



# ASHOKAN WATERSHED ADVENTURE GUIDE

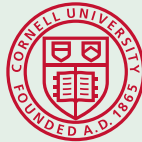
A Self-Guided Tour of the Ashokan Landscape for All Ages

[#AshokanWatershedAdventure](#)



Ashokan Watershed  
Stream Management Program

The Ashokan Watershed Adventure is sponsored by:



**Cornell Cooperative Extension** | **Ulster County**

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# About the Ashokan Watershed Adventure

The Ashokan Watershed Adventure is a self-guided tour of the Ashokan landscape for all ages. Adventurers explore the Ashokan Reservoir watershed at their own pace and earn prizes based on the number of Adventure Stops visited. From the humble headwaters of the Stony Clove Creek to the shores of the mighty Ashokan Reservoir, Adventurers will experience the landscape like never before. Adventure Stops have been thoughtfully curated by Ashokan Watershed Stream Management Program (AWSMP) staff to highlight some of the most interesting and beautiful places in the watershed. Grab your friends and family or head out on your very own Ashokan Watershed Adventure!

## How it works

There are 11 Ashokan Watershed Adventure Stops. Visit as many as you can to earn a prize. Adventure stops can be visited in any order. Each stop has a chapter in the Adventure Guide that includes the site name and location, geographic coordinates, directions and parking instructions, safety guidelines, and an educational message to inform Adventurers about the unique aspects of the site. Topics include the social history of the Esopus valley and Ashokan watershed, NYC Water Supply operations, stream process, the geology and environmental history of the area, aquatic ecology, and more!

There are two ways to earn credit for each Adventure Stop you visit:

### 1. Post a photograph to social media

Take a selfie or a landscape shot at the site and post it to Facebook, Instagram, or Twitter. Include the hashtag #AshokanWatershedAdventure and tag @AshokanStreams in your post (if posting to Facebook tag @AWSMPUIster.)

### 2. Answer the Essential Question

Each site write-up in the Adventure Guide ends with an essential question that can only be answered by visiting the site. Write down the answer to the essential question in the Adventure Guide and show it to staff at the AWSMP office.

## Pre-adventure planning

As with any adventure into the wild lands of the Catskill Mountains, planning is a very important part of having a fun and safe experience.

✓ **Cell phone service is limited to non-existent.** We recommend downloading a map of the area to your phone or tablet so that you can navigate the terrain without cell service. Instructions on how to download maps and use them to navigate offline can be found here: <https://support.google.com/maps/answer/6291838?co=GENIE.Platform%3DiOS&hl=en>

✓ **Check the safety guidelines.** Each Adventure Stop has a set of safety guidelines that tell you what to expect. Read these before you get to the Stops to ensure a fun and safe experience.

✓ **Be prepared.** The weather in the Catskill Mountains can be unpredictable so make sure to expect the unexpected. Bring lots of water, a raincoat, sunscreen, bug spray, snacks, and whatever else you might need to enjoy a day in the beautiful yet rugged Catskill Mountains.

✓ **Give yourself adequate time.** The entire Ashokan Watershed Adventure can be completed in one day, but expect a long day if that is your goal. The Adventure Map gives approximate driving times between stops. You can stop at each site just long enough to take a selfie or you can take your time and really explore the unique aspects of each site. It's up to you!

## Claiming your prizes

Make Adventure Stop #11 (AWSMP Office) your last stop in order to claim your prize. Prizes can only be claimed at the AWSMP office during normal business hours (8:00am-4:30pm, Monday through Friday) because we want to hear about your adventure! Here, you can show staff your social media images or show them your Adventure Guide with the

essential questions answered. Prizes are earned based on the number of Adventure Stops visited. Unfortunately, we are unable to mail prizes. If you need to make other arrangements to claim your prizes, call (845) 688-3047 or email Tim at [tk545@cornell.edu](mailto:tk545@cornell.edu).

### 4+ STOPS

Esopus Creek oval bumper sticker

Ashokan Watershed Adventure patch



### 8+ STOPS

Flora and Fauna of Catskill Streams poster

Esopus Creek sticker

Adventure patch



### 11 STOPS

AWSMP tote bag

Flora and Fauna of Catskill Streams poster

Bumper sticker, patch



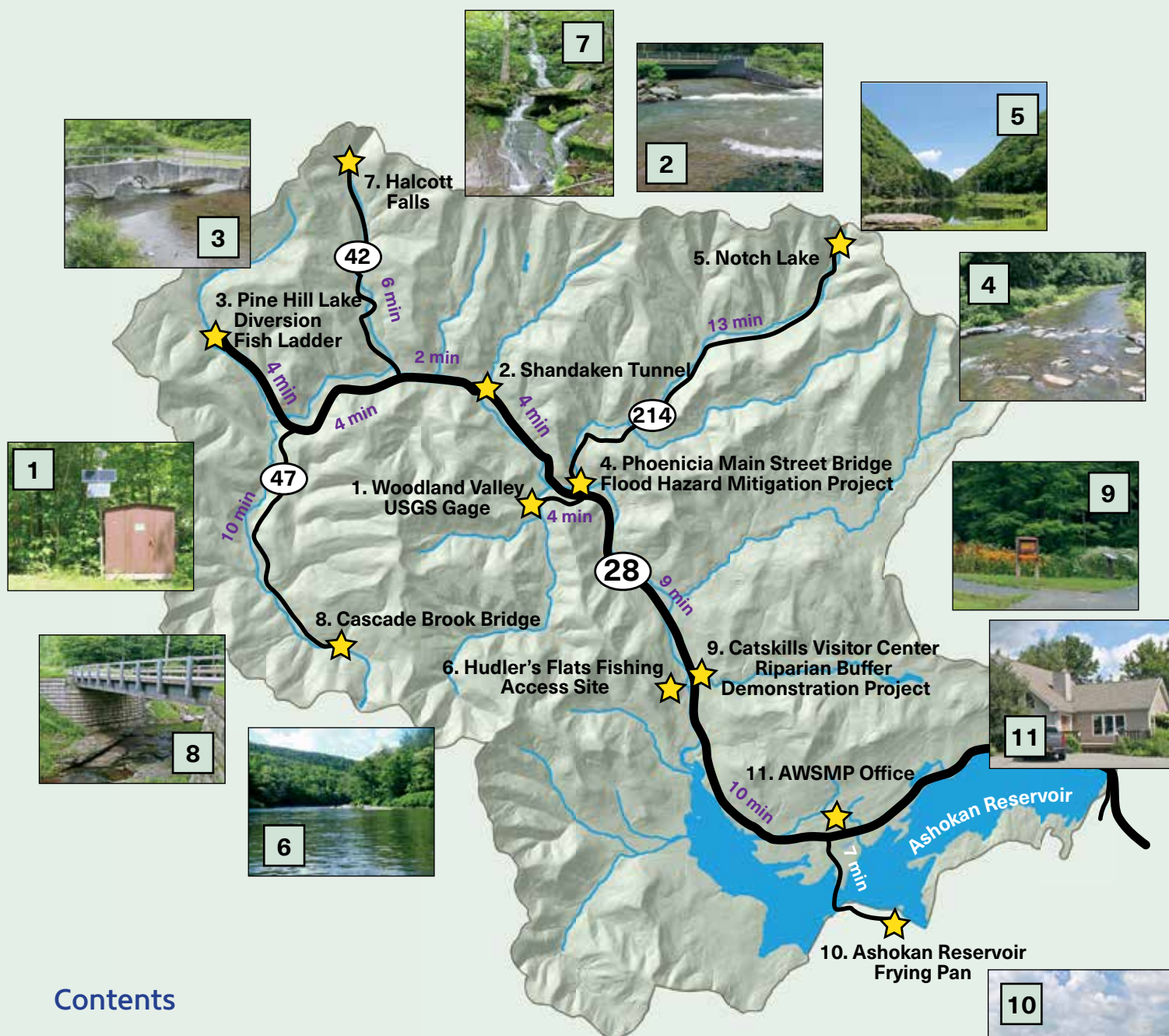
## The story

The Ashokan Watershed Adventure is hosted by the Ashokan Watershed Stream Management Program (AWSMP.) The AWSMP is a collaboration between Cornell Cooperative Extension of Ulster County, the Ulster County Soil and Water Conservation District, and the New York City Department of Environmental Protection. The program works collaboratively to maintain the health of streams in the Ashokan Reservoir watershed by improving stream stability, reducing erosion threats to water quality and infrastructure, mitigating potential damage from flooding, and enhancing aquatic and riparian habitat. We serve the residents and municipalities of the Ashokan watershed and host a number of fun and educational events throughout the year. AWSMP staff also perform site visits to advise streamside landowners on best

management practices and can provide technical assistance and guidance for any stream related issues including erosion and flooding. Call the office at (845) 688-3047 or stop in: 3130 State Route 28, Shokan, NY 12481.

This *Ashokan Watershed Adventure Guide* is online at [www.ashokanstreams.org/publications-resources/](http://www.ashokanstreams.org/publications-resources/). Visit our website at [www.ashokanstreams.org](http://www.ashokanstreams.org) to learn more about the watershed and for news and announcements. Find us on [Facebook at @AWSMPUlster](https://www.facebook.com/AWSMPUlster). To receive a printed version of the *Esopus Creek News* newsletter, contact us with your mailing address at [info@ashokanstreams.org](mailto:info@ashokanstreams.org). Sign-up to receive stream program announcements in your inbox at <http://eepurl.com/24xCL>.

# Ashokan Watershed Adventure Stops



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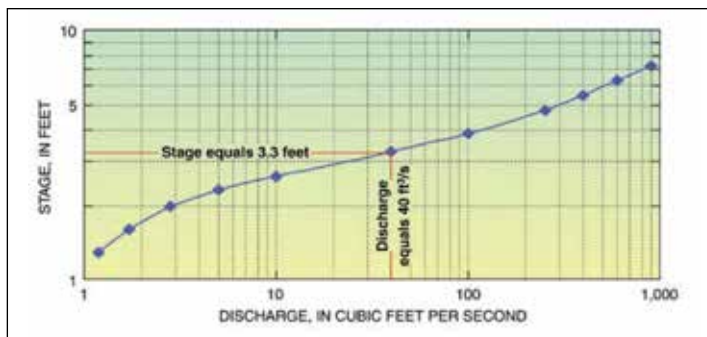


# 1. Woodland Valley USGS Stream Gage

## Woodland Valley

Have you ever seen one of these non-descript buildings when walking or driving along a stream? This is a United States Geological Survey (USGS) stream gage station. This spelling of “gage” is correct when referring to such facilities. In 1892, Frederick Newell, the first Chief Hydrographer of the newly created USGS and the “Father of Systematic Stream Gaging” officially adopted the spelling “gage.” He argued this was the original Saxon spelling and that the “u” was inserted as a result of Norman (French) influence on the English language. This gage station provides near real-time data on flow conditions and water quality in Woodland Valley Creek. There are currently over 9,000 active stream gages nationwide. Accurate streamflow data from gage stations not only help to ensure adequate water supplies but are also used to inform flood protection measures, engineering design, research, recreational safety, and the operation of locks, dams, and reservoirs.

The most commonly used data from stream gage stations are discharge values. Stream discharge is the volume of water passing a specific point in a given interval of time. In the US, discharge is measured in cubic feet per second (ft<sup>3</sup>/s, cfs). Interestingly, stream gages don’t actually measure discharge, they measure and record stream stage, which is the height or elevation of the water surface. Stage is much more practical to continuously measure than discharge and the strong mathematical relationship between the two means gages need only to measure stage in order to provide continuous, real-time discharge data to resource managers, anglers, boaters, and the public.



The Woodland Valley stream gage station collects stage measurements by forcing pressurized air through a metal tube into the water. When the water level is low it takes less pressure to force the gas out than when the stream is high. The amount of pressure required to force the air is converted into a stage measurement by a transducer in the gage house.

To convert stage (ft) to discharge (ft<sup>3</sup>/s), the volume and velocity of streamflow must be measured by hand at various stages. UGSS technicians first measure a cross-section of the channel. By knowing the water depth and width at a given stage, the cross-sectional area can be calculated. Technicians then measure water velocity using current meters. Discharge (ft<sup>3</sup>/s) is calculated by multiplying the cross-sectional area (ft<sup>2</sup>) by the average velocity (ft/s). By following this procedure at various stages, from summer low flow to moderate floods, a discharge rating curve can be developed which accurately predicts the discharge at any given stage.

Every 1-4 hours, discharge records are transmitted to USGS via the satellite antenna attached to the gage house. Data are then made freely available to the public through the



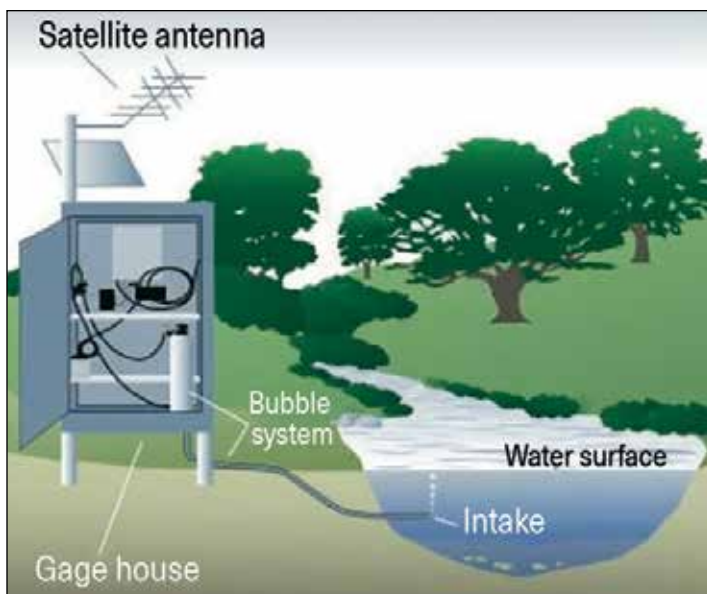
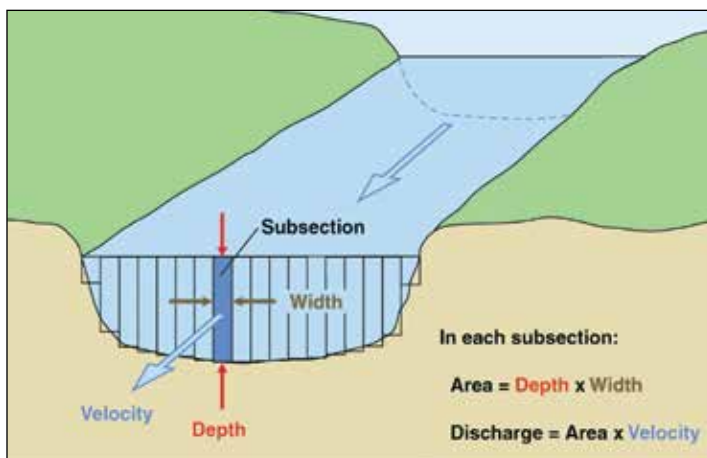


Diagram of a typical stream gage installation with equipment used to measure stream stage (by L.S. Coplin, U.S. Geological Survey).

USGS National Water Information System (NWIS, <https://waterdata.usgs.gov/nwis>). Real-time data for the Woodland gage can be found at: [https://waterdata.usgs.gov/nwis/uv?site\\_no=0136230002](https://waterdata.usgs.gov/nwis/uv?site_no=0136230002).

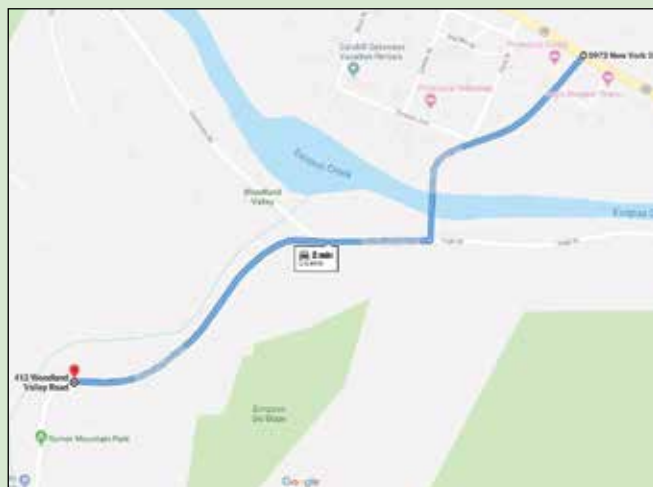
The NWIS provides information on current conditions including discharge, temperature, and/or turbidity. You can also look through historic data, sometimes dating back many decades. The Coldbrook gage on the Esopus Creek has data dating back to 1914. This is useful for determining the discharge of previous floods in order to prepare for future ones. Historic data are also useful for investigating longer term trends such as changes in turbidity or reduced summer base flow in streams following mild winters with little snow.



## Location

Woodland Valley USGS Gage  
413 Woodland Valley Road  
Phoenicia, NY 12464

**Coordinates: 42.079368, -74.335557**



## Directions and Parking

From Route 28, turn southwest onto Woodland Valley Road. After crossing the bridge over the Esopus Creek, turn right to stay on Woodland Valley Road. In 0.4 miles there is a small gravel parking area on the right.

## Safety Guidelines

There is small but steep hill that leads from the parking area down to Woodland Valley Creek. Once down the hill, watch your footing on the loose gravel.



## ESSENTIAL QUESTION

What company manufactured the gage house? (check the small plaque to the left of the door on the front of the gage house):

\_\_\_\_\_



## 2. Shandaken Tunnel

### Allaben

*“A whistling and then a subdued roaring heard at 9:01 o’clock this morning announced the joining of the waters of Schoharie and Esopus Creeks as they were united after an eighteen-mile trip through Shandaken Tunnel, driven through the heart of the Catskill Mountains, the outlet of which emerges at Allaben.”*

*New York Times, February 9th, 1924*

The Ashokan Reservoir was constructed between 1907 and 1915. In early 1917, construction began on a new reservoir on the Schoharie Creek. The dam and reservoir were not completed until 1926, but the Shandaken Tunnel (or Tube as it was called then) has been bringing Schoharie water to the Esopus Creek since February 1924, over 95 years. The two reservoirs and the Shandaken Tunnel make up the NYC Catskill System, connected to the City via the 92-mile Catskill Aqueduct.

The entirely gravity powered Shandaken Tunnel carries water 18 miles from the Schoharie Reservoir to merge with the Esopus Creek. After entering the tunnel, the water travels through four counties (Schoharie, Delaware, Greene, and Ulster), five Towns (Gilboa, Roxbury, Prattsville, Lexington, and Shandaken), and one mountain! The Shandaken Tunnel was carved directly through Balsam Mountain to the north. It flows 2,630 feet beneath the summit. The outlet of the Shandaken Tunnel is known as the *Portal*.

Due to this inter-basin transfer of water, stream and watershed management practices in the Schoharie Creek watershed, including portions of Delaware, Greene, and Schoharie Counties, have an impact on the Esopus. Thankfully, AWSMP’s sister organization, the Schoharie Watershed Stream Management Program, implemented by the Greene County Soil & Water Conservation District, works to improve the health and stability of their streams. What happens in the Schoharie doesn’t stay in the Schoharie, it comes through the Shandaken Tunnel and into the Esopus.

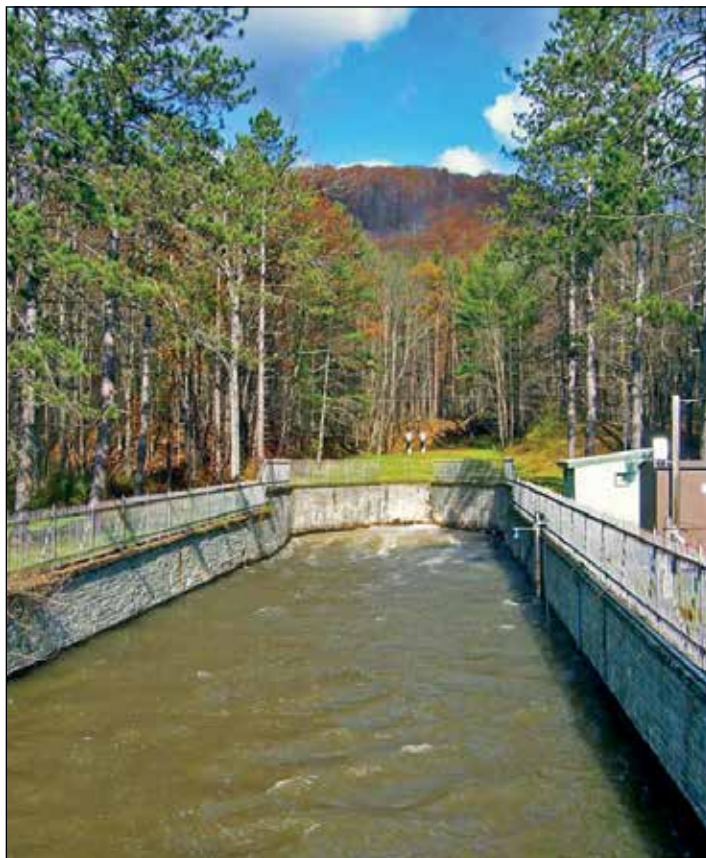


Photo by Daniel Case, CC BY-SA 3.0  
(<https://commons.wikimedia.org/w/index.php?curid=3148229>)

Operation of the Shandaken Tunnel is regulated by the Department of Environmental Conservation (DEC) to provide sufficient water to the Esopus Creek and Ashokan Reservoir. Water from the Portal is typically colder than the Esopus Creek, which helps to maintain a renowned coldwater fishery downstream of the Portal, which wouldn’t exist otherwise. The diversion also increases the amount of water in the Esopus Creek, which is beneficial to trout during periods of low flow. Another factor that informs management of the Portal is the amount of suspended sediment in the water, which can cause turbidity. Stream restoration projects in the Ashokan and Schoharie Creek watersheds are designed to reduce the amount of turbidity in the Catskill System and NYC Water Supply.

The Shandaken Tunnel can carry an approximate maximum of 600 million gallons per day (MGD) of water. In the summer months, when streams are usually at their lowest levels, there are occasional recreational water releases that facilitate





Schoharie Creek water entering the Esopus Creek at the Portal in Allaben. Photo by AWSMP.



Kayaker racing on Esopus Creek whitewater. Photo courtesy of DEC (<http://www.dec.ny.gov/lands/80682.html>)

whitewater sports. During a recreational release, raging Class II-III rapids attract kayakers and whitewater canoers from miles around to the banks of the Esopus.

Check the DEC website for information on releases (<http://www.dec.ny.gov/lands/80682.html>). For more information on whitewater paddling events on the Esopus, check out The Kayak and Canoe Club of New York ([www.kccny.com](http://www.kccny.com)) and the New England Slalom Series (<http://nessrace.com>) webpages.

#### Sources:

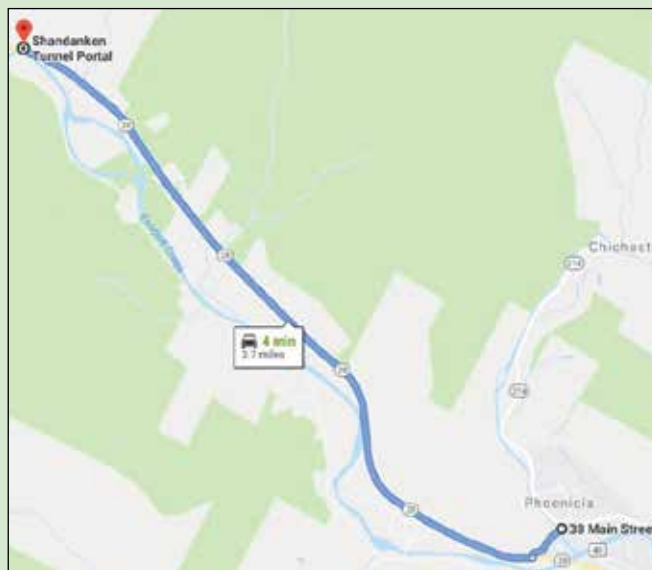
Department of Environmental Conservation. Water Releases for Esopus Creek. Retrieved from <http://www.dec.ny.gov/lands/80682.html>

New York City Department of Environmental Protection. Ashokan Reservoir. Retrieved from <http://www1.nyc.gov/site/dep/water/ashokan-reservoir.page>

### Location

Shandaken Tunnel Portal  
NY-28, Shandaken, NY 12480

**Coordinates: 42.115116, -74.363737**



### Directions and Parking

From Phoenicia, take NY-28 west approximately 3.5 miles. At 3.3 miles pass Broadstreet Hollow Rd on the right. Parking for the Shandaken Tunnel is approximately 0.2 miles past Broadstreet Hollow Rd, on the right.

### Safety Guidelines

Route 28 is a busy road with a 55-mph speed limit. Be aware of traffic when pulling into the parking area. Use extreme caution if you cross Rt. 28 to look at the outlet where the Tunnel enters the Esopus Creek. It is unsafe to enter the Portal or the Esopus Creek at this location.



### ESSENTIAL QUESTION

How many miles north of the Silver Lake Reservoir is the Shandaken Portal Tablet? (check the plaque for the answer):

\_\_\_\_\_

## 3. Pine Hill Lake Diversion Fish Ladder

### Pine Hill



Photo by Al Swearengen, CC BY-SA 3.0 ([https://en.wikipedia.org/wiki/Pine\\_Hill,\\_New\\_York](https://en.wikipedia.org/wiki/Pine_Hill,_New_York))

Pine Hill is a hamlet with a long and interesting story. A walk through Pine Hill is a walk through history. In fact, in 2012, nearly the entire hamlet was designated in the National Register of Historic Places. Originally known by the Esopus Indians as Kawiensinck, Pine Hill first appeared on a map in 1771. In 1872 the Ulster and Delaware Railroad reached the remote mountain town and Pine Hill boomed. It was a widely known resort town as well as a health spa, noted for its pure air and water. In fact, Pine Hill was known as the “Saratoga of the Catskills” because of the Crystal Spring Water Company that shipped six to nine railroad cars of fresh spring water to New York City every week. Twenty hotels once dotted the streets to house all the visitors.

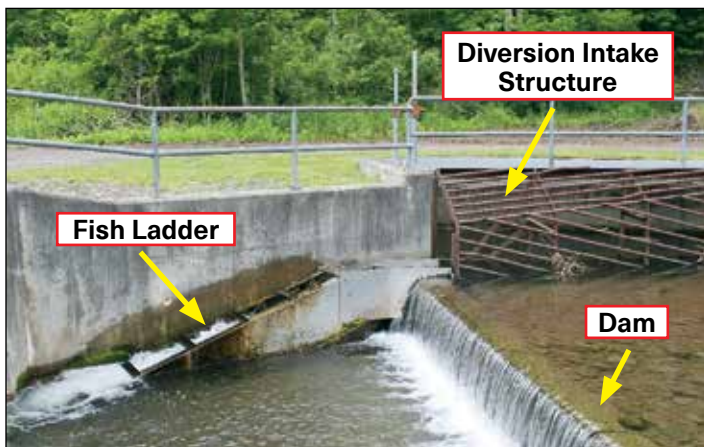
The histories of Birch Creek and Pine Hill Lake are tied to that of the village. Birch Creek is a tributary of the Esopus Creek that begins on the southern slopes of Halcott Mountain. In 1910, during Pine Hill's heyday, Birch Creek was dammed to create Pine Hill Lake (now home to Belleayre Beach Day Use Area), likely for recreation. That dam washed out in 1950. It was rebuilt only to be washed out again in 1968. The DEC bought the Day Use Area in 1985 and rebuilt Pine Hill Lake in 1988.

When DEC rebuilt Pine Hill Lake they considered the cold-water trout species that call Birch Creek home. Dams built directly on streams tend to increase the temperature of the water in the impoundment behind the dam. Trout prefer water less than 68°F and are stressed when the temperature exceeds 70°F. Rather than build another dammed lake directly on Birch Creek they built it off the stream and constructed a water diversion structure to feed the lake. This helped to keep the water in Birch Creek cold and suitable for trout. However, the diversion structure still required a small dam to feed the intake chamber and even small dams can act as severe barriers to aquatic organism passage.

Fish move throughout a stream network for a number of reasons and restricting their freedom of movement can be deadly. Trout travel to find food, spawn, and to alleviate stress caused by warm, turbid water. A 2012 study funded by AWSMP documented trout moving hundreds of feet per day in search of thermal refuge, areas with deep, cold water. One brown trout moved 2.25 miles over the course of one summer. The Ashokan-Pepacton and Catskill Mountain chapters of Trout Unlimited worked to improve fish passage at this site by installing a “fish ladder”. Rather than having to make a substantial vertical leap to get upstream of the dam, fish can







“take the stairs.” Dams are like waterfalls while fish ladders are more like the riffles and cascades found in free-flowing rivers, features that trout have less trouble navigating.

Culverts at road-stream crossings, especially perched culverts with a freefall drop at the outlet, act as severe barriers to fish passage as well. A 2018 study by AWSMP found a road-stream crossing every 0.75 miles along streams, on average. Trout Unlimited also improved fish passage in the culvert under Elm Street in the hamlet of Pine Hill. They installed wooden beams on the concrete floor of the culvert to make small pools where fish can take refuge as they navigate the unnaturally shallow water of the culvert.

Sources:

Catskill Mountain Club. On the Trail: Fishing the Birch Creek. Retrieved from [http://www.catskillmountainclub.org/ott/05\\_19\\_03.html](http://www.catskillmountainclub.org/ott/05_19_03.html)

Central Catskills Chamber. A Brief History of Pine Hill. Retrieved from <https://www.centralcatskillschamber.com/pine-hill.html>

New York State Department of Environmental Conservation. The Trout of New York. Retrieved from <https://www.dec.ny.gov/animals/7016.html>

### Location

Pine Hill Lake Diversion Structure  
16 Lake St., Pine Hill, NY 12465

**Coordinates: 42.128400, -74.475372**



### Directions and Parking

From Route 28 turn southwest on Elm St in Pine Hill. After 0.2 miles, turn left on Main St. After 0.3 miles, take a slight right onto Lake St. In 500 feet there is an open gravel area. When parking, be sure to obey the sign and not block the gate that leads to the diversion structure. The diversion structure is a 250 foot walk on the unpaved road past the gate.

### Safety Guidelines

Walk only on the unpaved road to avoid trespassing on private property. Do not enter the diversion structure.



### ESSENTIAL QUESTION

What does the sign say on the second barrier before reaching the diversion structure? (the 2nd barrier is wooden sawhorse painted red):

\_\_\_\_\_

## 4. Phoenicia Main Street Bridge

### Phoenicia



The village of Phoenicia is prone to flooding. It was built at the confluence of two streams: Stony Clove Creek and Esopus Creek. It was also built on a landform known as an alluvial fan. Alluvial fans are created when steep mountain streams with high sediment loads reach a flat plain. In Phoenicia's case, this was the flat floodplain of the Esopus Creek. The decrease in slope from mountain valley to plain causes the stream to lose its power, and thus its ability to transport sediment. Over thousands of years the material deposited on the plain takes on the shape of a fan at the outlet of the mountain valley. This depositional process is similar to how deltas form in oceans.

Prior to settlement, the Stony Clove Creek was a multi-thread (braided) channel that freely moved back and forth across the alluvial fan. The high sediment load from the Stony Clove was deposited and created multiple channels. As one filled with sediment, a new one was formed elsewhere. After Phoenicia was settled the Stony Clove was moved to one side of the alluvial fan to allow the village to expand. The multi-threaded Stony Clove was made into a single straight channel, an unnatural form on an alluvial fan, yet the high sediment load remained.

This understanding of the natural tendencies of streams is the foundation of AWSMP stream management activities and informed the design of a project at the Main Street bridge aimed at mitigating flood hazards in Phoenicia.

Phoenicia flooded three times in ten months between October 2010 and August 2011. The channel continuously filled with sediment (aggraded) under the Main Street bridge and reduced the size of the bridge opening. For years the Town of Shandaken dredged the channel to remove sediment, an expensive, time consuming, and potentially damaging process.

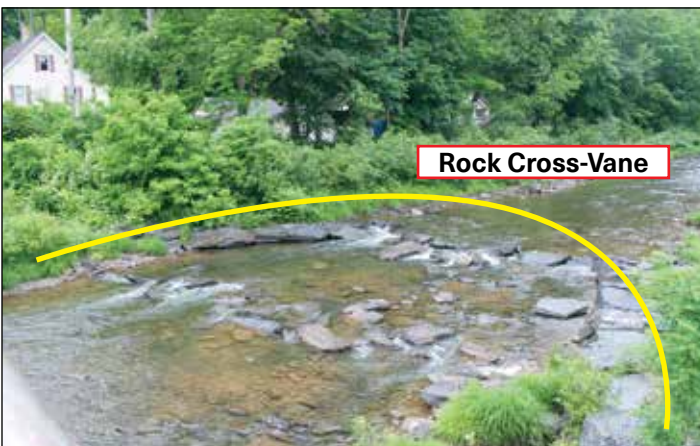
In late 2010, the Town of Shandaken, AWSMP, and NYC Department of Environmental Protection began designing a project to help alleviate flooding caused by sediment deposition under the Main Street bridge. After Tropical Storm Irene in 2011, sediment filled the channel to only four feet below the bridge deck. A horseshoe shaped rock cross-vane was then constructed in the channel to facilitate sediment transport under the bridge and reduce excess deposition.

AWSMP established multiple cross-sections above and below the bridge to monitor the project after it was completed. To





Prior to the restoration project in 2011, the Stony Clove Creek was over-wide, which reduced the stream's ability to carry sediment. This led to excess deposition and the formation of a mid-channel bar, which increased floodwater elevations and caused additional erosion of the streambanks.



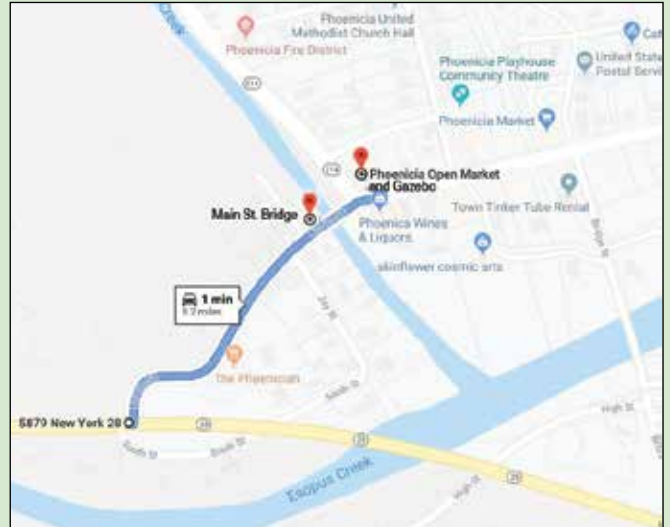
date, the rock vanes have been successful at preventing excess sediment deposition in the center of the channel. Volunteers from the Student Conservation Association's Hudson Valley Corps installed willow stakes along the side of the channel that have since grown into healthy shrubs. This riparian vegetation encourages a deep and fast mid-channel area capable of carrying sediment in a previously over-widened channel.

Since 2011, there has not been a substantial flood in Phoenicia. However, as with all floods, it is not a question of if one will happen, but when. And when it does, Phoenicia is now more resilient through careful planning and hazard mitigation. And AWSMP will be there to assess how well this project performed.

### Location

Phoenicia Open Market Parking Lot  
Simpson Mini Park (across the street)  
41 Main St., Phoenicia, NY 12464

**Coordinates: 42.083173, -74.315544**



### Directions and Parking

From Route 28, turn north on Main Street. Follow Main St. for 0.2 miles and turn northwest on Route 214. After the turn there is the parking lot for the Phoenicia Open Market on the right.

### Safety Guidelines

Phoenicia can have a lot of traffic in the summer and on weekends. Watch out for vehicle traffic and use the crosswalks when crossing the street. Use the sidewalk if standing on or crossing the bridge.



### ESSENTIAL QUESTION

Who donated the Simpson Mini-Park gazebo? (check the plaque on the rock next to the gazebo):

\_\_\_\_\_

## 5. Notch Lake

### Hunter



Notch Lake gets its name from being in the Stony Clove Notch, a narrow passage between two mountains. On the left (east) is the shoulder of Hunter Mountain. On the right is Plateau Mountain. Notch Lake is created by a dam on the furthest upstream reach of Stony Clove Creek.

If you continue north on Route 214 through the Notch, 0.3 miles past Notch Lake, you reach the watershed divide between the Esopus Creek and Schoharie Creek watersheds. On the Notch Lake side of the divide, all the precipitation that falls makes its way into the Stony Clove, merges with the Esopus near Phoenicia, and flows into the Ashokan Reservoir some 18 meandering miles downstream from here. On the other side of the divide, water flows into a small, unnamed tributary to the Schoharie Creek. Small streams, rivulets, and wetlands that drain the upper extent of any watershed are called the headwaters.

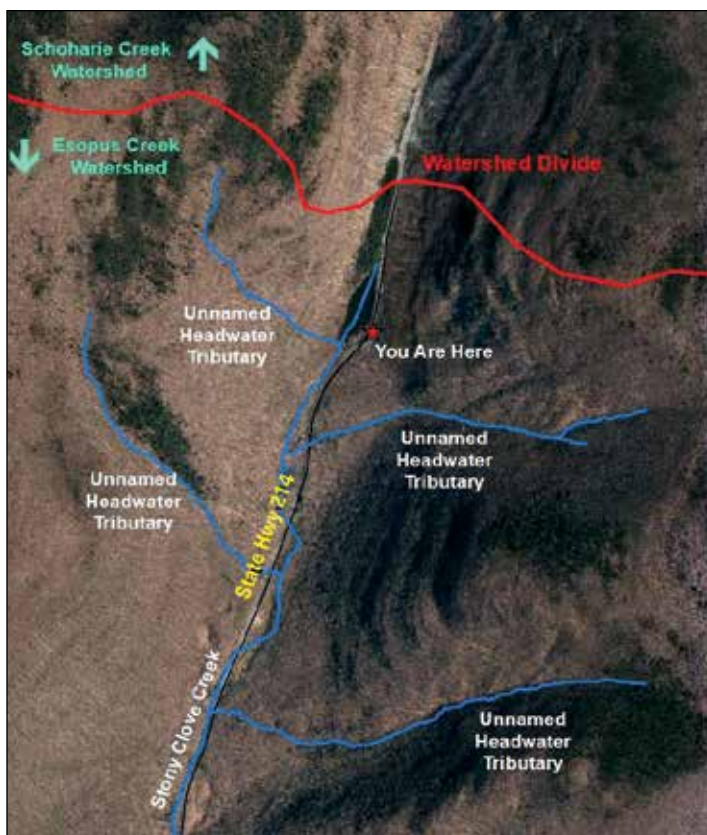
Stony Clove Creek, like any stream or river including the Hudson or mighty Mississippi, has humble beginnings in its headwaters. While Notch Lake may appear to be the “start” of the Stony Clove, the lake itself is fed by a network of over-

land and subsurface flow paths that make it impossible to pinpoint the exact start of the stream. If not for the dam, this area would be a shallow wetland with no one channel to follow to the source.

Headwater streams and wetlands are often unnamed and certainly underappreciated. They may be small, but headwater streams make up over 80% of the nation's river networks and supply well over 50% of the water to larger streams, lakes, and drinking water supply reservoirs downstream. “The physical, chemical, and biologic integrity of our nation's waters is sustained by services provided by wetlands and headwater streams” (pg. 24 of *Where Rivers Are Born*).

Ecosystem services are the benefits to humans that are derived from natural functioning ecosystems. Services provided by functioning headwaters include: storing water and reducing the intensity of flooding downstream, maintaining year-round drinking water supplies, preventing excessive sediment transport to downstream reaches, maintaining water quality, and supporting biodiversity with a large array of plants and animals that call headwaters home. The group





The foundation of our nation's great rivers is a network of unknown, unnamed, and underappreciated headwater streams that look like this. Of the 3.5 million miles of streams in the US, 50-80% are small, headwater streams.

American Rivers has published a great, easy-to-read pamphlet highlighting the importance of and threats to headwater streams titled "Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands." Find it here: <https://www.americanrivers.org/conservation-resource/small-streams-wetlands/>

### Location

Devil's Tombstone Campground and Day Use Area  
Route 214, Hunter, NY 12492

**Coordinates: 42.159628, -74.203334**



### Directions and Parking

From Phoenicia, turn north onto Route 214. Continue north for 9.3 miles. At 9.1 miles you will pass the office and main entrance to Devil's Tombstone Campground. Continue past the office 0.2 miles to a large parking lot on the left for the campground and day use area.

### Safety Guidelines

Be aware of oncoming traffic when pulling into the parking lot. Always walk on the left side of the road, going against traffic.



### ESSENTIAL QUESTION

What color trail marker crosses the headwaters of the Stony Clove and goes up Hunter Mountain? (check the post in the parking lot)

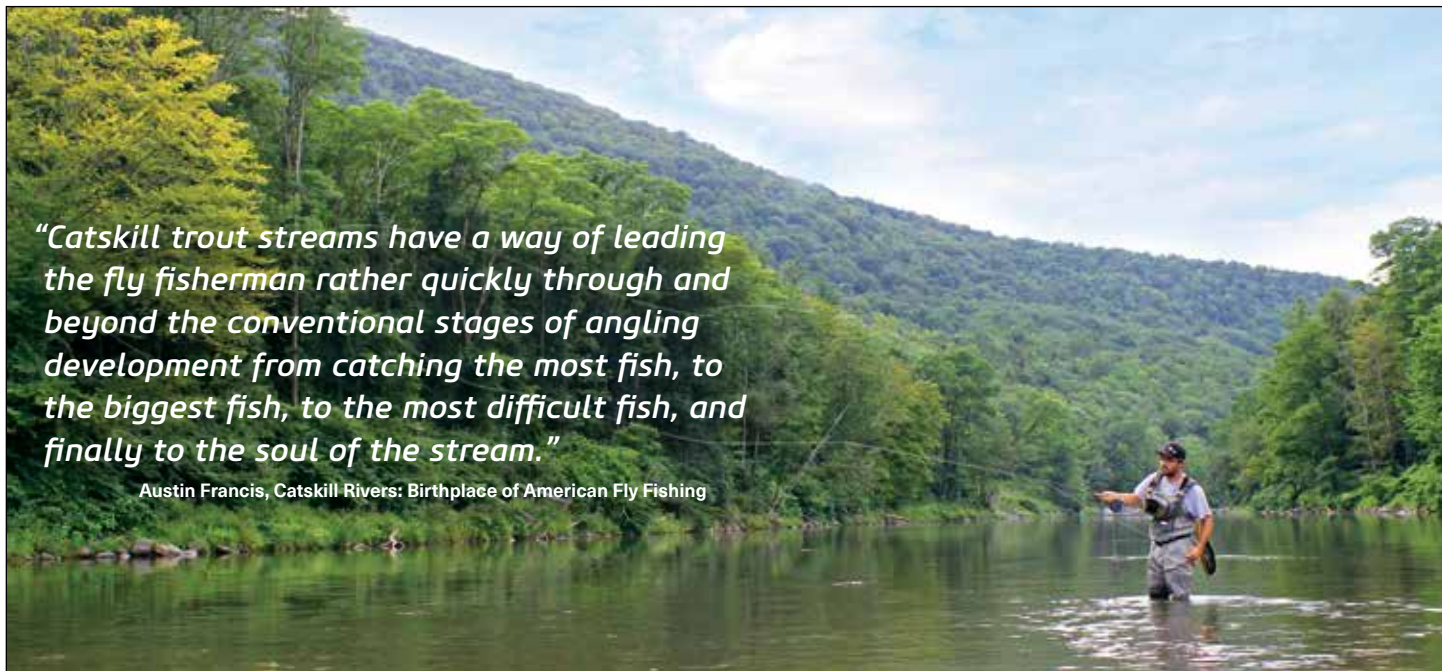
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## 6. Hudler's Flats Fishing Access Site

Mt. Tremper

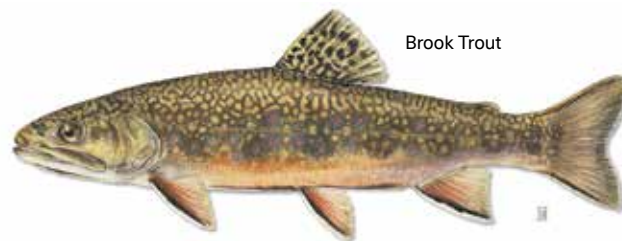
*"Catskill trout streams have a way of leading the fly fisherman rather quickly through and beyond the conventional stages of angling development from catching the most fish, to the biggest fish, to the most difficult fish, and finally to the soul of the stream."*

Austin Francis, *Catskill Rivers: Birthplace of American Fly Fishing*



The Ashokan Reservoir and its 255 square mile watershed with over 450 miles of mountain streams are renowned as a fishery. According to some, Ashokan means "Place of Fish" in the native language of the area, though the exact translation may be lost to history. However, the streams and rivers of the Catskill Mountains, including the Esopus Creek, are officially known as "the birthplace of American fly fishing." While the earliest known reference to using flies to catch fish dates back over 1,800 years, a new methodology centered on the dry fly spread outward from the Catskills starting in the 1850s. This new type of fly affected everything from rod design and casting technique to hatchery science and fishery management.

Since then the Catskills and the Esopus Creek watershed have continued to draw people from all over to try their luck at landing a trout, fish known for their beauty, taste, and



Brook Trout

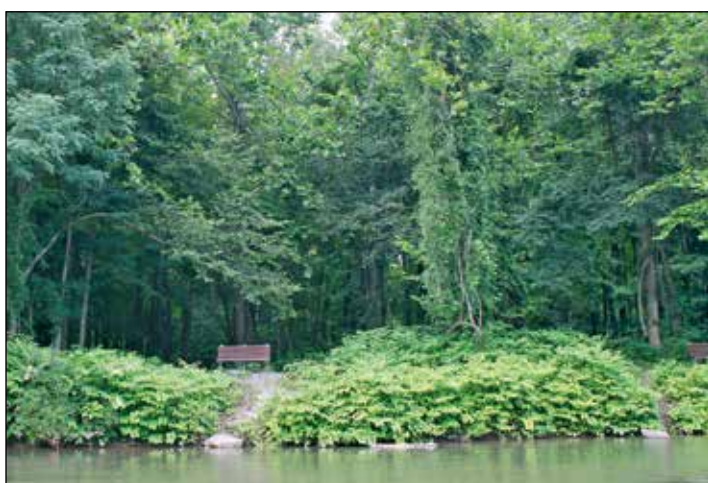
fighting ability. Angling and other forms of recreation tourism are a boon to local economies. Thanks to inputs of cold water from the Shandaken Portal (see Adventure Stop #2), the Esopus can be flowing with abundant cold water during the droughty summer months when other streams are too low and warm to fish. In mid-summer, up to 90% of water in the Esopus can come from the Portal, sustaining the cold-water fishery. Hitchhikers tag along on the water's 18-mile journey from the Schoharie Reservoir, through the Shandaken Tunnel, and into the Esopus Creek: daphnia — tiny transparent water fleas — a favorite food of Esopus rainbow trout.

New York State has three types of stream trout: rainbow, brown, and brook. Of the three, brook trout are the only species native to the area. Rainbows and browns were introduced from the Pacific coast and from Europe, respectively, in the late 1800s to enhance angling opportunities.



Brown Trout





Rainbow Trout

Rainbows and browns are also more tolerant of warmer water than the native “brookies” who are much smaller and tend to keep to the smaller, colder headwater tributaries.

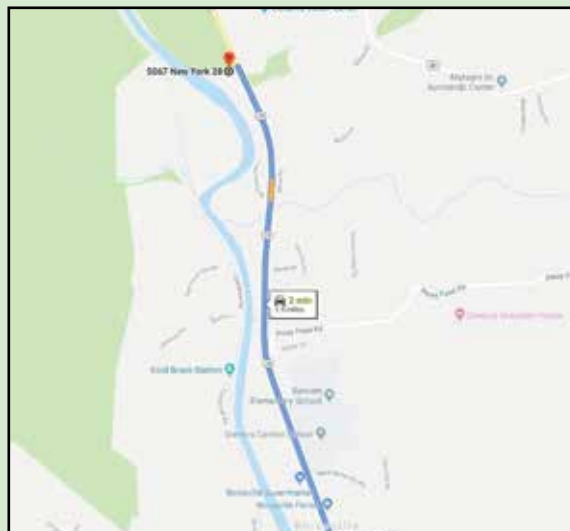
This location is known locally as “Hudler’s Flats.” Hudler is the name of the long-time Shandaken family who previously owned this parcel. It’s called Hudler’s Flats because this stretch of the Esopus is wide, shallow, and...well, flat.

Fishing in New York State requires a license. Fishing seasons and regulations vary by location so be sure to check these rules before heading out to try your luck. Information on fishing including how to obtain a license and a link to the official Freshwater Fishing Regulations can be found at <https://www.dec.ny.gov/outdoor/fishing.html>.

### Location

Hudler’s Flats Fishing Access Site  
5067 Route 28, Mt. Tremper, NY 12457

**Coordinates: 42.025538, -74.271897**



### Directions and Parking

From the intersection of Route 28 and Route 28A in Boiceville, continue northwest on Route 28 for 1.5 miles. On the left you will see a brown DEC sign for Esopus Creek Public Fishing Access.

### Safety Guidelines

This is a popular spot for anglers, be aware the parking lot may be crowded. Be aware and check for ticks if you walk the forested trails along the creek and towards the Catskills Visitor Center.



### ESSENTIAL QUESTION

How many brown trout are stocked in the Esopus Creek annually? (check the informational kiosk in the parking lot):

\_\_\_\_\_

## 7. Halcott Falls

### Halcott Mountain Wild Forest

Did you know that the Catskill Mountains are not a true mountain range? A true mountain range is formed when two of Earth's tectonic plates collide and initiate an orogeny, or mountain building event. When the tectonic plates collide, bedrock is contorted and mangled. The immensely high temperatures and pressures produced during an orogeny deform the existing bedrock, physically and chemically changing it to a different type of rock known as metamorphic.

There have been many orogenies throughout Earth's history and they are responsible for the shape and layout of the continents as we know them today. While the Catskill "Mountains" themselves were not formed by an orogeny, thus not true mountains, they are the result of an ancient orogenic event.

Around 375 million years ago, during the Devonian Period, the Acadian orogeny built mountains the size of the Himalayas just east of here. Over time, streams, weather, and gravity slowly broke down the Acadian Mountains. Streams carried the eroded materials westward where they entered an ancient sea and formed the Catskill Delta. A delta is formed when one body of water flows into another body of water that is moving more slowly. The sudden decrease in velocity causes the sediment to drop out of suspension and be deposited in flat layers.

Look closely at the rocks here. Notice the distinctly flat layers. The layering tells us these rocks were formed by the deposition of sediment and are thus known as sedimentary rocks. Unlike the metamorphic rock seen in true mountains such as the Adirondacks, these sedimentary rocks are un-deformed. No orogeny took place here.

The bedrock in the Catskills was created by the compaction and cementation of Acadian mountain sediment deposited in the Catskill Delta. Similar to today's Mississippi River delta in the Gulf of Mexico, the Catskill delta grew and changed over time as sediment was deposited and ancient streams migrated across the landscape. Changes in the shape and extent of the delta are preserved in the rock layers at Halcott Falls. The thin layers, composed of fine grained silt and clay



particles, are evidence of a time when this area was on the outer fringes of the delta. Only the smallest sediment particles were carried to the far reaches that extended into the sea. The thicker layers of sandy material were deposited in a different environment, further inland on the delta.

The mountains we see today were formed later by glaciers that carved valleys through the uplifted sedimentary bedrock 12,000 years ago. Streams and gravity have also carried away eroded material to help create peaks such as Halcott Mountain. So, the Catskills Mountains are not mountains but a "dissected plateau": eroded remnants of the Acadians, deposited in layers on an ancient delta, compacted and cemented into rock, uplifted, then dissected into the "mountains" we see today by glaciers and streams. Got it?





Visible layering is an easily identifiable trait of sedimentary rocks.



In undeformed sedimentary rock outcrops like this one, the oldest rocks are at the bottom. Changes in the characteristics of layers as you move up, such as thickness and material composition, tell a story about the environmental changes that occurred here millions of years ago.

### Location

Halcott Mountain Wild Forest Parking Lot  
Route 42, Westkill, NY, 12492.

**Coordinates: 42.184793, -74.414762**



### Directions and Parking

From Route 28, head north on Route 42. Continue on Route 42 for 5.1 miles. At 5.0 miles there is a concrete retaining wall on the left. The Halcott Mountain parking lot is on the left immediately after the retaining wall. At the south end of the parking lot there is a small trail that leads to Halcott Falls.

### Safety Guidelines

Be aware of oncoming traffic when pulling into this small parking lot. Rocks around the falls may be slippery. Terrain around the falls is steep.



### ESSENTIAL QUESTION

According to the sign in the parking lot, what is not allowed on State land?

\_\_\_\_\_



## 8. Cascade Brook Bridge

### Big Indian



Have you ever noticed how many bridges or culverts you cross during your normal drive? You'd probably be surprised. There are over 600 road-stream crossings in the Ashokan watershed. If you came from Route 28, you crossed four small streams during your six mile trip on Oliveria Road. This particular bridge carries the road over Cascade Brook, a headwater tributary of the Esopus Creek.

Culverts and bridges are easily overlooked, especially on relatively small streams like Cascade Brook, yet crossings of all sizes are critical pieces of infrastructure. If a culvert or bridge is poorly designed or undersized it can have negative impacts on the environment: fragmenting aquatic ecosystems, disrupting sediment transport, and causing erosion and channel instability in the stream. Undersized culverts and bridges are also prone to failure. This can be a slow process of gradual weakening of the structural components over time, or it can be a quick and catastrophic failure. During Tropical Storm Irene in 2011, the old Cascade Brook crossing suffered a catastrophic failure.

Prior to Irene, the Cascade Brook crossing was composed of two 8-foot diameter, cast-iron culverts. During the storm, the normally small Cascade Brook swelled with floodwaters. The culverts did not have adequate hydraulic capacity to handle the flood. The stream backed up at the inlet and put immense pressure on the structures and the road embankment. Eventually, the two massive culverts, 15 feet of fill material, and 4 inches of asphalt failed and were washed over 100 yards downstream. There was a massive gully where a road used to be. A number of residents were trapped, cut off from services like police, fire, and ambulances. To get a feel for what this culvert failure looked like, check out this video of a different culvert failure during TS Irene: <https://www.youtube.com/watch?v=TjOWAavU04Y>

Today the culverts lie in the same spot where they came to rest in August 2011, wedged between trees near the confluence of Cascade Brook and the Esopus Creek. They can just be seen from the new Cascade Brook bridge. The culverts are eerily out of place in the forever wild Forest Preserve, but





they serve as a stark reminder of the power of nature and the critical importance of culverts and bridges of all sizes.

Following the storm, AWSMP assisted the Ulster County Department of Public Works in replacing the Cascade Brook crossing with the well-designed structure that you see today, which is properly sized to accommodate future floods. Upgrading and upsizing road-stream crossings is a key component of building community resilience. AWSMP assists municipalities with funding and technical guidance for up-sizing culverts and bridges and mitigating flood hazards. AWSMP also provides technical guidance and permitting assistance to landowners who own private culverts or bridges.



### ESSENTIAL QUESTION

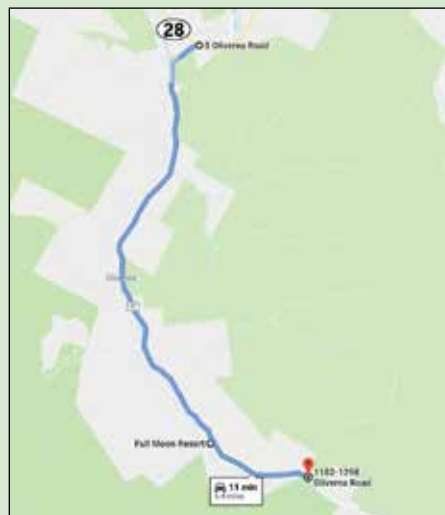
Who is the Cascade Brook bridge dedicated to? (check the plaque)

\_\_\_\_\_

### Location

Giant Ledge Stream, 1182-1298 Oliverea Road  
Big Indian, NY 12410

**Coordinates: 42.033677, -74.419671**



### Directions and Parking

From Route 28 in Big Indian, turn south onto County Route 47/Oliverea Road. Continue for 6.5 miles. At 5.2 miles you will pass the Full Moon Resort on your right. Continue 1.3 miles past Full Moon and you will come to the Cascade Brook Bridge (called Giant Ledge Stream in Google Maps). Cross the bridge and find a small parking area on the right.

### Safety Guidelines

The parking lot is on a blind turn where it can be hard to see oncoming traffic, especially when pulling out. There is a small, unmarked foot trail that starts at the parking area and goes down the hill on public land.



**USE EXTREME CAUTION** if you take this path, and only do so if you are in good physical condition and have proper footwear. There is no cell service. AWSMP is not responsible or liable for any injuries.

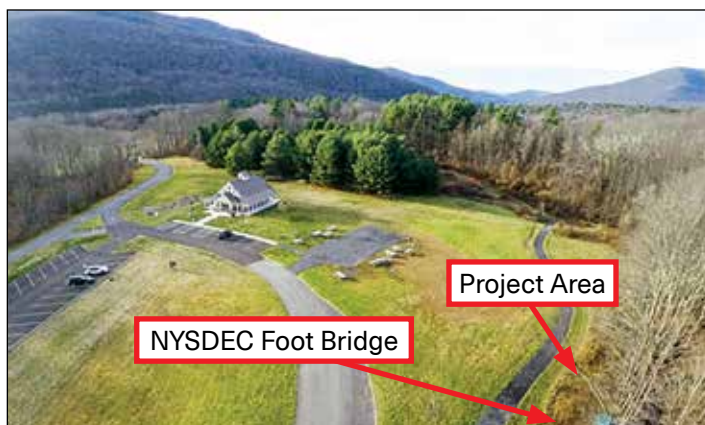
## 9. Catskills Visitor Center

### Native Riparian Buffer Demonstration Project

Mt. Tremper



Ninety-five percent of the 255 square mile Ashokan Reservoir watershed is forested. Thanks to these forests, NYC has the largest unfiltered drinking water supply in the world. However, urban development in the Ashokan Reservoir watershed is densely concentrated in the flat valley bottoms and in close proximity to streams. This concentrated development along streams dates back to the 1800s when railroads first brought industry and tourism to the Catskills Mountains. Tracks were laid on the flat floodplains adjacent to streams. When railroads were overtaken by automobiles, the same valley bottoms were utilized for roads. As the population grew, houses, resorts, and businesses were built in the valleys rather than on the steep mountain slopes. Development of the stream corridors and valleys drastically altered the natural stream-side vegetation. Native trees and shrubs growing on streambanks were replaced by buildings, roads, and farms, as well as by non-native plant species introduced as decorative landscape plants. So, while 95% of the watershed is currently forested, native riparian buffers still provide critically important services that help to mitigate the potential negative impacts of concentrated urban development along streams.



Riparian buffers are strips of vegetation (often a combination of trees, shrubs, and herbaceous plants) adjacent to streams, rivers, and other waterbodies. As rainfall runs off the landscape, riparian vegetation reduces runoff velocity, captures excess nutrients that cause harmful algae blooms, protects streambanks and floodplains from the erosive force of water; and regulates water temperature changes. Healthy buffers also provide food and cover to land animals, fish and other aquatic life, as well as conserve soil moisture and ground water levels.



The Riparian Buffer Demonstration Project at the Catskills Visitor Center was completed in 2017. The Catskill Stream Buffer Initiative (CSBI) designed and installed a model riparian buffer to educate visitors about riparian areas and their impact on water quality and aquatic ecosystems. Before 2016 this area was overrun with invasive plants including multiflora rose, bittersweet vine, and barberry. Over three weeks, CSBI and AWSMP staff removed all invasive plants including their underground root structures. Staff and volunteers, including the Girl Scouts Ashokan Service Unit, then replanted the area with plants native to the Catskills: 14 common native riparian shrubs, 8 native tree species, and a diverse mix of pollinator-friendly native wildflowers. With a grant from the AWSMP, the Catskill Center and the NYS Department of Environmental Conservation installed educational signage at the site. The public nature of the site and its location provides a unique opportunity to engage volunteers and new landowners on how to properly manage riparian areas.



CSBI is a landowner assistance grant program administered by Ulster County Soil & Water Conservation District. Its goal is to inform and assist landowners in being good stewards of their riparian areas by providing technical guidance and financial assistance for riparian buffer improvement projects. A program brochure that includes eligibility requirements for landowners can be found here: <http://catskillstreams.org/pdfs/CSBIbrochure.pdf>



### ESSENTIAL QUESTION

What are two riparian plant species found at the Riparian Buffer Project? (check the plaques along the walkway)

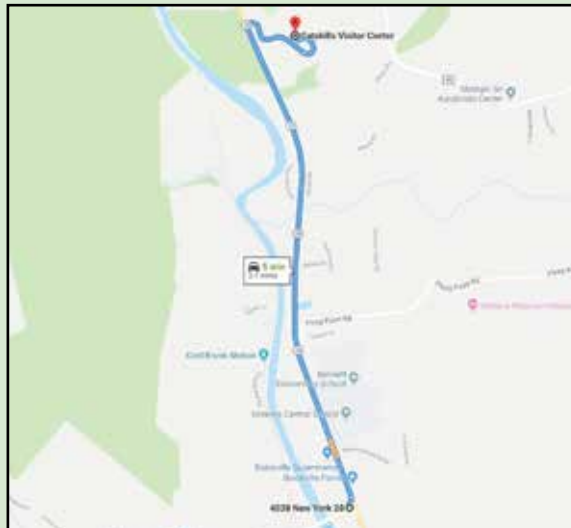
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## Location

### [Catskills Visitor Center](#)

5096 Route 28, Mt. Tremper, NY 12457

**Coordinates: 42.027816, -74.268565**



## Directions and Parking

From the intersection of Route 28 and Route 28A in Boiceville, continue west on Route 28 for 1.7 miles. On the right will be the entrance to the Catskills Visitor Center (look for the sign). Cross the bridge and go around the parking lot circle to where there are five parking spots near the footbridge. The planting project is located on the north side of the property upstream of the DEC footbridge and adjacent to the walking path around the grounds.

## Safety Guidelines

There are many walking trails and a hiking trail on the Catskills Visitor's Center grounds. Be aware there are a lot of ticks in this area. Check yourself carefully if you walk these paths.

## 10. Ashokan Reservoir “Frying Pan”

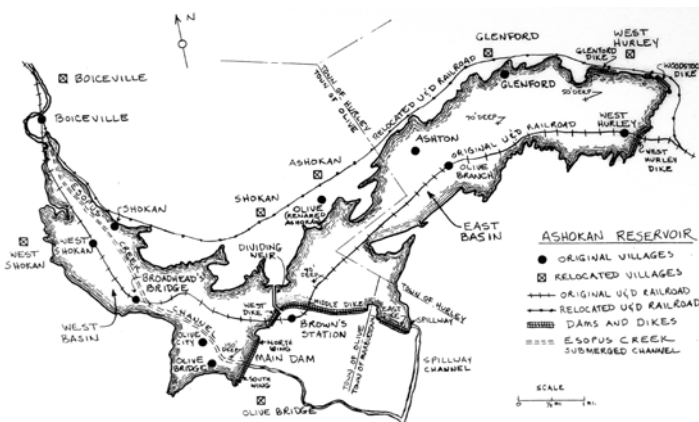
### Kingston



Welcome to the Frying Pan! A local name given to the Ashokan Reservoir East Parking Lot due to the shape of the facility. The paved walking path travels along the middle dike, a wall built to contain the reservoir after the Esopus Creek was impounded by the main dam further to the west. The dam, dikes, and reservoir are pieces of infrastructure whose roots go back hundreds of years.

The first water supply well in New York City was dug in 1677 by Dutch settlers. At that time, disposal of human waste was already a problem. It leached through the soil and into groundwater where it contaminated wells and caused significant disease and mortality. By 1775, the City was using more water than it could supply and was already investigating reservoirs as a solution. By 1830, a half-million-gallon reservoir on Chambers Street still only supplied one third of the population and was woefully insufficient to extinguish the Great Fire of New York in 1835. Thus, the Croton (1842) and Central Park (1862) reservoirs were built. Still, as the population continued to grow rapidly through the second half of the 19th century, NYC was regularly in a state of “water famine.”

The Esopus Creek was first mentioned as a possible water supply in a *Scientific American* article published in 1886. The first feasibility study was completed in 1903 and construction of the dam and the Ashokan Reservoir began in 1907. Ashokan is a Native American word and could mean “place of many fishes.” By the time of the American Revolution, the only remnant of Native culture in the area was in the place names: Moonhaw, Peekamoose, Shandaken, and Ashokan.







Today, 1.1 billion gallons of water are used each day by over 9.6 million New Yorkers, one million of whom live in communities north of the City. Approximately 40% of that (480 million gallons per day) comes from the Ashokan Reservoir. At full capacity, the Ashokan has the largest surface area of any NYC reservoir: approximately 8,300 acres, or nearly 13 square miles. It is the second largest by volume with a maximum depth of 160 feet and a capacity of 125 million gallons when full. At the time of its construction, this was one of the largest reservoirs in the world.

This capacity is split between two separate basins. Reservoir Road lies atop a concrete dividing weir that splits the reservoir into the East and West basins. Water flows from the Esopus Creek into the upper West basin where sediment has time to settle out. The water is then transferred to the lower East basin via four large stainless steel gates that were originally made of cast iron. From here it makes its way into the Catskill Aqueduct and is on its way to the thirsty City.

For more information on the social, environmental, and political history of the Ashokan Reservoir, check out Bob Steuding's book "The Last of the Handmade Dams." There is also a locally produced film about the reservoir's history called "Deep Water" available at many local libraries.

#### Sources:

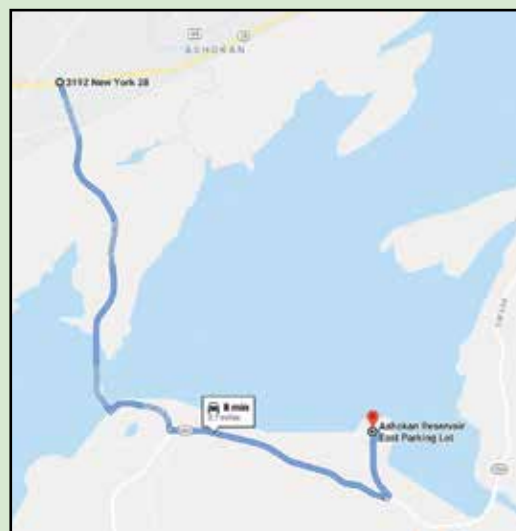
Steuding, B. 1985. The Last of the Handmade Dams: The Story of the Ashokan Reservoir. Purple Mountain Press, Ltd. Fleischmanns, NY

Wikipedia. Ashokan Reservoir. Retrieved from [https://en.wikipedia.org/wiki/Ashokan\\_Reservoir](https://en.wikipedia.org/wiki/Ashokan_Reservoir)

### Location

Ashokan Reservoir East Parking Lot  
27 B W S Road, Kingston, NY 12401

**Coordinates: 41.948080, -74.181469**



### Directions and Parking

From Route 28, turn south onto Reservoir Road. The road takes a sharp left after crossing the reservoir. Turn left onto Route 28A and continue for 1.2 miles. There is a green public parking sign on the right side of the road. Turn left onto B W S Road. immediately after this sign and follow this road 0.4 miles to the circular parking area.

### Safety Guidelines

Follow the rules and regulations posted on signs throughout the area. Department of Environmental Protection Police regularly patrol the area.



### ESSENTIAL QUESTION

How many workers were employed in building the Ashokan Reservoir? (check the informational kiosk for the answer)

## 11. AWSMP Office

### Shokan



The Ashokan Watershed Stream Management Program (AWSMP) is a collaboration between Cornell Cooperative Extension of Ulster County, Ulster County Soil and Water Conservation District, and New York City Department of Environmental Protection. The three agencies work together to maintain the health of streams in the Ashokan Reservoir watershed. This work includes: improving stream stability, reducing erosion threats to water quality and public infrastructure, mitigating potential damage from flooding, and enhancing aquatic and riparian habitat. AWSMP serves the residents and municipalities of the Ashokan Reservoir watershed and works to educate the community about stream stewardship best practices.



The AWSMP was born out of a 1997 Memorandum of Agreement (MOA) between NYC, New York State, the US EPA, watershed communities, and non-profit organizations. The MOA aimed to maintain and enhance water quality for the NYC water supply system as well

as to protect the economic vitality and community character of the Catskill lands that supply NYC's drinking water. It required NYC to establish a Stream Management Program in its West of Hudson water supply watershed to implement stream management strategies. AWSMP's first publication was the Broadstreet Hollow Stream Management Plan in 2003.

Stream management plans (SMPs) are the foundation for AWSMP's activities. In addition to Broadstreet Hollow, six other management plans have been developed for the upper Esopus Creek and five of its major tributaries. These publicly available documents contain a comprehensive review of stream characteristics, maps and data collected by AWSMP staff. Those data are then used to develop stream management recommendations to assist watershed municipalities and residents in planning for the protection of property, infrastructure, water quality, and biological resources. By ensuring the health of Ashokan Reservoir streams and environmental resources, economic growth and a high quality of life for watershed municipalities and residents are also secured.

The AWSMP office is open to the public from 8:00am – 4:30pm, Monday through Friday. There are a number of print resources available at the office including Stream Guides that provide guidance on a range of topics from flood emergency preparedness to properly managing large wood in streams.



AWSMP staff perform site visits and advise landowners on how best to manage their stream side property. Education staff deliver programs and activities ranging from Stream Process 101 to Floodplain Management for Real Estate Professionals. The Stream Management Implementation Program (SMIP) is coordinated by the AWSMP and provides funding to municipalities to implement management recommendations from stream management plans and to manage publicly owned streamside infrastructure.



AWSMP also hosts a number of fun and educational events throughout the year including: stream snorkeling, snowshoe stream walks, and a full day youth conference called Stream Explorers. Be sure to check out the marquee in front of the office to see what exciting programs are coming up. And lots more information can be found at <http://ashokanstreams.org/>.

There are a number of ways to stay up to date on AWSMP's activities and offerings. We maintain an email list, publish a semi-annual newsletter called Esopus Creek News, and are active on all social media platforms including Facebook (@AWSMPUIster), Instagram (@ashokanstreams), Twitter (@ashokanstreams), and YouTube. Calling (845-688-3047) or stopping by the office (3130 Route 28, Shokan, NY) are also great ways to get to know the program.

#### Additional Sources:

American Rivers. 2007. Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands. Retrieved from [http://americanrivers.org/wp-content/uploads/2016/05/WhereRiversAreBorn\\_report.pdf](http://americanrivers.org/wp-content/uploads/2016/05/WhereRiversAreBorn_report.pdf)

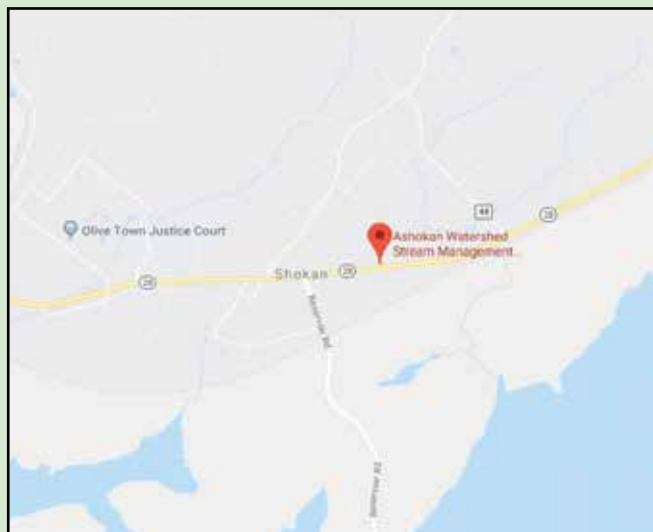
Follansbee, R. 1947. A History of the Water Resources Branch, U.S. Geological Survey: Volume 1, From Predecessor Surveys to June 30, 1919. Retrieved from <https://pubs.usgs.gov/msb/7000087/report.pdf>

Francis, A.M. 1983. Catskill Rivers: Birthplace of American Fly Fishing. Skyhorse Publishing. New York, NY

### Location:

Ashokan Watershed Stream Management  
Program Office  
3130 Route 28, Shokan, NY 12481

**Coordinates: 41.973956, -74.206369**



### Directions and Parking

We're on Google Maps! Simply search for Ashokan Watershed Stream Management Program and you'll be directed to the office. Park in the lot and come on into the "big house" (not the log cabin).

### Safety Guidelines

Route 28 is a busy road with a 45 mph speed limit in Shokan. Please be aware of traffic when turning into the parking lot.



### ESSENTIAL QUESTION

How many panes of glass are on the door of the Big House main entrance?

\_\_\_\_\_



The Ashokan Watershed Stream Management Program (AWSMP) is a joint effort between Cornell Cooperative Extension of Ulster County, the Ulster County Soil and Water Conservation District, and the New York City Department of Environmental Protection. The AWSMP focuses on reducing erosion and flood threats to water quality and property. We also work to improve aquatic habitat and stream access for recreation. Our stakeholders include municipalities, streamside landowners, and all watershed residents and visitors.

The AWSMP offers a variety of educational programs to raise awareness of stream best management practices. Understanding how rivers work in the Ashokan watershed is key to managing healthy streams, protecting property, and reducing the cost of river management over the long-run.

For more information on Ashokan watershed streams, visit [ashokanstreams.org](http://ashokanstreams.org). If you have a question about erosion or stream management on your Ashokan watershed property, call the stream program office at (845) 688-3047. Check out our riparian buffer planting program, the Catskill Streams Buffer Initiative at: [catskillstreams.org/catskill-streams-buffer-initiative](http://catskillstreams.org/catskill-streams-buffer-initiative). We offer free assistance with planting stream buffers on your property.



**Cornell Cooperative Extension** | Ulster County



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Ashokan Watershed Stream Management Program

845-688-3047 | 3130 Route 28, Shokan, NY 12481 | [www.ashokanstreams.org](http://www.ashokanstreams.org)