N

1500

STATE OF NEW YORK

501

1400

rip-rap

Top of Reference Reach

rip-rap

1400

STATE OF NEW YORK

1500

Mgt. Unit 1/ top 2

log cribwall

GIS Parcel, Contour and Wetland coverages are edited and provided by NYC DEP, 2000, UTM NAD 27, Zone 18 North, meters. Aerial Photography provided by UCSWCD & NYC DEP November 2001. All other coverages were developed using GPS in the UTM, Zone 18 North projection, NADCON (Conus), datum. GPS data collected 2001, by UCSWCD & NYC DEP SMP.

Note: G.I.S. data are approximate according to their scale and resolution. Data may be subject to error and are not a substitute for on-site inspection or survey. Parcel coverages are based on Ulster County Real Property tax maps 2000 and may not reflect actual surveyed property boundaries.

Broadstreet Hollow Management Unit 1

Contour Interval 20 feet

50 0 50 100 150 200 Feet

Scale 1:2,400

LEGEND

- 247 Street Address / 911 code
- Greene parcels
- Ulster parcels
- Land fills
- Managment units
- Stream Center (Thalweg)
- Top of Reference reach
- Wetland
- Clay exposure
- Revetment
- Eroding bank
- Tributary
- Behi pin
- Bridge
- Culvert
- Broadstreet Hollow Road
- Knotweed

Broadstreet Hollow Management Unit 1

General Description:

This unit is approximately 2,420 feet long, beginning at the upper end of Broadstreet Hollow Road, approximately 100 feet into New York State Department of Environmental Conservation (NYS DEC) land (Photo 1). This unit is in good condition (relatively *stable*), with some stream bank alteration along the roadside, and no development (houses or other structures) between the road and the stream.

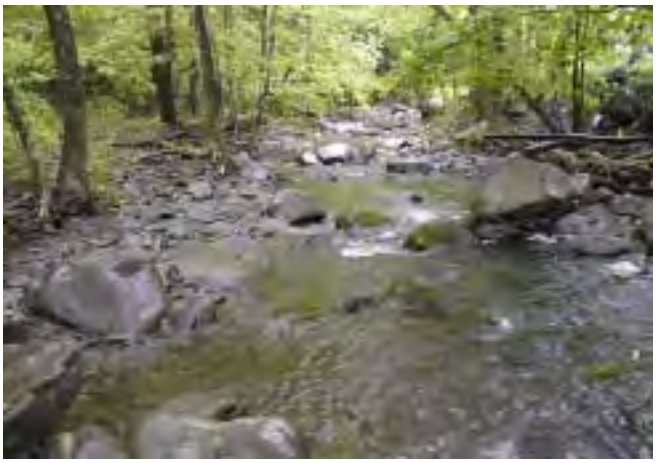

Photo 1. Looking downstream from the top of MU1.

The structural shape, or *morphology*, of the stream (i.e., slope, width and depth) changes frequently in this unit, creating smaller sections, or *reaches*, that have a discrete morphologic character, or *stream type*[5]. The valley in MU1 is particularly narrow throughout. Typically stable stream types associated with this type of valley are relatively narrow and steep, with small waterfalls ("steps"), and stream banks formed into low benches, or *discontinuous floodplains*. MU1 lacks these discontinuous floodplains on the banks near the road.

Approximately 1,500 feet of the downstream half of MU1 represents a naturally stable "*reference*" reach that was intensively surveyed in 1998, and resurveyed in 2000[1]. Detailed morphologic information from this stable reach was used as a blueprint for a *stream restoration design*, implemented in 2002, in an *unstable* downstream section of the Broadstreet Hollow (see MU3)[8].

I. Flooding and Erosion Threats

A. Infrastructure and Private Property

There are seven properties (land parcels) that contain or are bounded by the stream in MU1[1&2]. There are three structures in MU1, with three separate owners. These structures are on the opposite side of the road from the stream.

Broadstreet Hollow Road has a packed dirt surface for the length of MU1. Stream assessment data for 2001 show the centerline of Broadstreet Hollow Road ranges from approximately 15 to140 feet from the stream (measured from the *thalweg*, or the deepest part of the stream). Some areas of the stream banks closest to the road have been *rip-rapped* with large boulders, to maintain the roadside fill, or *embankment*. The presence of rip-rap in this area suggests some historic impact on the road resulting from stream bank *erosion*. However, there was little evidence of recent or ongoing erosion threats.

B. History of Stream Work

Approximately 640 feet, or 13%, of the stream bank in MU1 has been stabilized using rip-rap along the stream bank. This rip-rap occurs in two large sections (see MU1 Map).

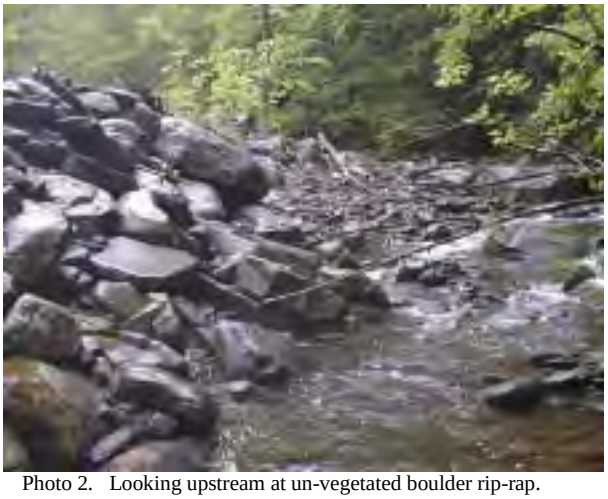

Photo 2. Looking upstream at un-vegetated boulder rip-rap.

Upper Rip-rap Section:

The upper rip-rap section, extending just downstream of DEC land along the right bank of the stream (looking downstream), is older (actual age unknown), primarily un-vegetated, and consists of large boulders, either *non-quarried natural boulders* from outside the stream, or local, or *native*, material from the stream channel itself (Photo 2) [3&7].

The road is approximately 25 to 50 feet from the stream in this section. The embankment is gently graded, which reduces the potential for future erosion. Though the stream in this section has a fairly steep slope, 3% to 3.5%, it appears to have reached relative *equilibrium*, or stability, with no apparent active stream bank or bed erosion. There are no *culverts* in this section to drain roadside ditches or *tributaries* (smaller streams entering the main stream).

Lower Rip-rap Section:

The lower section runs along the right bank, the length of a long straight reach in the middle of MU1. This section has

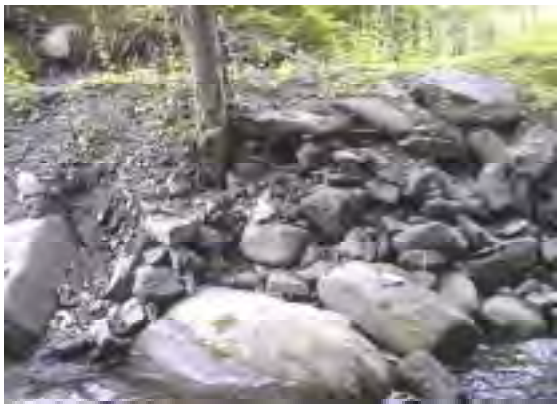

Photo 3. Culvert in lower rip-rap section, right bank, MU1.

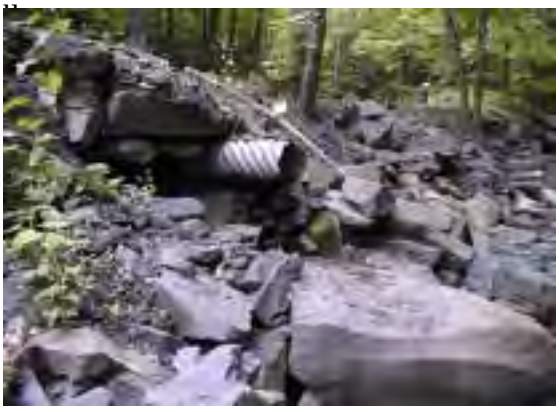

Photo 4. Culvert in lower rip-rap section, right bank, MU1.

no recent stream bank work and continues to experience stream instability and stream bank erosion (Photos 3 and 4). Rip-rap in

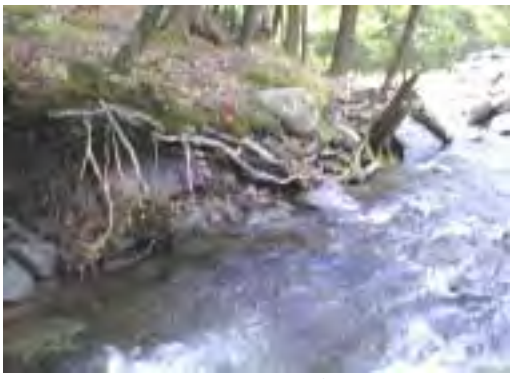

Photo 5. Minor bank erosion, across from lower rip-rap section, MU1.

this area is constructed of mixed sizes of dumped rock fill, primarily of quarried material, and no material from the stream channel.

This rip-rapped section appears to represent the greatest potential for stream instability in MU1. The angle of the stream bank is steep, there is very little vegetation to hold bank materials in place, and both the stream and the valley are particularly narrow and steep. This section of stream is primarily comprised of *entrenched* stream types (i.e., no discontinuous floodplain benches and close valley walls), some with greater than 5% slope. There is a small reach of especially narrow and highly entrenched stream type with approximately 2.5% local slope. This narrow reach has some bank erosion on the left bank (see Photo 5 and discussion below), opposite the rip-rap, and two culverts entering the stream channel well above the stream bed (see Photos 3 and 4, and discussion below).[3]

This section of stream is the most sensitive to ongoing erosion and needed stream work in MU1. In addition, there is a potential for instability in this reach to cause instability upstream or downstream from this section.

An exaggerated and potentially unstable stream "step", or *head-cut*, is present just upstream of this narrow reach, near the bottom of the joining, or *convergence*, of a split channel. The head-cut in the split channel above the lower rip-rapped section is likely to continue to migrate upstream, especially with the increase in stream erosive power in floods due to the confinement of the stream here.

However, the stream does not run directly adjacent to the road in the section above, so the road is not under imminent threat at this time. This section should be visually inspected yearly.

<u>MU1 Culverts</u>

Seven culverts were found in MU1 during the *stream assessment survey* conducted in 2001. Four of them had flowing water in them at the time of the survey, during the lowest yearly flow, or *summer base-flow*, condition. This indicates some groundwater supply and shows the stream is spring fed year round, even during drought conditions in 2001. Culvert flow under flooding conditions was not documented.

The two culverts in MU1 in the lower rip-rapped section (see Photos 3 and 4, above) currently enter the stream from a steep angle. Hence, the water falling into the stream has greater erosive potential as it falls and hits the stream bank below. In addition, the water runs over a distance of bare rock before entering the stream, potentially heating the water and increasing stream temperature[3]. Where possible, the outlets to these culverts should be reconfigured to allow water to directly enter the stream, at a low angle to minimize

erosion, or splash rocks, possibly with vegetation, installed or adjusted to dissipate the energy of the falling water.

Adding woody vegetation (trees, shrubs) at and opposite culvert outlets, with a mixture of native riparian species, can improve shade and cover conditions for aquatic habitat, as well as reducing water heating. This can also improve bank stability and reduce the need for bank stabilization work that potentially causes stream ecosystem disturbances[7].

C. Exposed banks

Stream assessment conducted in 2001 did not reveal any significant eroding or exposed banks that currently warrant intensive stabilization or monitoring. Two areas of minor bank erosion were noted[1] but do not currently threaten the road or any other structures (Photos 5 and 6). Road fill at the turnaround area at the top of Broadstreet Hollow Road is eroding (see Photo 5) but does not appear to impact the parking area, or stream reach stability in this area.

Minor bank erosion at the left bank across from the lower section of rip-rap, with the road and two culverts opposite, does not threaten any structures or the road, though this section may represent a potential future risk to stream stability and clearly indicates an imbalance in this reach (see Photo 6) [3&8].

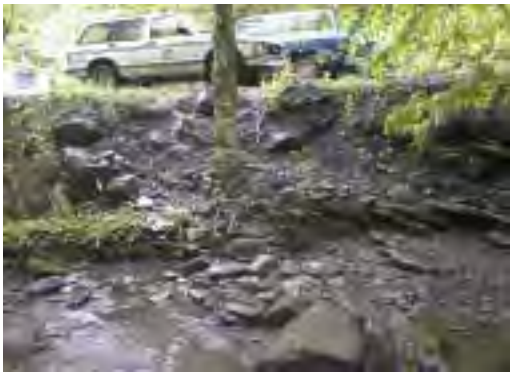

Photo 6. Minor bank erosion, NYSDEC turnout, MU1.

II. Water Quality

A. Sediment

The stream assessment conducted in 2001 did not reveal any significant areas of bank erosion or *clay exposures* in MU1 that could contribute to water quality impairment from clay and silt, or *sediment*, sources.

B. Landfills/Dumping sites

The stream assessment conducted in 2001 did not reveal any current *dumping sites* in or near the stream in MU1 that could contribute to water quality impairment from leaching of toxic materials.

C. Other Water Quality Issues

Investigation of other possible sources of contamination was not part of the stream assessment conducted in 2001. However, no obvious evidence was found for nutrient or pathogen contamination in the stream (i.e., odors or discolored water). Any runoff of water from the road and culverts that may contain salts or other

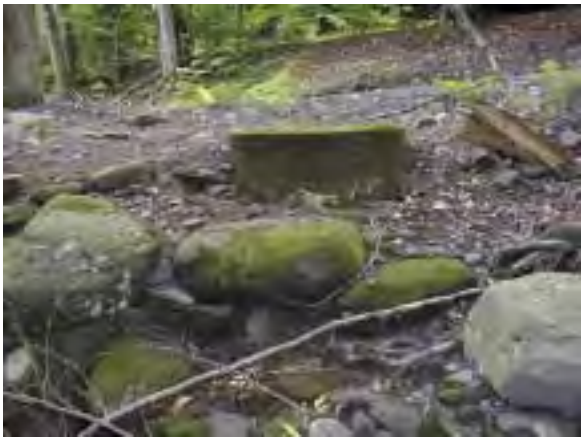

Photo 7. Shallow water supply well, right bank, MU1.

pollutants was not specifically investigated, but the lack of a vegetated area alongside the stream, the *riparian area*, especially in the two rip-rapped areas could reduce the capacity of the stream banks to assimilate, or slow the input of contaminants to the stream[7].

One shallow-water well was noted during the stream assessment survey conducted in 2001 that serves a property on the opposite side of the road from the stream (Photo 7). This type of well, typically less than ten feet deep, could be subject to road runoff and suspended sediments.

III. Stream Ecology

A. Aquatic habitat and populations

Fish and aquatic insect population data have been gathered within the stable reference reach since 1998[6]. These data show this section of stream supports populations of all three common trout species (rainbow, brook and brown) as well as a healthy and diverse community of aquatic insects[9].

B. Riparian Vegetation

The stream assessment conducted in 2001 did not investigate specific streamside (riparian) plant species or density, other than to note areas of insufficient or stressed vegetation that could affect stream stability, flooding or erosion threats, water quality or aquatic habitat for trout species. Based on these general, non-quantitative observations, riparian vegetation throughout MU1 appears healthy and dense overall, excepting locations where the road is in close proximity to the stream and banks are rip-rapped.

These sections of stream do not benefit from the protection that riparian vegetation provides to streams, including increased bank stability from plant roots. In addition, bare banks and un-vegetated rip-rapped areas store heat from the sun, and can increase stream temperature by contact with stream flow and rain runoff do not afford any shading to the stream and cause heating via the sun. Elevated aquatic temperatures may adversely affect water quality and stream ecology. Un-vegetated sections in this reach should be vegetated with a mixture of native riparian species to improve shade and cover conditions for aquatic habitat, as well as to improve bank stability and reduce the need for bank stabilization work that potentially causes stream ecosystem disturbances[7].

No *Japanese Knotweed*, a non-native, *invasive* plant was noted in this reach at the time of the assessment survey[7].

[1]Broadstreet Hollow Management Unit 1 Map
[2] Volume II Appendix 3.1.5 Management Unit 1 Workbook.
[3] Volume II Section 2.2 Watershed Management Recommendations
[4] Volume II Section 2.2.1-Monitoring Cross Section and Summary Tables
[5] Volume I Sections 3.2.1&2 Stream Processes, Morphology and Classification
[6] Volume I Section 3.5 Fisheries and Wildlife
[7] Volume I Sections 3.4 & Volume II 2.2.2 Riparian Vegetation Issues and Recommendations
[8] Volume II 2.0 Stream Stability Restoration Projects, Techniques and Contact Information & Appendices
[9] Volume I Sections 3.4 & Volume II 2.2.2 Riparian Vegetation Issues and Recommendations
[10] Section 3.2.4.2 Broadstreet Hollow Geology