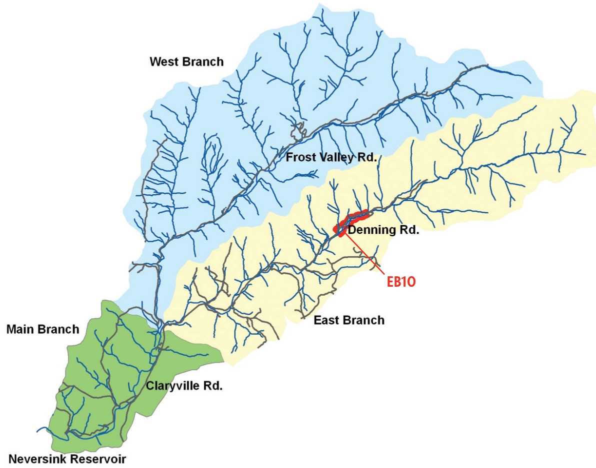
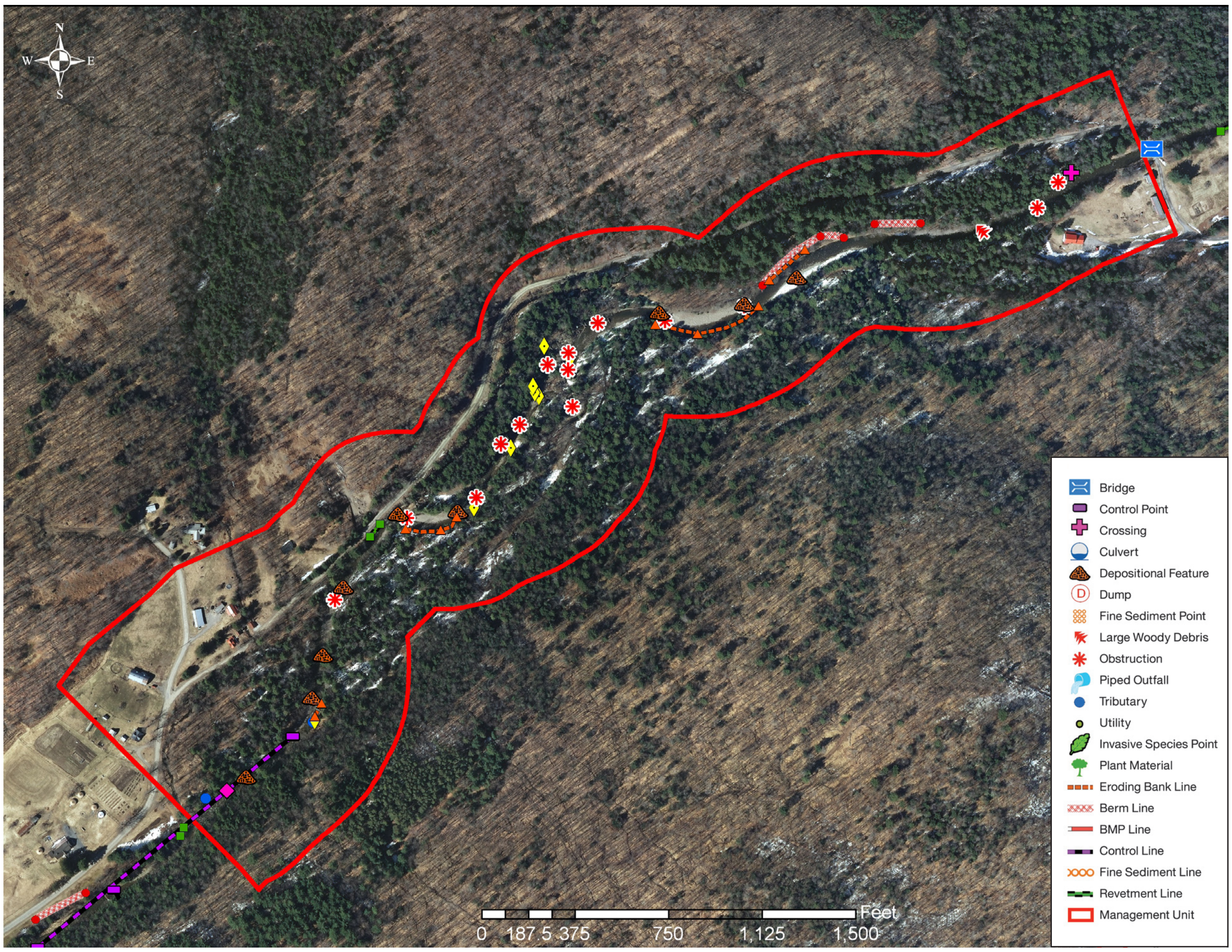
# Neversink River East Branch

## MANAGEMENT UNIT 10

- 9 % of stream length is experiencing erosion
- 0.62 % of stream length has been stabilized
- 17.21 acres of inadequate vegetation within the riparian buffer
- 250 feet of the stream length is within 50 ft. of the road
- One structure is located within the 100-year floodplain boundary




*Stream Feature Inventory 2010 (Figure 1)*

# Management Unit Description

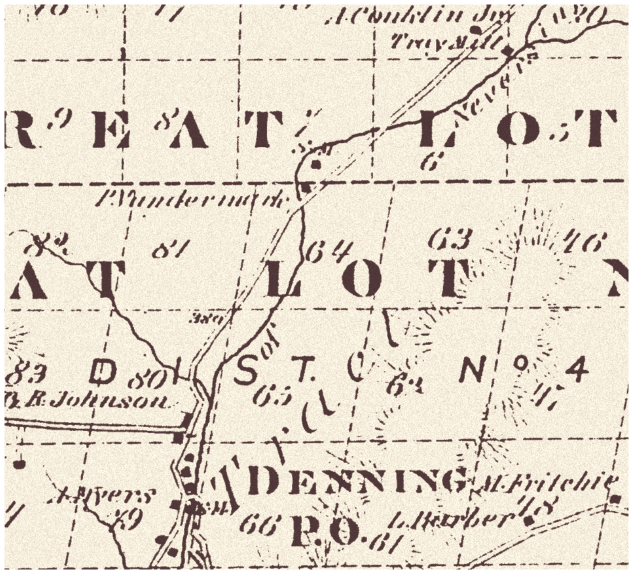
This management unit begins at a tributary confluence with Erts Brook, continuing approximately 5,177 ft. to at a private bridge crossing at Frost Valley YMCA. The drainage area ranges from 13.30 $mi^2$ at the top of the management unit to 15.40 $mi^2$ at the bottom of the unit. The valley slope is 1.07%. The average valley width is 558.60 ft.

# Summary of Recommendations
# East Branch Management Unit 10

| | |
|---|---|
| **Intervention Level** | Assisted restoration of the bank erosion site between Station 38660 and Station 38475. (BEMS NEB10_38400)<br>Assisted restoration of the bank erosion site between Station 38380 and Station 37930. (BEMS NEB10_37900)<br>Passive restoration of the bank erosion site between Station 36720 and Station 36450. (BEMS NEB10_36400)<br>Passive restoration of the bank erosion site between Station 35600 and Station 35540. (BEMS NEB10_35500) |
| **Stream Morphology** | Conduct baseline survey of channel morphology. |
| **Riparian Vegetation** | Improve a buffer along Frost Valley YMCA property on left bank between Station 40080 and Station 39600.<br>Improve riparian buffer along Denning Road on right bank between Station 36500 and Station 36300. |
| **Infrastructure** | Assess flood threats to Denning Road. |
| **Aquatic Habitat** | Fish population and habitat survey. |
| **Flood Related Threats** | Assess inundation threat to buildings just outside of 100-year floodplain.<br>Floodproofing as appropriate.<br>http://www.fema.gov/library/viewRecord.do?id=1420 |
| **Water Quality** | None. |
| **Further Assessment** | Long-term monitoring of erosion sites.<br>Assess effects of excessive woody debris accumulation and channel braiding. |

# Historic Conditions

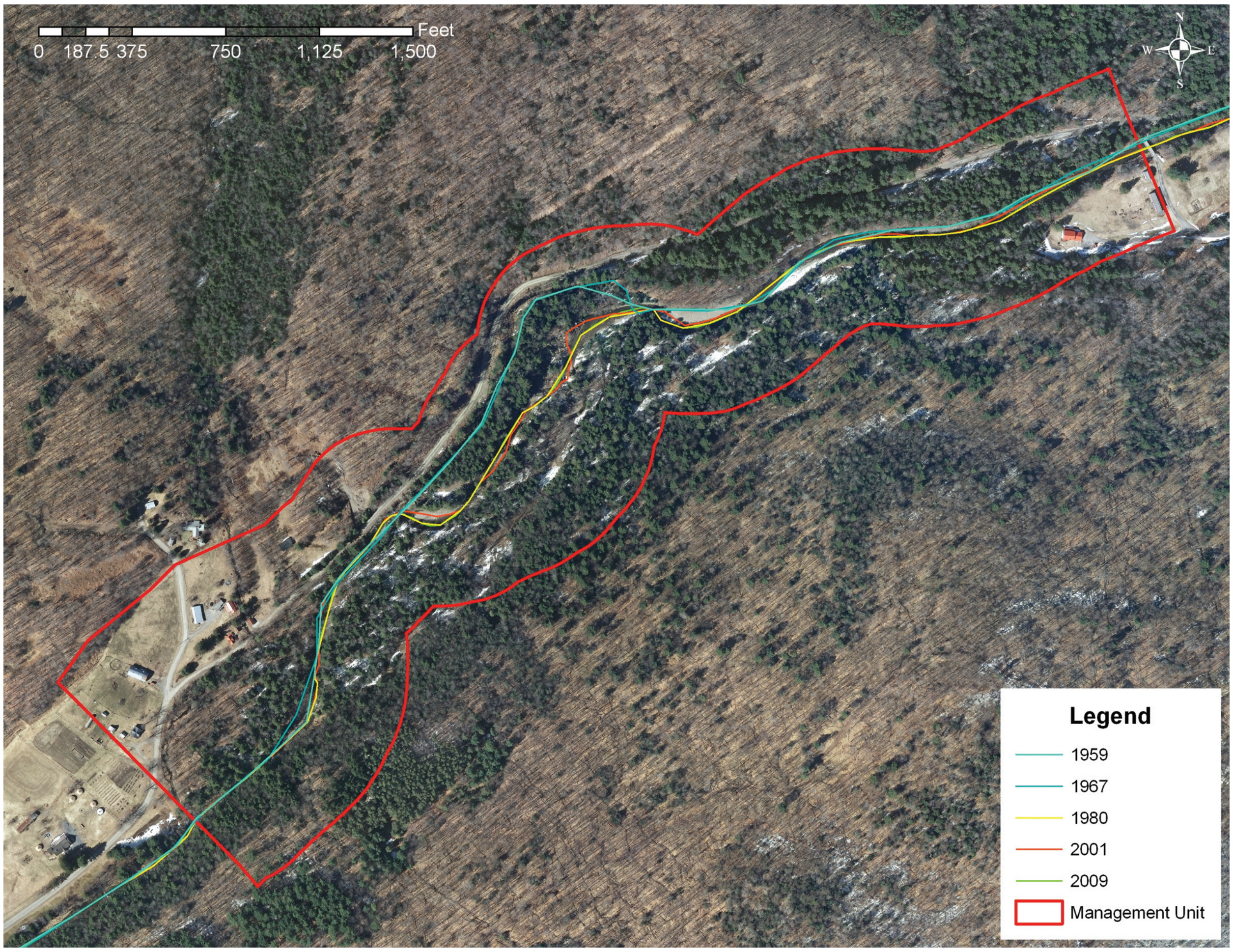
As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 *Geology of Upper Neversink River,* for a description of these deposits. These deposits make up the soils in the high banks along the valley walls on the Neversink mainstem and its tributaries. 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 5 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.

EBMU10 begins at Station 40080 just downstream of where a private bridged owned by Frost Valley YMCA crosses the channel. The first 500-feet of this management unit consists of a very narrow strip of riparian vegetation on the left bank, which provides little flood protection to the three structures that have been established in the floodplain. These structures are at a high risk of inundation during flood events. Denning Road runs parallel to the stream along the right floodplain for the entire management unit. There is however a relatively good riparian buffer consisting of mature woody vegetation between the stream and the road.

At Station 39790 vegetation has been cleared on both banks to allow for a recreational crossing to be maintained. *(A186)* Large woody debris has also begun to accumulate and cause obstructions to flow in this area, first evident at Station 39720 where a tree trunk has become lodged on the right bank. *(B95)* Fallen trees are also causing obstructions on the left bank at Station 39600, *(B98)* and on the right bank at Station 39370. *(A188)* The size of these woody debris deposits illustrates the power that the stream has to move large materials under high flows.

An old stone berm begins on the right floodplain at Station 39125, continuing approximately 185-feet to Station 38940. This berm is set back from the stream 100-feet and was most likely intended to prevent flooding on Denning Road. It is now overgrown with roots and woody vegetation, indicating that it has not been maintained in many years. *(B100)*

*Recreational crossing (A186)*

*Woody debris accumulation on right bank (B95)*

*Fallen trees causing obstructions on left bank (B98)*

*Fallen trees causing obstructions on right bank (A188)*

Another larger berm begins along the right bank at Station 38800, ending nearly 400-feet downstream at Station 38440. *(B104)* The side cast stream materials in this berm along with the shallow and overwidened channel in this reach suggest that the stream may have been cleared with a bulldozer at some point in the past. Directly in front of the berm the bank is actively eroding for approximately 185-feet from Station 38660 to Station 38475 (BEMS NEB10_38400). *(A193)* Cobble sized alluvial materials are exposed along this 7-foot high bank, caused by hydraulic pressure under higher flow events. Recommendations for this bank erosion site minimally include monitoring for significant changes in condition and possible assisted restoration with techniques to stabilize the bank.

A point bar has formed on the left side of the channel across from the berm and bank erosion sites between Station 38900 and Station 38420. *(A198)* This bar was formed through the deposition of cobble sized materials. The only vegetation present is an occasional clump of grass or sedges, indicating that this feature is frequently inundated during large flow events.

*Old stone berm on right floodplain (B100)*

*Large berm on right bank (B104)*

*Overwidened channel and actively eroding bank (A193)*

*Cobble point bar forming on left side of stream (A198)*

*Erosion of left bank (A200)*

*Undercut left bank exposing cobble and large silt (B115)*

Continuing downstream, the stream begins to meander to the right exposing a long bank erosion section on the left bank beginning at Station 38380 and continuing approximately 450-feet to Station 37930 (BEMS NEB10_37900). *(A200)*This bank has been undercut through hydraulic erosion, exposing cobble sized materials and larger silts. *(B115)* There are several large trees along this bank that are experiencing root scour and have either fallen or are at risk of falling into the stream. Recommendations for this bank erosion site minimally include monitoring for significant changes in condition and possible assisted restoration to stabilize the bank.

A point bar consisting of cobble sized materials has formed on the inside of the meander bend directly across from the bank erosion site between Station 39330 and Station 37780. *(B112)* This depositional feature has formed behind a large woody obstruction which extends from the right bank across a large portion of the stream channel. *(B108)* The bar is frequently inundated under large events, as is evidenced by the lack of any significant vegetative growth. A large tree has fallen from the eroding left bank, spanning the entire width of the stream channel and causing a second obstruction at the downstream end of the point bar. *(A204)*

*Cobble point bar on right bed (B112)*

*Large woody obstruction causing point bar downstream (B108)*

Approximately 100-feet downstream from the point bar the stream takes a hard left turn and enters into a straight reach highlighted by excessive accumulation of large woody debris and channel instability. Debris accumulation begins at Station 37700, where woody debris has created a log jam effect with deposition upstream and scour downstream of the obstruction. *(A206)* This pattern of woody debris obstruction is also evident in excessive amounts between Station 37500 and Station 37300, *(B121)* resulting in channel braiding along the well connected right and left floodplains. *(B124)* Side channels diverging into the right floodplain run relatively close to Denning Road, which may result in issues with flooding. Continued channel instability is also evident in the formation of a headcut below an obstruction at Station 37300. *(A229)* 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.

*Obstruction across channel width (A204)*

The side channels that diverged at various points along the left floodplain between Station 37300 and Station 37500 make their first convergence back with the main channel at Station 37060. *(A223)* The trend of large woody debris obstruction continues at this point, where the remnants of three trees have accumulated on the right bank. *(B133)* This obstruction is causing a headcut directly below, as well as erosion of the right bank both up and downstream. A second convergence of the side channels occurs at Station 36780. *(A232)* An obstruction in the same general area is resulting in deposition upstream and scour below. *(B138)*

*Woody debris creating log jam (A206)*

*Woody debris obstructions in main channel (B121)*

*Diverting side channels caused by obstructions in main channel (B124)*

*Looking downstream at obstruction and headcut (A229)*

*Convergence of side channel with main channel (A223)*

*Large woody debris accumulation on right bank (B133)*

*Second convergence with side channel (A232)*

*Obstruction causing deposition upstream and scour downstream (B138)*


*Point bar forming on right bank (B141)*


*Large tree deposited during high flows causing deposition (B150)*


*Erosion of left bank exposing cobble (A238)*


*Small tributary convergence (B148)*

At Station 36720 the stream begins to meander to the right flowing perpendicular to Denning Road. A point bar consisting of cobble sized materials and averaging 50-feet in width begins along the right bank at this station, continuing approximately 270-feet to Station 36450. *(B141)* A large tree that has deposited near the downstream end of the bar at Station 36500 is causing an obstruction to high flows, further contributing to this depositional area. *(B150)* On the opposite side of the stream, erosion of the left bank begins at Station 36720 and continues until Station 36450 (BEMS NEB10_36400). Hydraulic erosion has exposed cobble sized alluvial material at the toe of this bank. *(A238)* Large rocks are beginning to deposit at the toe of this eroding bank, 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.

A small unnamed tributary enters the main channel at Station 36450 which most likely carries drainage from the floodplain. *(B148)* The stream channel takes a hard left turn at this point and continues running parallel to road for the remainder of the management unit. There is very little riparian

*Stacked rock wall on right bank protecting Denning Road (B152)*

*Cobble side bar on left side of channel (B161)*

*Large woody obstruction deposited on side bar (B157)*

*Side bar beginning on right side of channel (A247)*

vegetation along the right bank between the stream and the road from Station 36450 to Station 36300. Stream banks that lack mature deep rooted vegetation are often very unstable and susceptible to erosion during high flows. They also do little to prevent road runoff which may contain chlorides (salt) and petroleum by-products from reaching the stream. A stacked rock wall was placed between Station 36380 and Station 36300 in order to provide bank stabilization and protection for this section of Denning Road. *(B152)* This wall appears to be in good structural and functional condition. A culvert is protruding through the revetment, which is a potential source for contaminants from road runoff.

Continuing downstream, the channel takes a slight turn to the left at Station 36100 and moves further away from the road. A cobble side bar has formed on the left side of the channel beginning at this station and continuing downstream until Station 35800. *(B161)* At Station 36010 a large woody obstruction has deposited on the bar. *(B157)* A transverse cobble bar begins along the right side of the channel at Station 35600, continuing approximately 150-feet downstream until Station 35450. *(A247)*

*Hydraulic erosion of left bank (A244)*

*Large cobble restabilizing bank (A245)*

*Relict side channel entering from left floodplain (A251)*

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

At Station 35600 across from the depositional bar the left bank is eroding and exposing the root structure of the mature vegetation until Station 35540 (BEMS NEB10_35500). Hydraulic pressure put on the bank during higher flow events is entraining the cobble sized alluvial material. *(A244)* Despite the severe appearance of this erosion, large rocks are beginning to deposit at the toe and are providing some armoring of the eroding bank. The sod mats which have been undercut are now slumping down over the exposed bank sediment, offering additional protection and stabilization. *(A245)* 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.

Downstream of the eroding left bank at Station 35520 there is evidence of a relict side channel entering from the left floodplain. *(A251)* At Station 35420 the stream flows up against the left valley wall and is controlled on the left bank and channel bottom by this feature for the remainder of the management unit, continuing into EBMU9. *(B163)* The channel begins to aggrade at Station 35170 as a result of a

*Channel wide deposition (B168)*

*Erts Brook convergence (A259)*

backwater effect from the Erts Brook tributary confluence downstream. Evidence of this channel wide deposition continues for approximately 100-feet until Station 350700. *(B168)*

EBMU10 ends at Station 34900 where Erts Brook converges from the right floodplain. *(A259)* Erts Brook is a perennial tributary which crosses under Denning Road approximately 700-feet prior to its confluence with the East Branch of the Neversink River, making it a potential source for contaminants from road runoff.

## 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 throughout EBMU10. 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 (32.44%) followed by mixed-closed tree canopy (21.87%). *Impervious* area makes up 3.87% of this unit's buffer. No occurrences of Japanese knotweed were documented in this management unit during the 2010 inventory.

There are no documented wetlands in EBMU10.

# 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. One building structure is located in the 100-year floodplain in EBMU10. 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 significant portion of Denning Road and two building structures fall just outside of the 100-year floodplain boundary. This infrastructure is at very high risk during flood events. 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, stream banks at four locations within this management unit are experiencing active hydraulic erosion. The first begins along the right bank at Station 38800, ending nearly 400-feet downstream at Station 38440.

Assisted restoration with bioengineering techniques is recommended to stabilize this bank. The second bank erosion site is on the left bank beginning at Station 38380 and continuing approximately 450-feet to Station 37930. Assisted restoration with bioengineering techniques is also recommended for this site. The third begins at Station 36700 on the left bank and continues until Station 36750. Large rocks are beginning to deposit at the toe of this eroding bank, indicating that it is possible for this bank to stabilize without treatment (passive restoration). The final bank erosion site in this management unit begins on the left bank at Station 35600 and is eroding and exposing the root structure of the mature vegetation until Station 35540. It is possible for this bank to stabilize without treatment (passive restoration).

**INFRASTRUCTURE** 0.62% (64 ft.) of the stream bank length in this management unit has been treated with some form of stabilization. There is one revetment in EBMU10, which is stacked rock wall intended to provide bank stabilization and protection for the section of Denning Road between Station 36380 and Station 36300. Two berms were documented in this management unit totaling 5.63% (582.6 ft.). The first is an old stone berm beginning on the right floodplain at Station 39125, continuing approximately 185-feet to Station 38940. Another larger berm begins along the right bank at Station 38800, ending nearly 400-feet downstream at Station 38440.

# 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.

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 EBMU10 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**.