# B. Physical Stream and Valley Characteristics

## 1. Geology

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Rock formation at Crystal Falls. Photo taken by Derrick Kelly, WAC, courtesy of Archie Dean.

# B. Physical Stream and Valley Characteristics

## 1. Geology

### a. Introduction

In a landscape that has not been changed by human activities, the streams of a region reflect the climate, geology, and biology of that region. For instance we know that the Catskill High Peak region has higher rain/snowfall amounts than the western and northern Catskills, and as a result, for a given watershed drainage area, streams are generally larger in the High Peaks than elsewhere in the Catskills (Miller and Davis, 2002). Likewise, the large amount of forest cover in the Catskills affects the amount of rain and snowfall that will run off the landscape to become streamflow, and therefore the shape and size (morphology) of stream channel required to handle the runoff. Similarly, the geology of the Catskill Mountains exerts a clear influence on the landscape and stream valley and channel morphology. This section describes the basic geology of Chestnut Creek watershed.

### b. Physiography

The Catskill Mountains are a dissected plateau of mostly flat-lying sedimentary rocks cut into by streams and ice flow over millions of years. The mountains are at the northeastern extreme of the Alleghany Plateau, a physiographic province (a land area with fairly uniform physical characteristics) that extends from Tennessee along the western border of the Appalachians (Rich, 1935).

There are many descriptions of the boundaries of the Catskills (Rich, 1935; Thaler, 1996; Isachson et al, 2000). A useful definition is Rich's description of the escarpments that comprise this mountainous region: Northeastern Escarpment (Blackhead Range); Eastern Escarpment (Wall of Manitou); the Central Escarpment (Indian Head to Utsayantha); and the Southern Escarpment (Slide Mountain to Ashokan High Point) (Figure 1). Chestnut Creek is located at the western end of the Southern Escarpment.

### c. Chestnut Creek Geology

Two episodes in the geologic history of New York are represented by the landscape and rocks in Chestnut Creek watershed. Unconsolidated sediments are mostly remnants of Pleistocene glaciation, during which an ice sheet covered this region until about 12,000 years ago. Bedrock in the region represents an earlier stretch of geologic history, the Devonian period about 370 million years ago, during which huge amounts of sediment were being deposited by ancient rivers in this region from uplifting mountains to the east.

Unconsolidated Sediments

Much of Chestnut Creek watershed is covered with a layer of unconsolidated sediment. These deposits are mostly glacial sediments. There are basically two primary kinds of glacial sediment in Chestnut Creek watershed: glacial till and stratified "drift". Glacial till ("t" on the surficial geology map, Figure 2) is the material that is deposited either at the base of the glacier or along glacier margins. Glacial till is typically an unsorted assemblage of sediment that can range in

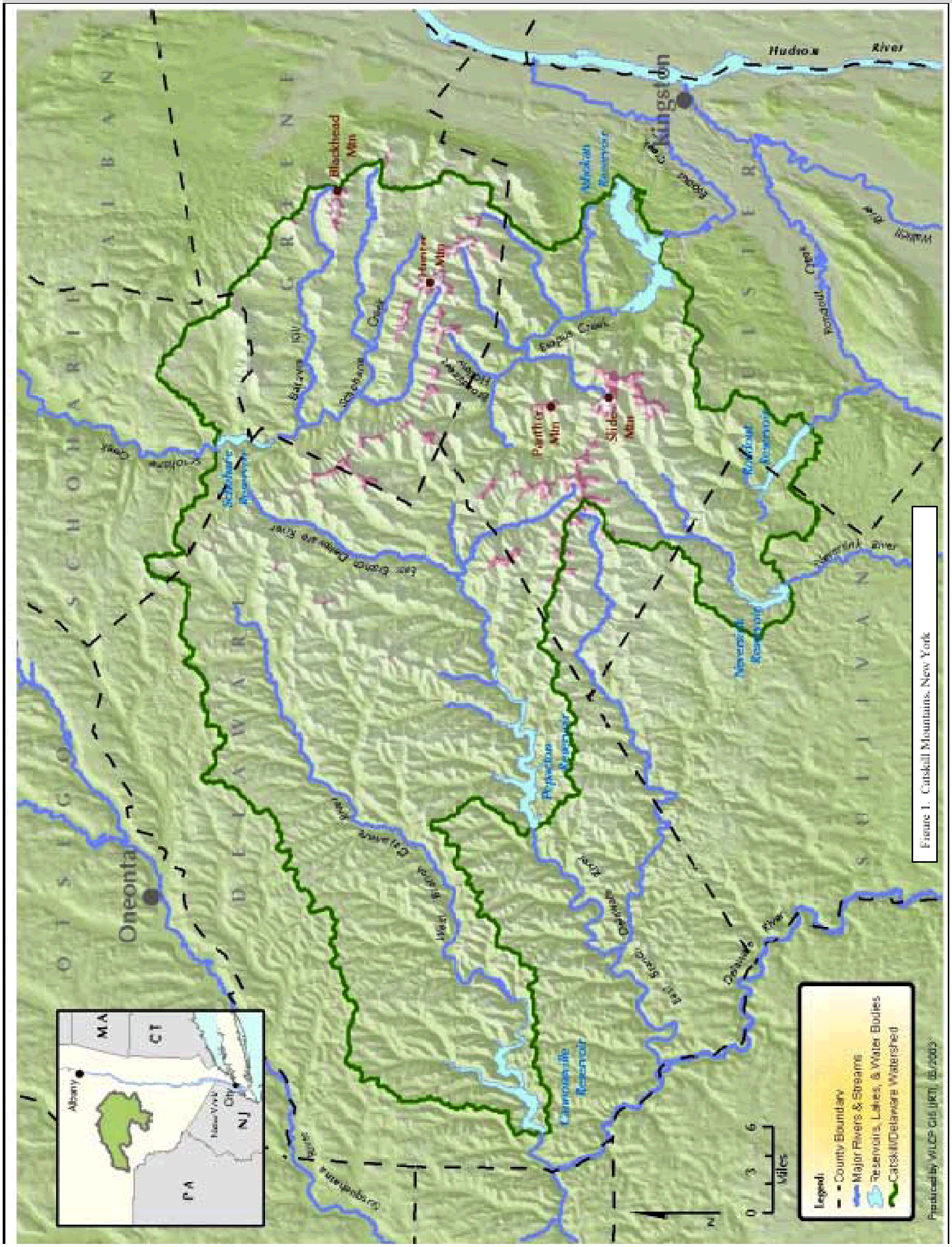



Figure 1. Catskill Mountains, N.Y.

size from clay to boulders. This material can be very compact, almost rock-like in its consolidation. This is often referred to as lodgement till, as it is "lodged" into place at the base of flowing ice. Till can also be a loose assemblage of material that is formed along ice margins, or melts out of the base of the ice. A lot of the valley walls are covered by weathered and partly eroded bouldery glacial till. Till also is deposited as a veneer of compacted sediment across the valley floors. There are several reaches of Chestnut Creek that are thick with boulders where the stream has incised into bouldery till, see Figure 2.

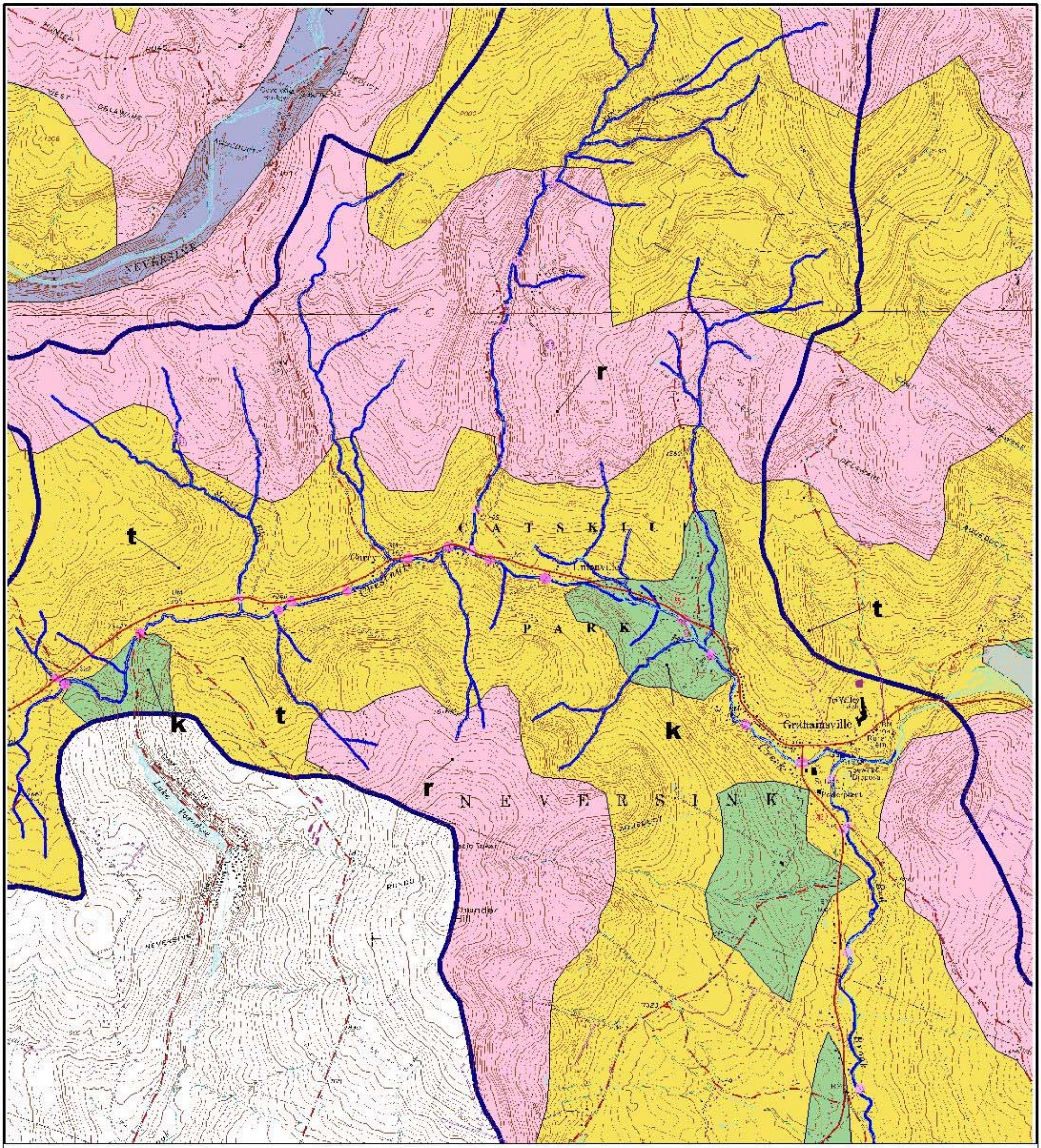
When glacier ice stagnated and melted in place, vast amounts of meltwater transported and reworked till into "stratified drift" deposits comprising layers of silt, sand, gravel and cobble. These deposits are present in glacial outwash (old meltwater stream deposits) , kames and kame terraces, deltas into glacial lakes, and glacial lake deposits. According to the NYS surficial geology map (Cadwell, 1986) Chestnut Creek's glacial deposits are principally till and kame-type deposits. In some of the mapped kame deposits (k) there are extensive layers of sand, which are locally mined.

There are also older river sediments (gravel and cobble layers) that were deposited in meltwater streams that eventually became the Chestnut Creek. According to mapped glacial geology there are no silt-clay glacial lake deposits as are often found in the Esopus and Schoharie Creek watersheds. Along the course of Chestnut Creek, the stream has incised into these ancestral river and glacial deposits which comprise the streambank and streambed material.

Bedrock

Bedrock exposed in the Chestnut Creek watershed, (in hillsides, along the creek bed and in road cuts) is Upper Devonian in age, which means it was deposited around 360-374 million years ago. Most of the exposed rocks are in the Walton Formation ("r" on the surficial map, Dsw and Dww on the bedrock map), which is composed of alternating layers of sandstone, shale, mudstones and, at higher elevations, conglomerate. These rocks were all formed by deposition from moving water (rivers and streams), but they differ in the size of particles within them. Conglomerates have particles that are typically sand to gravel size, sandstones have sand-sized particles, and shales and mudstones have silt/clay-sized particles. Particle size is an indication of the energy of moving water; bigger particles indicate higher energy which carries away finer sediments leaving courser deposits behind. That means conglomerates formed from fast moving river sediments while shales and mudstones formed from floodplain or basin deposits.

Rock typically exposed in the Chestnut Creek channel are inter-bedded sandstones and shales/mudstones. More resistant sandstone layers tend to form steeper, bedrock-controlled sections with minor falls and cascades, while less erosion resistant shales and mudstones tend to form lower-gradient plane bed reaches of the stream.

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**Surficial Geology**
**Chestnut Creek Watershed**
**Neversink Valley, NY**

1:40,000

2000 0 2000 4000 Feet

**Legend**

Surficial Geology Boundaries

- k - Kame deposits
- r - Bedrock
- t - Till

Streams

Chestnut Creek Watershed Boundary

* See Disclaimer

**References**

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