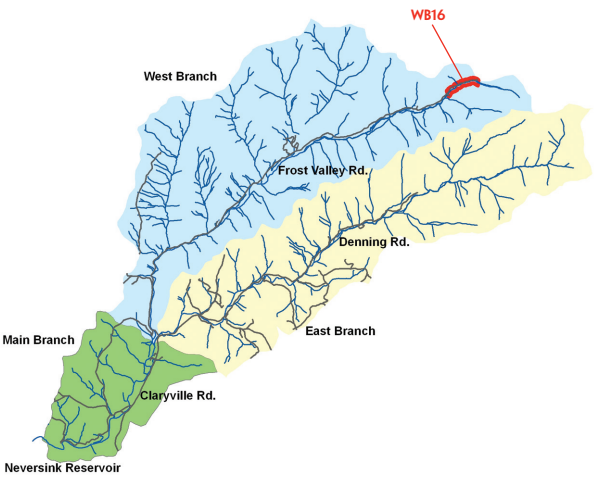
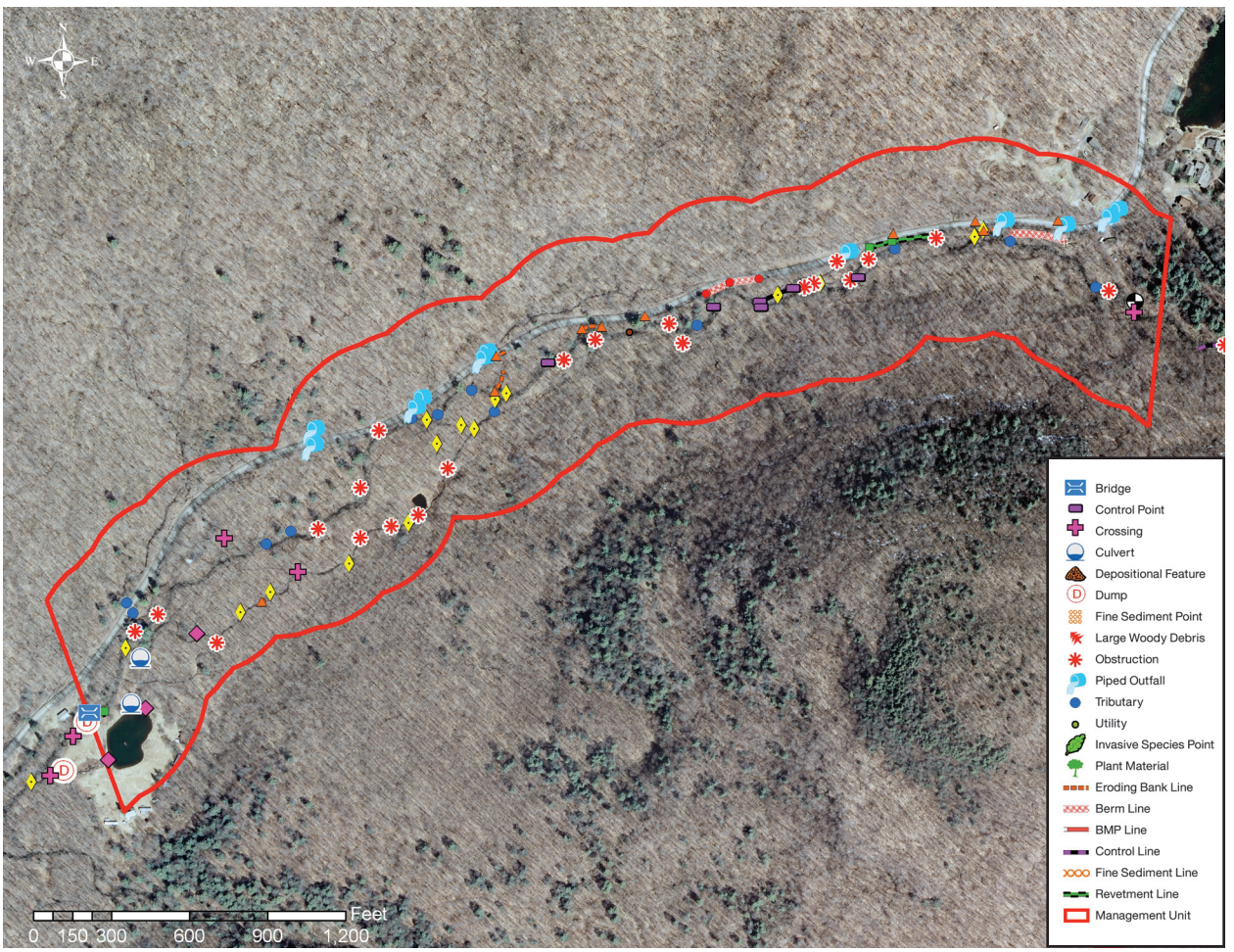
Neversink River West Branch

MANAGEMENT UNIT 16

STREAM FEATURE STATISTICS

- 4 % of stream length is experiencing erosion
- 2.87 % of stream length has been stabilized
- 6.66 acres of inadequate vegetation within the 100 ft. buffer
- None of stream is within 50 ft. of the road
- No building structures are located within the 100-year floodplain boundary





Stream Feature Inventory 2010 (Figure 1)

Management Unit Description

This management unit begins at the private driveway accessing the Shandaken Rod & Gun Club at Station 64300 continuing approximately 5,400 feet upstream to the USGS gauging station "West Branch Neversink River at Winnisook Lake Near Frost Valley, NY" at Station 69700. The drainage area ranges from 0.8 mi^2 at the top of the management unit to 1.60 mi^2 at the bottom of the unit. The valley slope is 6.12%. The average valley width is 510.87 ft.

Summary of Recommendations West Branch Management Unit 16

Intervention Level	Assisted restoration of eroding bank segment from Station 68950 to Station 68850 (BEMS NWB16_68800). Passive restoration and monitoring of eroding bank segment from Station 67140 to Station 67060 (BEMS NWB16_67075) and eroding bank segment observed at Station 66610 (BEMS NWB16_66600). Preservation elsewhere.
Stream Morphology	Protect and maintain floodplain connectivity for storage capacity and habitat value. Conduct baseline survey of channel morphology.
Riparian Vegetation	Potential riparian buffer improvement area from Stn 64500 to Stn 64300.
Infrastructure	Evaluate culverts at Stns 64600 and 64400 for replacement.
Aquatic Habitat	Fish population and habitat survey.
Flood Related Threats	None.
Water Quality	Evaluate water quality affects of runoff from Frost Valley Road.
Further Assessment	Include MU16 in comprehensive Local Flood Hazard Mitigation Analysis of Claryville MUs.

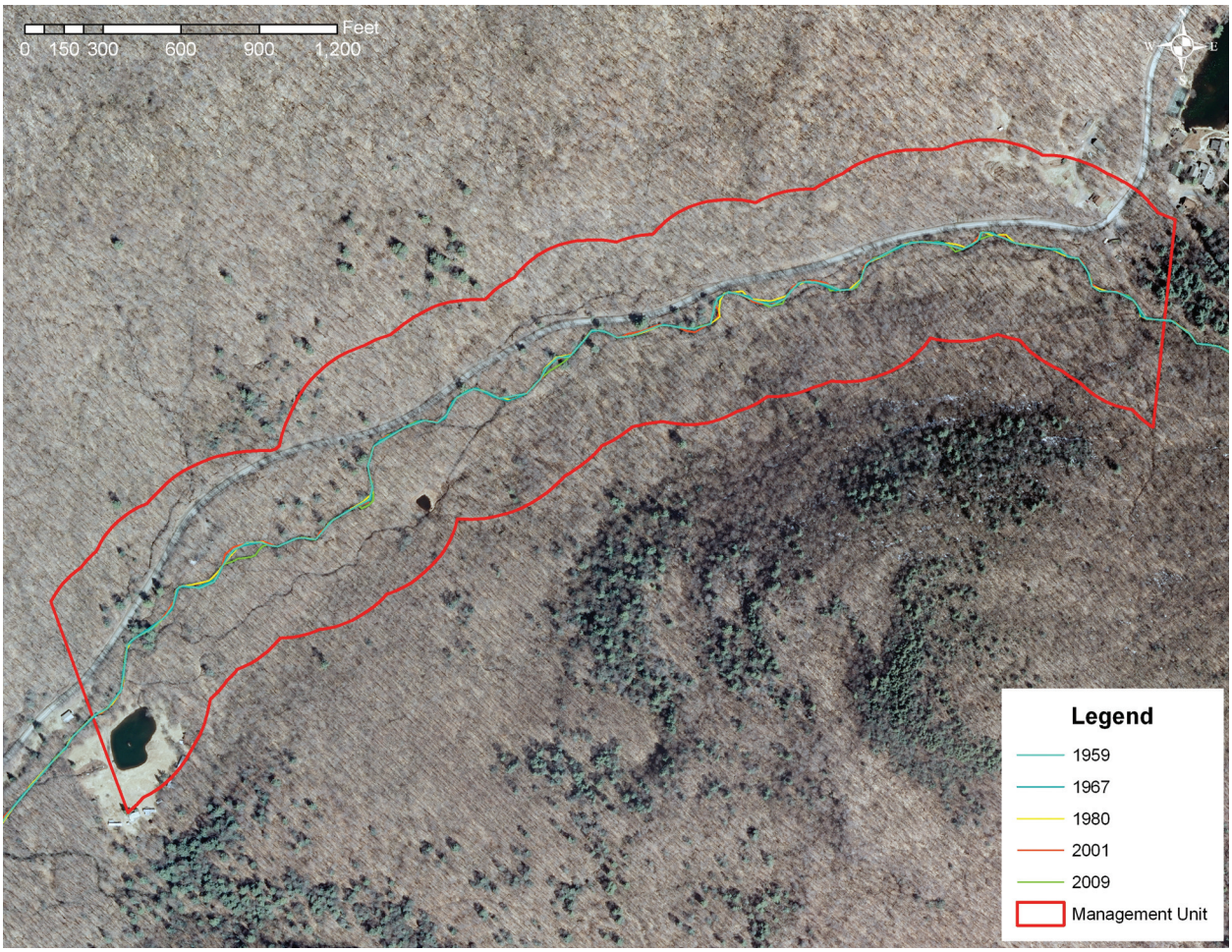
Historic Conditions

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 little lateral channel instability. According to records available from the NYSDEC DART database, 1 NYS Article 15 stream disturbance permit has been issued in this management unit. These permits pertain to activities which have the potential to significantly impact stream function, such as bank stabilization, stream crossings, habitat enhancement, and logging practices.



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.

WBMU16 begins at the USGS gauging station "West Branch Neversink River at Winnisook Lake Near Frost Valley, NY" at Station 69700 which measures flow from a drainage area covering 0.77 square miles. The period of record for this gauge is 1991 to the current year. Slightly downstream of the gage house a stream crossing was observed. This is most likely a trail spur that connects to the Phoenicia-

Trail crossing through stream (B469)

East Branch Trail which heads due south up the valley wall to connect to trails leading to the summit of Slide Mountain and other Catskills High Peaks. *(B469)*

At Station 69480 a large woody debris jam was observed in the main channel. The dense forest surrounding the stream in this management unit and the river upstream provides a continuous source of large mature trees that can be blown down or washed into the stream during storm events. However, it appeared that some of the material in this debris jam was not natural and could have originated from nearby construction. The origin of this debris should be investigated. *(A548)* At Station 69420 an intermittent tributary joins the main channel which conveys runoff from the left valley wall. *(B471)*

For the remainder of this management unit, the main channel is within approximately 50 feet of the Frost Valley Road (also known as Oliverea Road or Ulster County Route 47). Like the slope of the main channel, the slope of the road is relatively steep in this location, and many culverts convey road drainage from the road to the river.

Construction and natural debris causing jam (A548)

Intermittent tributary (B471)

The first of these culverts was observed along the right side of road conveying flow from the right valley wall at approximately Station 69200. *(A601)* Coincident with this culvert placement, an earthen berm was observed between what appeared to be an old logging road at the main channel for 220 feet from Station 69220 to Station 69000. At the end of the berm a tributary joins the main channel from a 12 inch diameter smooth steel culvert which conveys flow from Frost Valley Road and the forested right valley wall. *(B479)*

Downstream of this convergence the main channel splits around a vegetated center island near Station 68900. The right channel runs adjacent to Frost Valley Road where a 95 foot long eroding bank segment was observed from Station 68950 to Station 68850 (BEMS NWB16_68800). This eroding segment appeared to be caused by hydraulic erosion of a bank that is sparsely vegetated with grass and sedge. *(A550)*

Recommendations for this site include *assisted restoration* using *bioengineering* techniques to stabilize the eroding bank and establish a more effective riparian buffer. This restoration effort should include an investigation of the contribution of road runoff to the bank failure and restoration design should include appropriate stormwater management practices if deemed necessary.

Downstream of the eroding bank segment along Frost Valley Road the side channel converges as the river makes a small meander to the left before again becoming laterally controlled by Frost Valley Road on the right. At Station 68690 there is a natural log weir that exaggerates the step-pool pattern of this segment of the river. Significant deposition of coarse gravel was observed upstream of the log and a scour pool was observed downstream. *(A555, A554)*.

Culvert conveying flow from right valley wall (A601)

Tributary entering through culvert (B479)

Debris jam causing hydraulic erosion (A550)

Log weir causing deposition upstream (A555)

Log weir causing scour downstream (A554)

Large boulder revetment that is slumping (A557)

Directly downstream of the log weir the river flows adjacent to a 260 foot long stacked rock revetment along Frost Valley Road. This revetment was documented as in fair structural and functional condition; the stacked rock is slumping and there was scour around and behind the larger boulders. There was no riparian buffer between the revetment and the road in this location. *(A557, A559)*. Recommendations for this site would include renovation of the revetment with bioengineering techniques to more effectively stabilize the bank, improvement of the riparian buffer and, potentially, placement of *flow deflection structures* to reduce erosive forces on this bank.

No riparian buffer between revetment and road (A559)

Across from the revetment on the left bank at Station 68510 an intermittent tributary joins the main channel. It appears that this tributary drains a perched wetland area slightly up slope although it was dry at the time of the stream survey. *(B484)* At station 68410 another woody debris jam in the main channel with additional logs and fallen branches was observed. *(B487)*

Around Station 68300, a large boulder constrains lateral movement of the main channel to the left, while on the right a forested, low-elevation floodplain that appears to be inundated during moderate flow events. *(B492, B496)* As the main channel is directed back toward Frost Valley Road by the boulder control the channel diverges around a forested center island near Station 68150. *(A560)*A side channel continues relatively straight while the main channel meanders towards the road and converges with a tributary from a culvert conveying flow from Frost Valley Road and the right valley wall. The side channel is littered with woody debris jams until it converges with the main channel at Station 67970. A 140-foot long segment of exposed bedrock provides lateral control for the side and main channel on the left bank centered around this convergence. *(B505)*.

Tributary draining perched wetland area (B484)

Woody debris jam in main channel (B487)

Woody debris on right bank and floodplain (B492)

Boulder constraining lateral movement (B496)

From Station 67840 to Station 67630 a stone berm was observed between the main channel and Frost Valley Road. It is likely that this berm was constructed for flood control as the right bank floodplain and road are at the same elevation at this location. The berm coincides with a sharp meander to the right in the main channel and a floodplain with a riparian buffer in poor condition. Near the end of the berm at Station 67640 there is a natural log weir across the main channel providing stream bed elevation control with deposition on the upstream side and a scour pool directly downstream. *(A573)*

Channel divergence around forested center island (A560)

For the subsequent 1,000 feet features in the main channel follow a similar pattern with control structures preventing lateral migration on the left bank and natural log weirs and woody debris providing stream bed elevation control that enhances longitudinal migration and the step-pool pattern of the river in this management unit. Near Station 67300 the valley floor widens, with more extensive floodplain connectivity on both banks, and the meander bands of the main channel become more exaggerated.

Exposed bedrock providing lateral control (B505)

An undercut, eroding bank segment was observed on the right bank from Station 67140 to Station 67060 (BEMS NWB16_67075), caused by hydraulic erosion. *(A735)* It is anticipated that this bank will revegetate and stabilize without treatment (*passive restoration*). However, it is recommended that this site be monitored for changes in condition.

At Station 66610 another eroding bank segment was observed that appeared to be surficial failure caused by conveyance of road drainage from Frost Valley Road through the narrow floodplain on the right bank. (BEMS NWB16_66600) *(A739)*

Natural log weir (A573)

Eroding right bank (A735)

Flood chute entering stream channel (A743)

Right floodplain conveying road drainage (A739)

Woody debris littering floodplain (A770)

It is anticipated that this bank will revegetate and stabilize without treatment (*passive restoration*), however, it is recommended that this site be monitored for changes in condition.

Downstream of this bank failure the majority of the flow continues along Frost Valley Road while several flood chutes and side channels form a braided channel network in the right floodplain. These chutes and side channels have embedded cobble beds that convey flow from both the main channel and the left valley wall with both surface and subsurface flow. This network continues to the open water pond on the Shandaken Rod and Gun Club Property at the end of the management unit. This floodplain is littered with woody debris which indicates that the area is inundated during high flow events. *(A743, A770)* New York State land, in "forever wild" status, begins at approximately Station 65700; no recommendations are made for lands in forever wild status. The Slide Mountain trail head parking area is located in the right floodplain near Station 65200; the Phoenicia-East Branch Trail crossed the main channel and braided floodplain channels at this location. NYS land ends at approximately Station 64800.

Culvert conveying road drainage (A759)

Culvert conveying flow from side channel to pond (A764)

At Station 64710 an intermittent tributary conveying drainage from Frost Valley Road and the right valley wall joins the main channel. This drainage is conveyed under Frost Valley Road from the right valley wall by a 48" culvert. Scour was observed at the outfall of this culvert that was documented in poor condition. It is likely that this drainage is conveying fine sediments and other materials from the road directly to the main channel in this location. *(A759)*

Shandanken Rod & Gun Club pond (A768)

At Stations 64600 and 64400 corrugated metal culverts documented in poor structural and functional condition convey flow from a side channel in the floodplain to the Shandaken Rod & Gun Club pond. *(A764, A768)* It is recommended that these culverts be evaluated for replacement. The pond, in turn, outlets into a small channel that rejoins the mainstem in Management Unit 15. With numerous cabins This off-line pond h

At Station 64300, at the end of WBMU16, the bridge for the Shandaken Rod and Gun Club driveway crosses the main channel. Stacked rock revetment was observed on the left bank for approximately 50 ft. upstream of the bridge. The revetment was documented in fair structural and functional condition as it was slumping throughout its length. *(A773)*. The potential for improvement of the riparian buffer from Station 64500 to 64300 should be investigated.

WBMU16 ends at this private bridge located at Station 64300.

Stacked rock revetment on left bank (A773)

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).

Until Station 63700, this management unit is largely a sediment transport reach, with relatively low channel sinuosity, bankful stage floodplains of moderate entrenchment with mature vegetation, and overflow channels to accommodate larger discharges of water and sediment when necessary. Transport reaches, like the areas in WBMU15 with boulder and bedrock grade and planform control, are in a state of *dynamic equilibrium,* effectively conveying sediment supplied from upstream during each flow event. However, the densely forested floodplain serves as a continuous source of large woody material that that can be introduced into the channel during flood events. This large woody debris often serves as a local obstruction to sediment transport, resulting in the aggradation of bed material and the development of floodplains over the long-term.

Near Station 63700 the valley floor widens and portions of the main channel behave as sediment storage reaches. 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 more dynamic, with frequent lateral channel migration through bank erosion, *avulsions* and woody debris accumulations. Sediment storage reaches can result from natural conditions, like the widening valley floor and decreased channel slope in this management unit or as the unintended consequence of poor bridge design, check dams or channel overwidening. This is one process by which floodplains are created and maintained. Healthy undeveloped floodplains throughout the Neversink watershed like the right bank floodplain in WBMU17, reduce the velocity of higher flows thereby mitigating the threat of stream bank erosion and property damage during flood events.

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. There were no occurrences of Japanese knotweed documented in this management unit during the 2010 inventory.

An analysis of vegetation was conducted using aerial photography from 2001 and field inventories *(Figure 5)*. In this management unit, the predominant vegetation type within the 100 ft. riparian buffer is deciduous-closed tree canopy (88.77%) followed by herbaceous vegetation (3.25%). Impervious area makes up 4.26% of this unit's buffer. There are 2.64 acres of potential buffer improvement area in this management unit.

There are 0.81 acres of wetland (1% of WBMU16 land area) within this management unit mapped in the National Wetland Inventory in one distinct classification (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 0.81 acres of wetland in WBMU16 is classified as Freshwater Pond and include the open water pond on the Shandaken Rod & Gun Club property at the end of the management unit.

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. 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 FIRM maps did not include a 100-year floodplain boundary in WBMU16; flooding is unlikely due to the steep topographic relief and confined flows in this management unit.

BANK EROSION There are three bank erosion sites in this management unit. A 95 foot long eroding bank segment was observed from Station 68950 to Station 68850 (BEMS NWB16_68800). This eroding segment appeared to be caused by hydraulic erosion of a bank that is sparsely vegetated with grass and sedge. A second eroding bank segment was observed on the right bank from Station 67140 to Station 67060 (BEMS NWB16_67075) that included undercut bank caused by hydraulic erosion.
A third eroding bank segment was observed at Station 66610 that appeared to be surficial failure caused by conveyance of road drainage from Frost Valley Road through the small floodplain on the right bank (BEMS NWB16_66600). It is anticipated that the second and third sites will revegetate and stabilize without treatment (*passive restoration*). Recommendations for the first site include *assisted restoration* using *bioengineering* techniques to establish a stronger riparian buffer and stabilize the eroding bank. Furthermore, it is recommended that all three sites be monitored for changes in condition.

INFRASTRUCTURE A 260 foot long stacked rock revetment was observed from Station 68700 to Station 68440 along Frost Valley Road. This revetment was documented as in fair structural and functional condition; the stacked rock is slumping and there was scour around and behind the large boulders otherwise designed to protect the bank. In addition, there was no riparian buffer between the revetment and the road in this location. From Station 67840 to Station 67630 there is a stone berm between the main channel and Frost Valley Road. It is likely that this berm was constructed for flood control as the right bank floodplain and road are at the same elevation at this location. Lastly, a 50 foot stacked rock revetment was observed on the left bank upstream of the private driveway bridge on the Shandaken Rod & Gun Club property. This revetment was documented in fair structural and functional condition as it was slumping throughout the length of the structure.

Aquatic Habitat

Aquatic habitat is one aspect of the Neversink River ecosystem. 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 uses 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 mainstem in WBMU16 has been given a "C(T)" class designation with best use for 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 several piped outfalls 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 three documented bank erosion sites in WBMU16, however, they are not a significant source of fine sediments.

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**.

Community Comments
Fall 2012

Station 66200–66100 *"Tree obstructing flow"*

Station 67100 *"Large woody debris obstructing secondary channel"*

Erosion occurring at the Slide Trail stream crossing.

Trout habitat and atmospheric deposition are priorities.

Invasive species and erosion at the road are concerns.

Erosion occurring upstream of crossing at Shandaken Rod and Gun Club, with clay exposure at abutment and erosion downstream of the bridge.

It was noted that a tannery was once located near the border of management units 15 and 16.