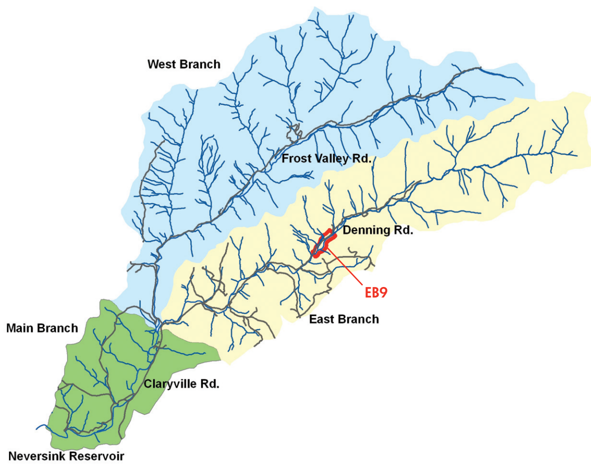
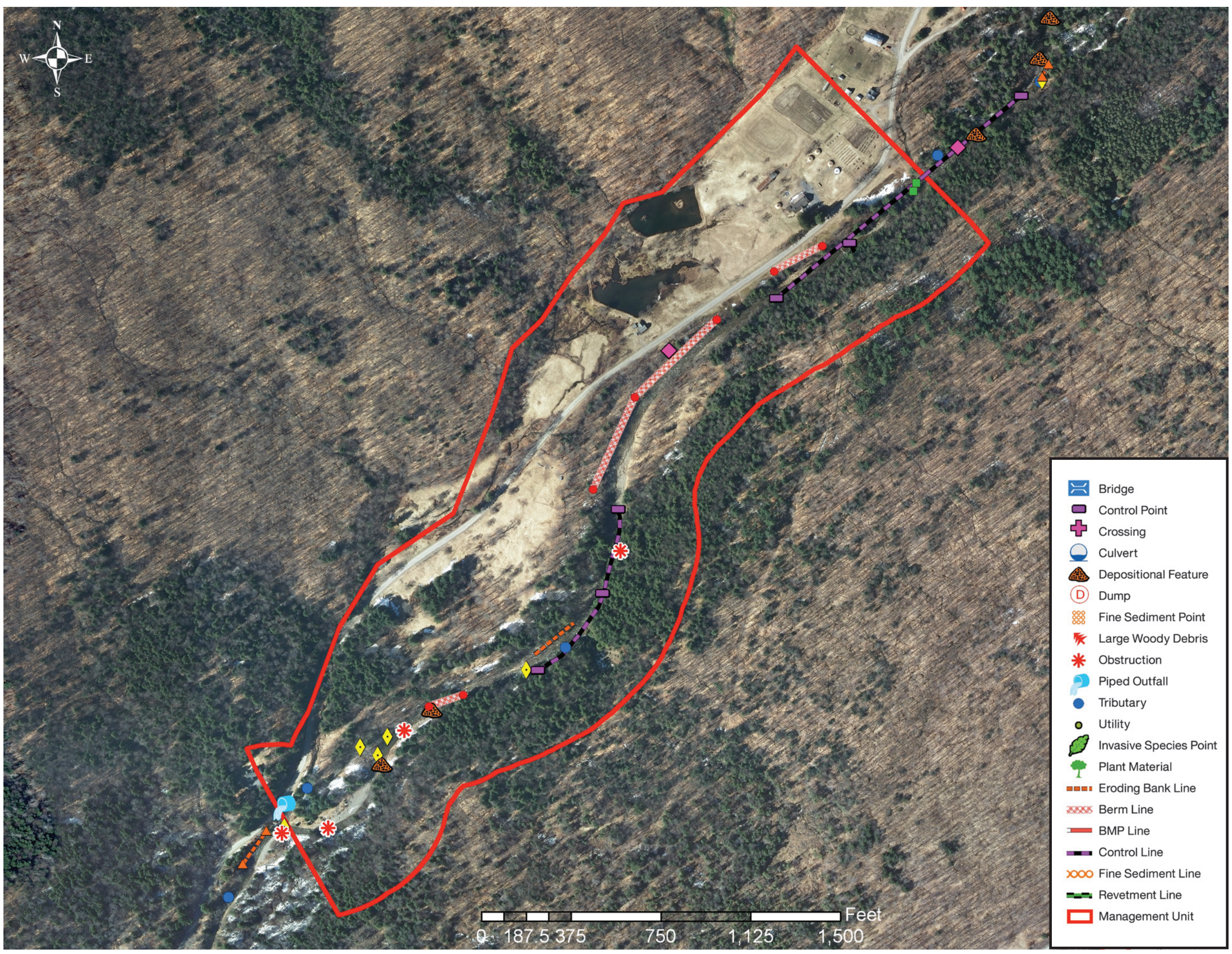
Neversink River East Branch

MANAGEMENT UNIT 9

- 3 % of stream length is experiencing erosion
- 0.44 % of stream length has been stabilized
- 28.69 acres of inadequate vegetation within the riparian buffer
- None of the stream length is within 50 ft. of the road
- Two structures are located within the 100-year floodplain boundary





Stream Feature Inventory 2010 (Figure 1)

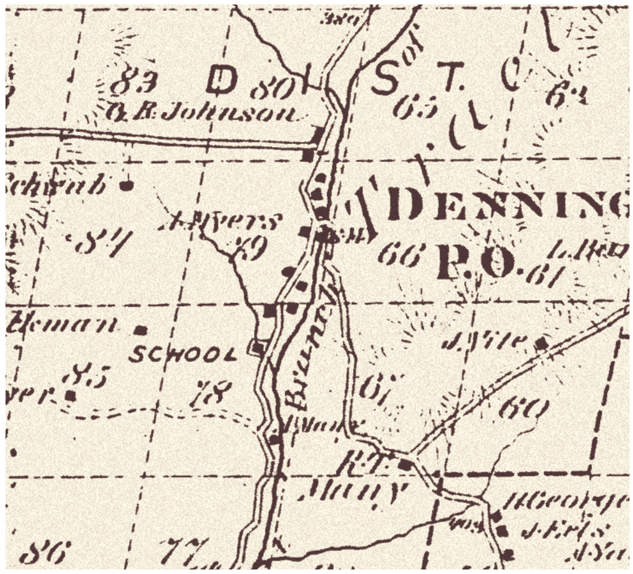
Management Unit Description

This management unit begins where drainage from a retention pond enters the main channel, continuing approximately 5,177 ft. to a tributary confluence with Erts Brook. The drainage area ranges from 15.40 mi^2 at the top of the management unit to 16.70 mi^2 at the bottom of the unit. The valley slope is 1.69%. The average valley width is 723.74 ft.

Summary of Recommendations East Branch Management Unit 9

Intervention Level	Passive restoration of the bank erosion site between Station 32380 and Station 32170. (BEMS NEB9_32100)
Stream Morphology	Assess sediment deposition and channel migration from the accumulation of large woody debris supplied by the watershed upstream. Conduct baseline survey of channel morphology.
Riparian Vegetation	Improve riparian buffer along revetment at Station 34860. Improve riparian buffer along berm between Station 34360 and Station 34135.
Infrastructure	Assess flood threats to Denning Road.
Aquatic Habitat	Fish population and habitat survey.
Flood Related Threats	Assess inundation threats to building structures within 100-year floodplain boundary. Floodproofing as appropriate. http://www.fema.gov/library/viewRecord.do?id=1420
Water Quality	Assess effectiveness of Culvert at Station 30830 during storm events.
Further Assessment	Long-term monitoring of erosion site. Assess effects of excessive woody debris accumulation and channel migration.

Historic Conditions

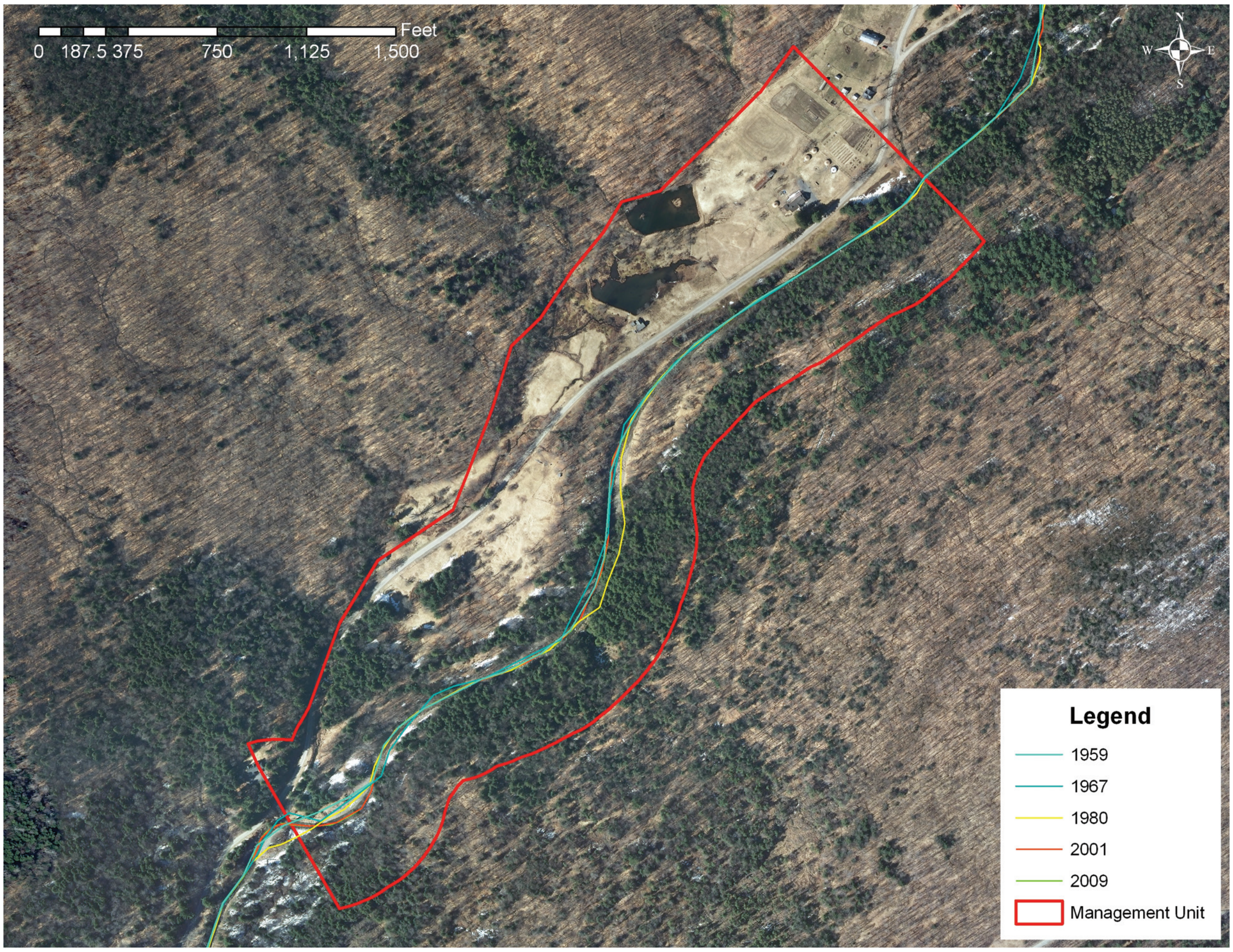


Excerpt from 1875 Beers Map (Figure 2)

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.

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. 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 little lateral channel instability, and only 1 NYS Article 15 stream disturbance permit has 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.

The East Branch enters EBMU9 just downstream of where Erts Brook flows into the main channel. The backwater effect created by this tributary confluence is causing significant aggradation just upstream. *(B173)*. The exposed bedrock first documented in EBMU10 continues along the channel bottom and left valley wall in this management unit until Station 34080, restricting both vertical and lateral channel

Aggradation upstream of Erts Brook (B173)

migration. *(B163)* The stream is controlled by the left valley throughout most of this management unit, however, it maintains good floodplain connectivity on the right side.

Relict bridge abutments are now serving as revetments on both sides of the stream at Station 34860. *(B171)* The abutments consist of stacked rock and are approximately 12-feet in length. The good structural condition of the abutment on the right bank suggests that it has been maintained over the years to provide bank stabilization.

Bedrock control along stream bed and left valley wall (B163)

Relict bridge abutments serving as revetment on right and left banks (B171)

Mowed grass above abutment (B174)

Large boulders and wooden dam (A266)

Looking upstream at wooden dam spanning channel (A269)

Cobble size stone berm (A272)

The riparian area above this abutment consists of mowed grass, which does not adequately provide stability to the stream bank under high flows. *(B174)* It is recommended that this area be planted with native woody vegetation, which can strengthen the stream bank and slow erosive forces of higher flows during flood events.

At Station 34460 there is an old wooden dam that spans the entire width of the stream and is supported by large boulders on both sides. *(A266 & 269)* This structure appears to have been placed to provide habitat for trout. The water faces an abrupt 3-foot vertical drop as it flows over the dam, resulting in a deep scour pool below. The structure continues to function for the creation of habitat, but appears unmaintained and is beginning to wash out towards the center. Structures such as this were observed frequently in the East Branch of the Neversink River.

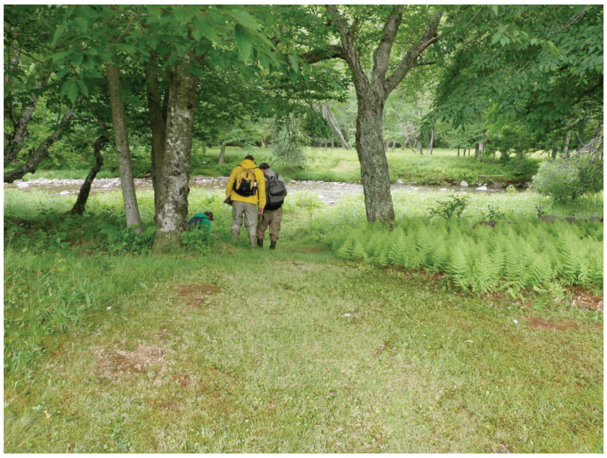
A stone berm consisting of cobble sized materials begins along the right bank at Station 34360, continuing approximately 225-feet until Station 34135. *(A272)*. This berm was most likely intended to prevent flooding along the adjacent Denning Road. The portion of the riparian corridor directly adjacent to the stream consists of only a 5-10-foot wide buffer of woody vegetation before transitioning to mowed grass until it is intersected with Denning Road. A wider vegetated riparian buffer in this corridor would assist in mitigating flood risks to Denning Road, and it is recommended that the mowed grass be replaced with mature woody vegetation.

A second berm begins along the right bank at Station 33830 and continues approximately 895-feet until Station 32935. *(B190)* The berm consists of cobbles and other earthen materials, and has become overgrown with mature vegetation. At Station 33600 there is a break in the berm where a mowed access path runs from the road to the stream. *(B187)*

Continuing downstream, the channel again flows up against the left valley wall at Station 32900. *(A280)* The stream remains semi-confined on the left side for approximately 790-feet until Station 32110. A tree and root ball have fallen out of the bank at Station 32710 and deposited at the toe of the slope, causing an obstruction to higher flows. *(B193)* It does not appear that the removal of this tree will cause significant bank failure in the future; however, it should be monitored for future changes in condition.

The right bank begins to erode at Station 32380 (BEMS NEB9_32100), continuing approximately 210-feet to Station 32170. *(A282)* This erosion is caused by hydraulic pressure on the bank during high flows, which entrains the alluvial sediments (listed as alluvial, this looks like till to me double check) and exposes the root structure of the vegetation present. Large rocks have deposited at the toe of this bank, which along with the present establishment of sedges and various other

Cobble and earthen berm on right bank (B190)



Mowed path across stream channel (B187)

Stream flowing against left valley wall (A280)

Tree and root ball fallen on left bank (B193) vegetation, indicate that it is possible for this bank to stabilize without treatment (passive restoration). *(A284)* However, it is recommended that this site be monitored for changes in condition.

A small unnamed tributary enters through the bedrock valley wall on the left bank at Station 32270. *(B195)* This tributary contributes a perennial flow of cool water to the East Branch which helps to maintain good water quality and aquatic life. At Station 32100 the channel begins to pull slightly away from the left valley wall and has established just under 100-feet of forested floodplain. This reach appears very aggradational, characterized by frequent shallow riffles. *(B202)*

At Station 31800 a stone berm begins on the right bank and continues for approximately 150-feet until Station 31650. The intention of this berm was most likely to prevent high flows from reaching the nearby section of Denning Road. *(B208)* Across from the downstream end of the berm a depositional side bar has formed on the left side of the stream bed at Station 31650. *(A289)* This bar is well vegetated with sedges and grasses, and does not appear to be causing any management issues.

Erosion of right bank (A282)

Large rocks deposited at toe of right bank (A284)

Small tributary entering on left bank (B195)

Aggradated stream channel (B202)

Stone berm on right bank protecting (B208)

Depositional side bar on left bed (A289)

Large woody obstructions (A293)

Channel braiding caused by obstructions (A306)

Side channel divergence (B211)

A series of large woody debris obstructions begins at Station 31500, and is evident again at Station 30950, causing channel braiding and instability throughout the remainder of EBMU9. *(A293, 306)* A side channel diverges to the right at Station 31450 and continues to braid through the right floodplain in a series of several small side channels. *(B211 & 216)* These side channels are oriented in the direction of Denning Road and pose a flood risk to the road under high flows. Woody debris and sediment deposition are evident throughout these side channels. The presence of large woody debris obstructions is also causing sediment deposition in the main channel in the form of side bars and full channel aggradation. *(A299)*

At Station 30830, a, 18-inch diameter plastic drainage culvert conveys storm water runoff from Denning Road into the stream. This pipe was halfway covered with silt at the time of that this inventory was conducted, indicating that it may not be fully effective during storms. *(A315)*

EBMU9 ends at Station 30800, where a drainage channel enters the stream on the right side. *(B218 &219)* The drainage channel flows from two relatively large retention ponds located on a farm in the right floodpain. This drainage flows adjacent to Denning Road for approximately 2,500-feet before entering the stream, making it a potential source of contaminants including chlorides (salt) and petroleum by-products from road runoff to the East Branch of the Neversink River.

Braided side channels on right floodplain (B216)

Full channel aggradation (A299)

Denning Road culvert pipe (A315)

Drainage channel entering stream on right side (B218)

Looking upstream at convergence with drainage channel (B219)

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 is largely dominated by sediment storage reaches and occasionally punctuated by short transport reaches. Relatively good floodplain connectivity is maintained along the right side of EBMU9. 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 herbaceous vegetation (30.86%) followed by evergreen-closed tree canopy (26.41%). *Impervious* area makes up 3.03% of this unit's buffer. No occurrences of Japanese knotweed were documented in this management unit during the 2010 inventory.

There are 3.74 acres of wetland (4.29% of EBMU9 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). There is 0.81 acres of Riverine, 1.99 acres of freshwater pond, and 0.94 acres of freshwater emergent wetland present in EBMU9.

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. Two building structures are located in the 100-year floodplain in EBMU9. 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.

The stream channel maintains good floodplain connectivity on the right side of the stream throughout this management unit. A significant portion of Denning Road falls within the floodplain boundary and is at high during flood events. Several building structures fall just outside of the floodplain boundary and should be monitored for risk of flood inundation. 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 EBMU11, the stream bank at one location is experiencing active hydraulic erosion. The right bank begins to erode at Station 32380 (BEMS NEB9_32100), continuing approximately 210-feet to Station 32170. Passive restoration is recommended for this site because it is likely that it can stabilize without treatment.

INFRASTRUCTURE 0.44% (36 ft.) of the stream bank length in this management unit has been treated with some form of stabilization. There is one revetment in EBMU9, which is stacked that was once a bridge abutment at Station 34860. Three berms were documented in this management unit totaling 15.51% (1271.4 ft). The first is a stone berm consisting of cobble sized materials begins along the right bank at Station 34360, continuing approximately 225-feet until Station 34135. A second berm begins along the right bank at Station 33830 and continues approximately 895-feet until Station 32935. At Station 31800, a third stone berm begins on the right bank and continues for approximately 150-feet until Station 31650.

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 is one piped outfall of road drainage that conveys storm water runoff directly into the Neversink River in this management unit at Station 30830.

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 is one bank erosion sites in EBMU9 that is a potential source of fine sediment. This site does not 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**.