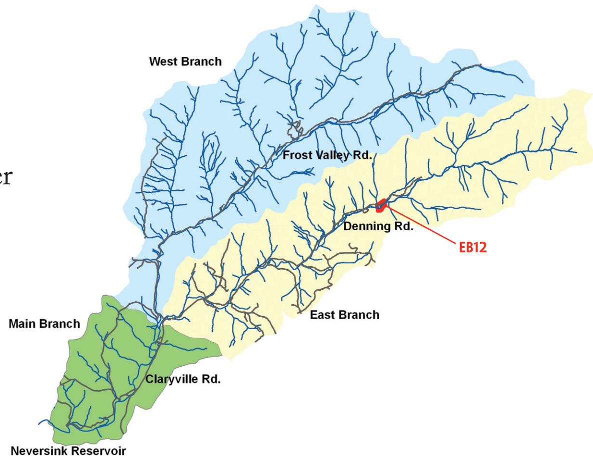
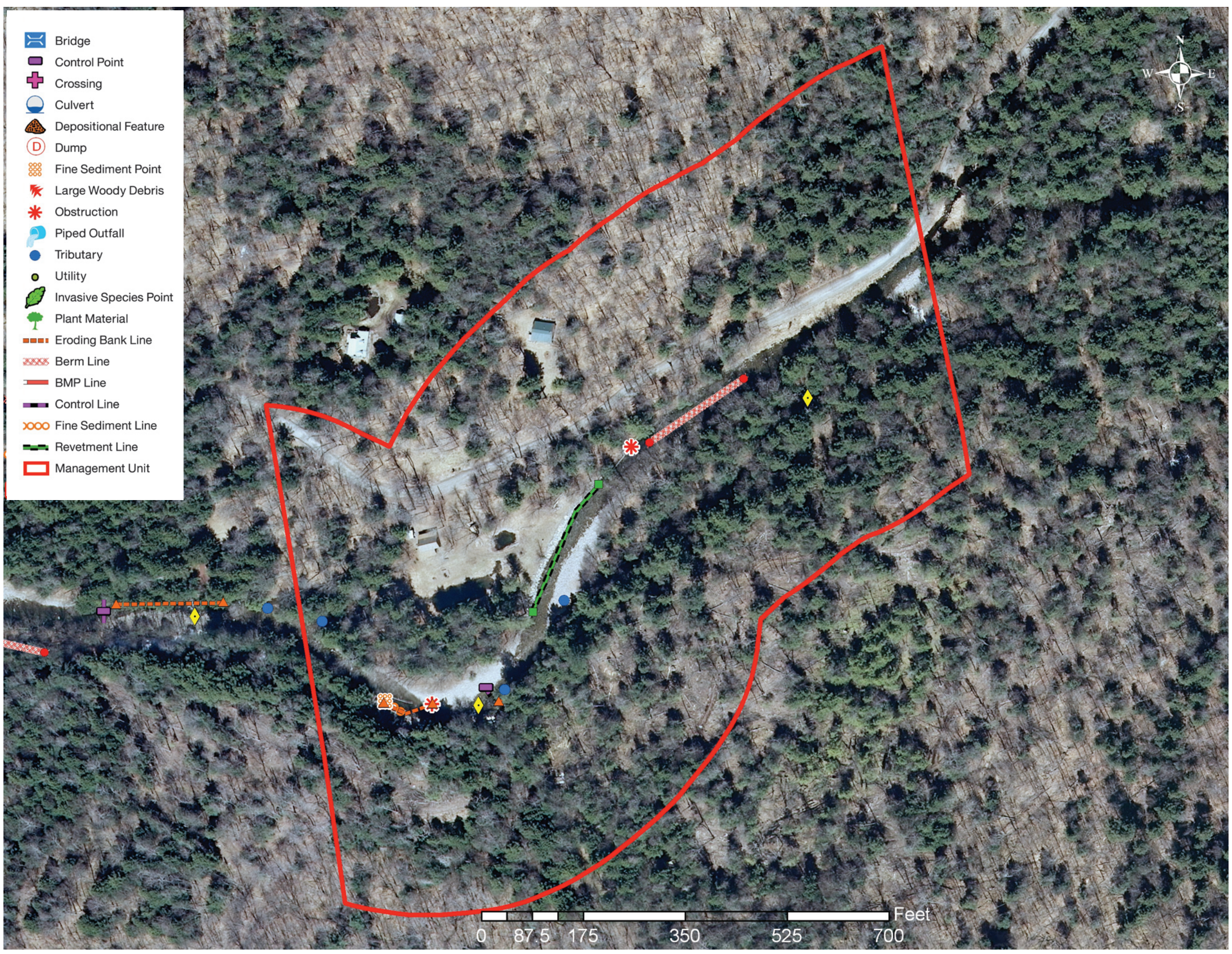
Neversink River East Branch

MANAGEMENT UNIT 12

- 3 % of stream length is experiencing erosion
- 8.45 % of stream length has been stabilized
- 2.34 acres of inadequate vegetation within the riparian buffer
- 460 ft. of stream is within 50 ft. of the road
- No structures are located within the 100-year floodplain boundary





Stream Feature Inventory 2010 (Figure 1)

Management Unit Description

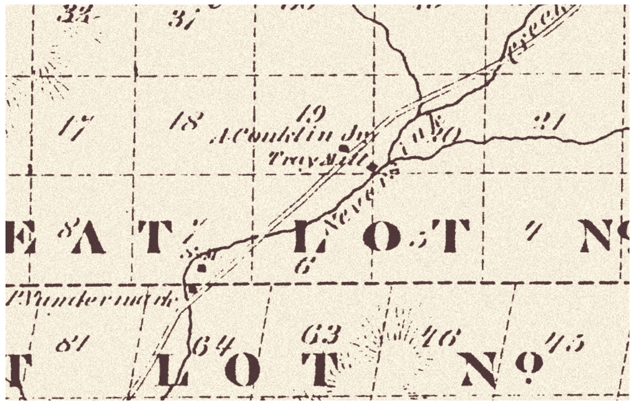
This management unit begins at a confluence with Riley Brook, continuing approximately 1,469 ft. to a confluence with Flat Brook. The drainage area ranges from 12.20 mi^2 at the top of the management unit to 12.60 mi^2 at the bottom of the unit. The valley slope is 0.79%. The average valley width is 783.84 ft.

Summary of Recommendations
East Branch Management Unit 12

Intervention Level	Passive restoration of the bank erosion site between Station 42570 and Station 42550. (BEMS NEB13_44500) Passive restoration of the bank erosion site between Station 42440 and Station 42360. (BEMS NEB12_42300)
Stream Morphology	Assess sediment deposition resulting from the accumulation of large woody debris supplied by the watershed upstream. Baseline survey of channel morphology and sediment transport analysis.
Riparian Vegetation	Improve riparian buffer along berm between Station 42290 and Station 43095. Improve riparian buffer along the revetment between Station 42670 and Station 42650.
Infrastructure	Assess inundation threat to Denning Road just outside of 100-year boundary on right floodplain.
Aquatic Habitat	Fish population and habitat survey.
Flood Related Threats	Assess inundation threat to homes just outside of 100-year boundary on right floodplain. Floodproofing as appropriate. http://www.fema.gov/library/viewRecord.do?id=1420
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. 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 and no 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 43650, where Flat Brook enters the main channel from the right floodplain. This tributary crosses Denning Road and runs adjacent to it for approximately 1,200-feet before converging with the Neversink. There is a very narrow riparian buffer between Flat brook and

Denning Road, and it is likely that this tributary contributes chlorides (salt) and petroleum by-products from road runoff to the Neversink.

This location also marks where Denning Road begins to encroach on the East Branch and we begin to see the effects of human development on stream morphology.

At Station 43310, a portion of the flow diverges into a small side channel on the left floodplain, continuing for about 550-feet before converging back with the main channel at Station 42840. This side channel was receiving a small flow at the time of the walkover, indicating that it stays inundated even under relatively dry conditions. *(A130)*

A cobble berm begins on the right bank at Station 42290, continuing 195-feet until Station 43095. *(B61)* This berm was installed with the goal of preventing the stream from flowing onto Denning Road during flood events. The right stream bank is less than 50-feet from the road in this location and does not have a vegetated riparian buffer. A vegetated riparian buffer can naturally slow the flow velocity along stream banks during flood events, and can help prevent water from easily reaching the road. A riparian buffer including woody vegetation can also strengthen the stream bank and slow erosive forces of higher flows during flood events.

Continuing past the downstream end of the berm there is an accumulation of large woody debris on the right bank at Station 43070. *(B65)* A bedrock protrusion located directly underneath the debris obstruction is preventing the bank from any significant erosion. The bank continues to remain relatively stable for approximately 90-feet until Station 42980, where a stacked boulder revetment

Divergence with small side channel (A130)

Cobble berm on right bank protecting Denning Road (B61)

Large woody debris on right bank (B65) begins on the right bank. The boulders are deeply embedded in the bank with the intention of stabilizing the severely eroding bank in this section of stream. This revetment continues for 248-feet to Station 42720 and is in good structural and functional condition. *(B68)* The riparian zone behind this revetment is primarily mowed grasses and other herbaceous vegetation which offer little stabilization to the bank. Improvements can be made to this riparian buffer through planting techniques *(B71)*

The stream begins a sharp meander to the right at Station 42700, forming a 180-foot long point bar on the inside of the bend along the right bank. A small unnamed tributary enters the main channel from the left bank at Station 42570. *(A138)* A large tree has deposited at the mouth of this tributary, diverting higher flows into the left bank and causing hydraulic erosion (BEMS NEB13_44500). This bank erosion averages 5-feet in height and continues to expose alluvial cobble sized materials for approximately 20-feet in stream length. *(A139)* The larger cobbles that are accumulating on this bank are offering some armoring against further erosion, indicating that 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.

At Station 42560, several boulders embedded in the right side of the stream channel are acting as a grade control. *(A136)* Scour is occurring directly downstream of the grade control because the water faces an abrupt vertical drop as it flows over the boulders. A headcut is occurring at Station 42530, most likely resulting from the presence of the grade control directly upstream. *(B73)* The headcut is actively migrating upstream, and will continue to do so until it meets the boulder control point.

A mass failure of the left stream bank begins at Station 42440, continuing downstream until Station 42360 (BEMS NEB12_42300). This bank is 40-feet in height and consists of alluvial material, much of which is larger cobbles (I'm not sure that this isn't glacial till, rocks appear jagged edged mixed with silts). *(A145)* The exposed silts near the top of this slope are a potential source of fine sediment that could be entrained during high flows.

Stacked boulder revetment on right bank (B68)

Mowed field offering little stabilization to right bank (A71)

Large tree at small tributary entrance on left bank (A138)

Erosion on left bank (A139)

Boulders embedded in right side of stream channel (A136)

Looking upstream at headcut (B73)

Mass failure on left bank (A145)

Large cobble and sedge beginning to stabilize toe (A140)

Large cobble deposition and sedge colonization have begun to stabilize the toe of this bank. It appears that larger mature trees have slid down the slope and established near the toe of the bank, suggesting that this slope failure may have reached an angle of repose and will continue to stabilize. *(A140)* 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.

EBMU12 ends at Station 42200, where Riley Brook enters through the right floodplain.

Sediment Transport

Streams move sediment as well as water. Channel and floodplain conditions determine whether the reach aggrades, degrades, or remains in balance over time. If more sediment enters than leaves, the reach aggrades. If more leaves than enters, the stream degrades. (See Section 3.1 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. 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 (30.08%) followed by mixed-closed tree canopy (26.55%). *Impervious* area makes up 0.06% of the land cover within this unit.. No occurrences of Japanese knotweed were documented in this management unit during the 2010 inventory.

There are no documented wetlands in EBMU12.

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 houses 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.

The stream channel maintains good floodplain connectivity throughout this management unit. A very small portion of Denning Road near the top of EBMU12 is the only infrastructure that falls within the 100-year floodplain boundary. However, there are several homes and other structures that fall just outside of this boundary in the right floodplain and are at high risk during floods. There is little to no mature riparian vegetation in these areas to help mitigate flood risks. 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 EBMU12, stream banks at two locations within this management unit are at risk of erosion. The first is caused by hydraulic erosion and begins at Station 42670, continuing approximately 20-feet in stream length. Passive restoration is recommended for this site. The second bank erosion site is a mass failure that is a potential source of fine sediment along the left stream bank between Station 42440 and 42360. This site appears to be stabilizing on its own, making it a candidate for passive restoration.

INFRASTRUCTURE 8.45% (248 ft.) of the stream bank length in this management unit has been treated with some form of stabilization. The only revetment existing in EBMU12 is a stacked rock wall in good structural and functional condition between Station 42980 and Station 42730. One berm was documented in this management unit between Station 42290 and Station 43095, totaling 6.66% (195.7 ft.) of the total length of stream bank. This berm was installed with the goal of preventing the stream from flowing onto Denning Road during flood events.

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 two bank erosion sites in EBMU12 that are a potential source of fine sediment. Neither 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**.