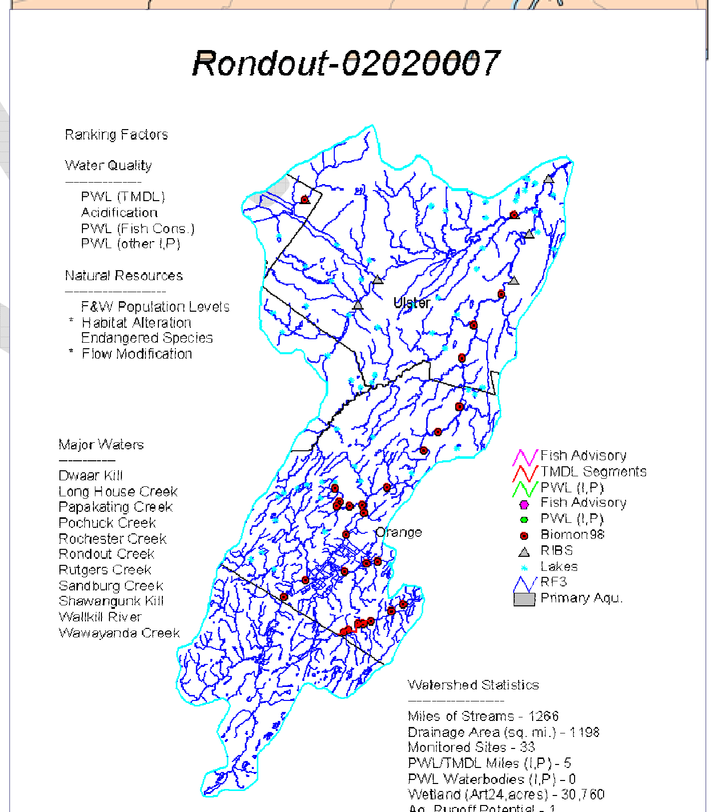
SECTION 2 - RONDOUT CREEK AND ADJACENT WATERSHEDS

2.1 The Rondout-Wallkill Watershed

The Rondout Creek is among the largest tidal tributaries to the Hudson River. The headwaters of the Rondout creek begin in Shandaken at an elevation of 3,837 feet (DEP, 2008). It is impounded at the Rondout Reservoir in Sullivan and western Ulster counties then travels southeast through Ellenville, where it bends northeast to the High Falls waterfalls. It is joined by the Wallkill River beyond the Central Hudson-owned hydroelectric plant at Sturgeon Pool in Rifton. The Wallkill River system and Rondout Creek system form the approximately 3,082-km^2 Rondout-Wallkill watershed, the largest tributary basin entering the Hudson River south of the head of tide at Troy. The Rondout then continues to flow north over the Eddyville dam, where it is tidal for a 4-mile stretch until it empties into the Hudson River in downtown Kingston at an elevation of 190 feet. The Rondout enters the Hudson River Estuary at River Mile ___ (148 km), far enough north of the limit of saltwater intrusion so that the Rondout is a tidal freshwater system.

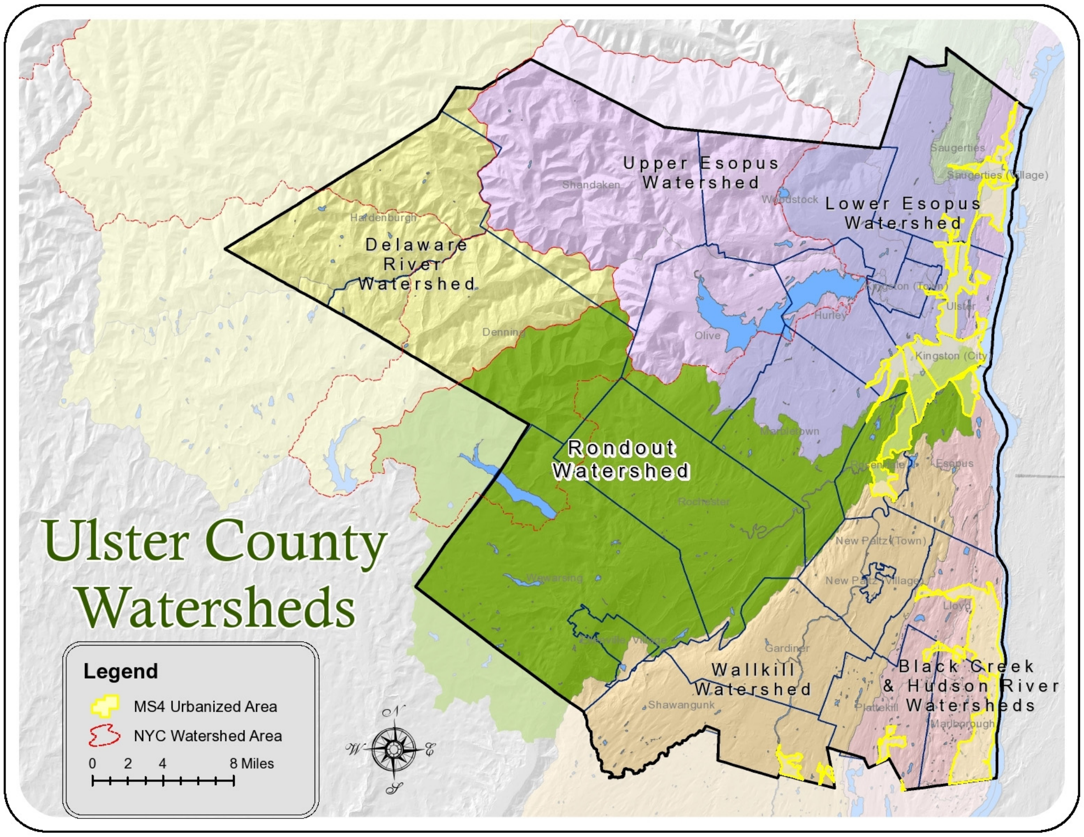
Map 2.1: Rondout – Wallkill Combined Watershed



Map 2.2

Delineation

Delineating the Rondout Creek watershed is challenging because it overlaps with the Catskill Park and the New York City Water Supply System for the Catskill and Delaware. In addition, the Hydrologic Unit Code (HUC # 02020007 – Map 2.2) is called Rondout, but includes the Wallkill Creek, which flows north from New Jersey through Orange County. A watershed management plan has already been created for the Wallkill, so the Rondout Creek Interim Watershed Management Plan for the lower, non-tidal section has been designed interface easily with this and other watershed planning and protection efforts in the adjacent watersheds, with a focus on the Upper Rondout (NYC DEP) and the Upper and Lower Esopus (LEWP).



Map 2.3 The full Rondout Creek Watershed covers most of the southwest portion of Ulster County with the Delaware Watershed in Delaware and Sullivan Counties to the west, the Upper and Lower Esopus to the north and the Wallkill and Black Creek to the east.

Impervious Surface in the Rondout-Wallkill Watershed

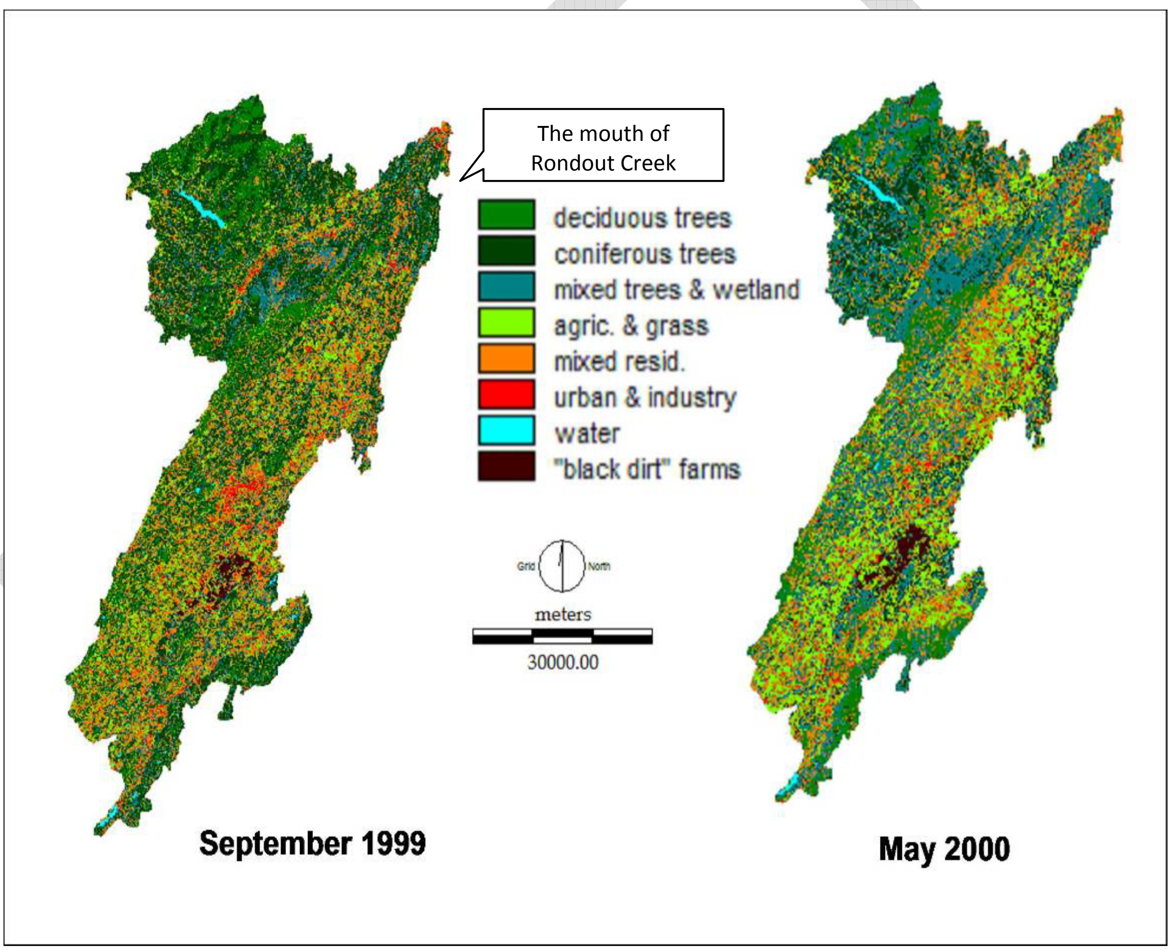
This section has been adapted from *Using a Shoreline Inventory for Conservation and Planning: the Rondout Creek Case Study,* original research by Chris Bowser (*Appendix E*).

Because it contains a high diversity of shoreline type in a relatively short stretch, it was used extensively and historically used as an early site for sampling, inventory and collection classification for many studies. Finally, the Rondout Creek contains, within a relatively small area, many of the same issues and challenges found along the greater mainstem estuary, including competing needs of economy and ecology as well as management across municipal borders. The design and implementation of a Watershed Management Plan that takes into consideration the Rondout Watershed's ecological assets and cultural highlights will establish the context of conservation needs and could best be applied to the larger whole (connectivity of all the watersheds) in the future.

Land Cover of the Rondout Watershed and Creek (Winter 1999, Spring 2000)

Percentage of impervious land cover within a watershed can be used as a general indicator of watershed health and non-point source pollutant loading. Impervious cover refers to roads, roofs, and parking lots that do not allow rainwater to penetrate soils, thus increasing the likelihood of erosion and non-point source pollutants to rapidly enter local waterways. Urban areas typically have a high percentage of impervious cover, agricultural areas less so, and forested areas have the least (For more information about impervious surfaces see section 4.2).

Thirty-meter resolution Landsat imagery (bands 4, 3, and 2) of the Wallkill-Rondout watershed from both September 1999 (a month when deciduous trees are in full leaf) and May 2000 (a time before deciduous leaves have fully formed) were classified for land use cover using the IDRISI software package. Two seasons were used to examine the effect of multi-seasonal differences, such as deciduous leaf cover, on classification.

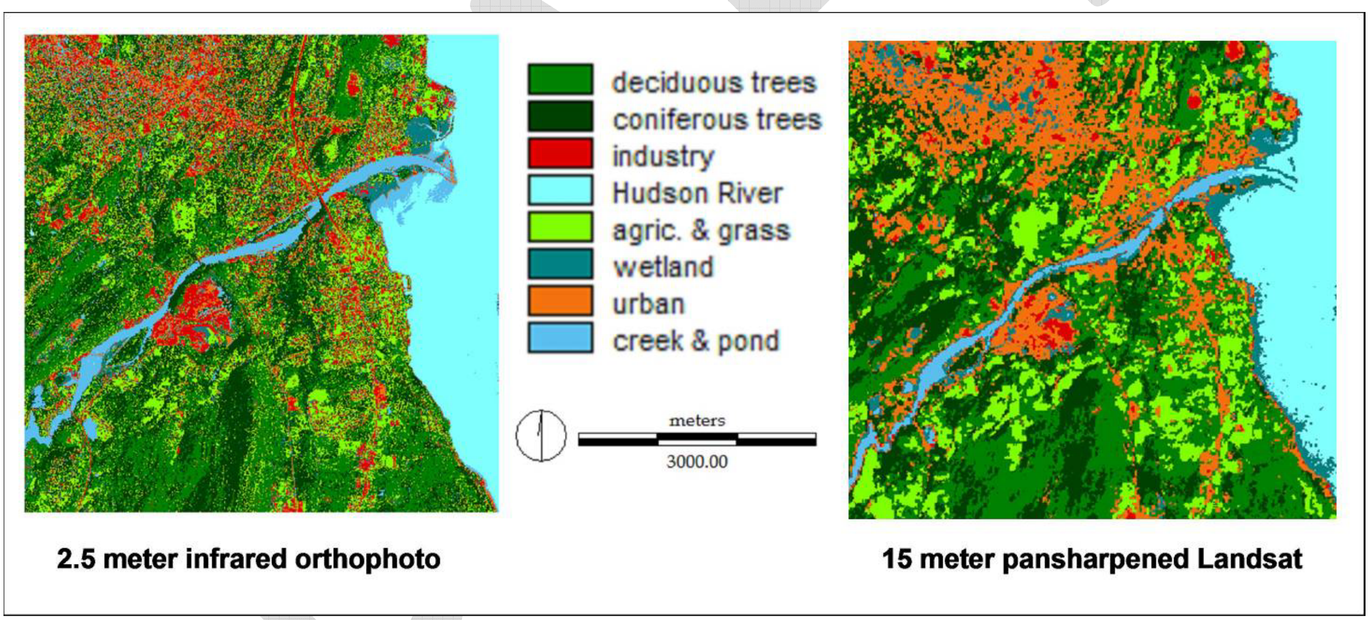


Map 2.4. Land use in the Rondout-Wallkill watershed *(Source of Landsat image: University of Maryland website: glcfapp.umiacs.umd.edu).* Note: This HUC map includes both Rondout and Wallkill watersheds.

For the September and May images, impervious surface was calculated at 9.2% and 9.6%, respectively. The presence of leaves on the trees did not greatly affect the impervious cover calculations in this analysis. According to the Center for Watershed Protection, watershed imperviousness of 10% to 25% indicates an impacted stream or estuary tributary likely to exhibit a decline in water quality, loss of biodiversity, greater storm flows and altered stream geometry. Imperviousness beyond 25% indicates severe degradation, no longer able to support a diverse stream biota and likely having poor water quality. Similar thresholds have been linked to other indicators. Wang et al., (1997) found habitat quality and biotic integrity, based on an array of fish and invertebrate community metrics, with an impact range of 10% to 20% similar to that of Zielinski's land use thresholds of 10% to 25%.

The 1999-2000 average calculation of 9.4% impervious cover for the Wallkill- Rondout Watershed indicates a watershed that is on the borderline of experiencing negative water quality impacts from runoff and non-point sources associated with impervious cover.

A similar analysis of the area around the tidal Rondout Creek, located in the northeast corner of the watershed, reveals a smaller region of greater imperviousness. An impervious cover of 14.7% to 18.5% is higher than the overall imperviousness of the entire watershed (9.4%), and indicates the tidal Rondout Creek may be an impacted estuary tributary that is experiencing negative water quality impacts from runoff and non-point sources associated with urbanization at the local scale of land use immediately adjacent to the tidal Rondout Creek.



Map 2.5. Land use along the tidal Rondout Creek. (L) Derived from 2.5 meter orthophotos, April 2001. (R)Derived from 15-meter pan-sharpened Landsat, May 2000. *(Source: Ulster County Information Services, Kingston, NY).*

The Rondout-Wallkill watershed, specifically the area around the tidal Rondout Creek, exhibits a percentage of impervious cover (14.7% to 18.5%) that may lead to negative water impacts. In the case of the Rondout Creek, the effects of watershed-scale water quality is especially relevant since the lower portion of the creek is the "bottleneck" of the drainage basin before entering the Hudson estuary. The Creek's tidal nature at this point also means it has a more variable flushing rate and considerable re-suspension of sediments. Shoreline hardening and the reduction of riparian vegetation can lead to reduced filtration and greater inputs of pollutants and sediment into streams.

Furthermore, urban waterfronts are usually associated with impervious parking lots and rooftops as well as hardened shorelines. It is typical that imperviousness will increase as development pressures in the watershed continue.

Reminder to mention NYC Water Supply – with or without map of it.

Land Use – Land Cover

Forested land exceeds 95% of the total watershed land cover, ranging from 95.5% to 99%. (Although in the 1800's the watershed had been significantly logged and the streams consequently altered by the sediment eroding from the landscape.) In the valley bottom, forest cover still tends to dominate the land cover along most of the stream's course, however along the Route 28 corridor, development associated with roads, residences, businesses, and town centers increases the percentage of impervious surfaces. There is no large-scale agricultural land use in the watershed.

Geology

Streams and glaciers sculpted the rugged Upper Esopus Creek Watershed. Much of the current character of the watershed is a consequence of the most recent ice ages of 12,000 – 25,000 years ago, when the Catskills were mostly occupied by glacial ice or the meltwater streams and lakes that followed the ice's retreat. These mountains are composed of sedimentary rock. The broken bits of this bedrock is the source of almost all of the stream sediment you see today - from clay to boulders. The reddish layered clays exposed in stream banks are ancient glacial lake sediments eroded from the red siltstones and shales that often form the mountain slopes; the cobbles and boulders eroded from the thick-bedded sandstones that form the mountain cliffs. The nature of the glacial lake deposits and the dense, clay-rich glacial till that can also form channel boundaries makes them variably susceptible to stream erosion and the main contributor to tin the Catskill streams. In particular, the lake and till sediments are sensitive to natural or man made disturbances which can have a long lasting negative effect on channel stability, water quality and stream ecology.

Water Supply and the Catskill District System

Upper Esopus Creek is a regulated river by inter-basin transfer of water. The Shandaken Tunnel, also referred to as the "Portal," is a handmade aqueduct that connects the Schoharie Reservoir to the Esopus Creek. The Catskill District of New York City's West-of-Hudson water supply system is one of three systems that supply water to New York City and includes the Schoharie Reservoir, Shandaken Tunnel, Ashokan Reservoir and the Catskill Aqueduct west of the Hudson River. Approximately 40% of the City's average water supply demand is provided by the Catskill System.

New York City must abide by two regulatory documents administered by the New York State Department of Environmental Conservation (DEC) when operating the Shandaken Tunnel: 6 NYCRR Part 670 "Reservoir Release Regulations: Schoharie Reservoir - Shandaken Tunnel – Esopus Creek" and a State Pollution Discharge Elimination System or "SPDES" permit, which together provide for flows, temperatures, and turbidity thresholds to protect aquatic biota. Part 670 also allows up to four (4) recreational releases for whitewater recreation to be granted per year to be granted by the DEC.

It is important to note that a separate "Catskill Turbidity Control Study" has been conducted in parallel with this effort. The recently concluded Phase II of the Catskill Turbidity Study has structural and operational modifications options for controlling turbidity releases from the Shandaken Tunnel that are currently being considered by NYC and the U.S. EPA.[1]

Lower Esopus Watershed[2]

The reservoir continues for 6.5 miles (10.5 km) to its spillway near Olive Bridge.Its eastern section, slightly to the north, is not part of the creek's course. Below the dam, having descended almost 2,000 feet (610 m) from Winnisook Lake, it runs through a wild, rocky section with cascades and rapids, flowing southeast, away from Route 28, until it reaches US 209 at Marbletown. There, it turns northeast and parallels the road to Hurley, where it crosses.

After the New York State Thruway crosses just west of Kingston, the Esopus bends to the north and meanders parallel to it. After Route 209 crosses again, it receives the Saw Kill, which drains the southeastern corner of Greene County, from the west and straightens out past Lake Katrine. The riverside is more developed here, with homes

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[1] Upper Esopus Creek Watershed Management Plan, Cornell Cooperative Extension – Ulster County New York City Department of Environmental Protection, U.S. Army Engineer Research Development Center, January 2007

[2] http://en.wikipedia.org/wiki/Esopus_Creek

and docks on the east bank. Just southeast of the village of Saugerties, it turns east and forms the south boundary of the village, with one bridge carrying US 9W and NY 32. Just below the bridge it flows over a small dam. It bends north, passes Saugerties Light, and empties into the Hudson 1.3 miles (2.1 km) east of the dam.

Conservation and management efforts in the lower Esopus are not as coordinated as they are in the upper stream, and there is no stream management plan. Most efforts have been spearheaded by local municipalities. In the wake of the 2005 flood, the towns of the lower Esopus and the city of Kingston began holding an annual Esopus Creek Lower Basin Watershed Conference. One of its chief concerns was the effects of that flood on the region, where it took some farmers several months to recover from its effects.

The town of Marbletown, first along the stream's course below the Esopus, was where much of the farmland affected by the flood was located. Silt and other eroded materials pile up on the land and must be removed, and some of the farmland was lost permanently. Marbletown has planned to work with its farmers to acquire development rights to at least 750 acres (300 ha) outside the creek's flood plain, which cannot be developed, and further protect the rare plant and animal communities along the creek in addition to minimizing the effect of any future floods.

Flooding concerns in the lower Esopus have also led to criticism of the DEP for maintaining the reservoir at capacity levels that may be higher than necessary, requiring releases during periods of heavy rain that aggravate flooding during periods of heavy rain. In 2010 the city began implementing new computer software that more closely monitors water levels in all its reservoirs as well as data that allows it to estimate near term water availability. Local officials, particularly State Senator John Bonacic, praised the move but said they would keep working for DEP to be more conscious of its impact on downstream property owners.

Further downstream, in the Saugerties area, conservation efforts have been led by the Esopus Creek Conservancy, a non-profit organization that works to conserve the landscapes and ecosystems around the creek. It was created in 1999 from a local citizen's efforts to protect a section of creekside property from development. Five years later, with the help of the Catskill Center for Conservation and Development, the land was purchased and the conservancy formed. It is now the 161-acre (65 ha) Esopus Bend Nature Preserve, just outside the village of Saugerties, that protects a long stretch of crucial habitat along the south shore of the creek. Trails within it lead to views over the creek to the Catskill Escarpment beyond.