physical structure is compromised, inter-species competition is increased. Fish habitat in this management unit appears to be relatively diverse.

It is recommended that a population and habitat study be conducted on the Neversink River, 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 Neversink 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 Neversink River. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly degrade water quality. There are no piped outfalls or road drainages that convey storm water runoff directly into the Neversink River in this management unit.

Sediment from stream bank and channel erosion pose a potential threat to water quality in the Neversink River. Clay and sediment inputs into a stream may increase *turbidity* and act as a carrier for other pollutants and pathogens. There are four bank erosion sites in EBMU13 that are a potential source of fine sediment. None of the sites represent a significant source of turbidity.

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. Four structures are 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 included 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**.