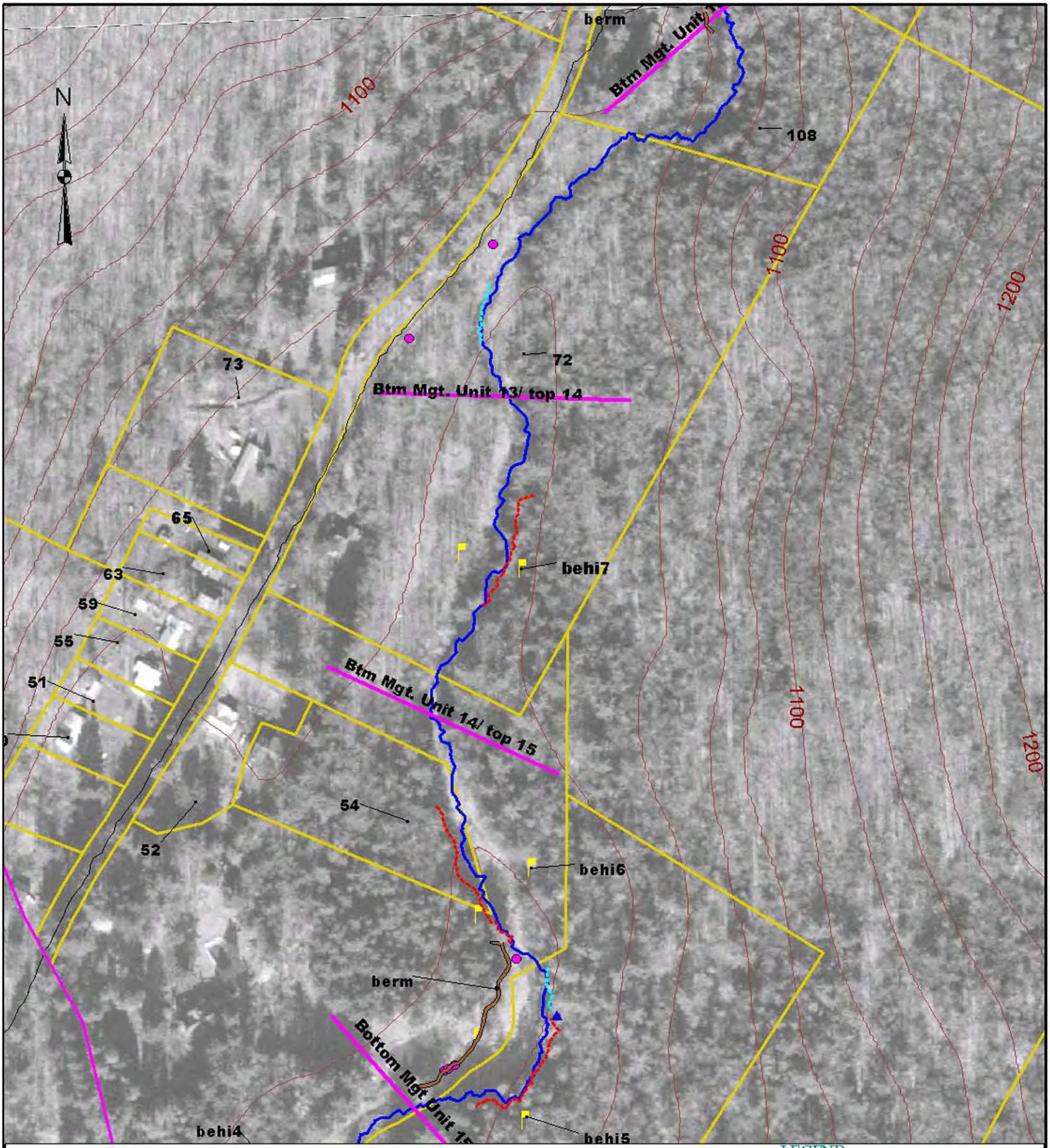

GIS Parcel, Contour and Wetland coverages are edited and provided by NYC DEP, 2000, UTM NAD 27, Zone 18 North, meters. Aerial Photography provided by UCSWCD & NYC DEP November 2001. All other coverages were developed using GPS in the UTM, Zone 18 North projection, NAD CON (Conus), datum. GPS data collected 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 14

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)

Culvert

Wetland

Clay exposure

Revetment

Eroding bank

Tributary

Behi pin

Bridge

Broadstreet Hollow Road

Knotweed

Broadstreet Hollow Management Unit 14

General Description:

Management Unit 14 (MU14) is located in Ulster County, NY, the top beginning just below the split channel, or *braided*, section of the Broadstreet Hollow, extending approximately 520 feet downstream (Photo 1). This unit can't be seen from Broadstreet Hollow Road[1&2].

Photo 1. Looking upstream, near the downstream end of MU14.

The structural shape, or *morphology*, of the stream (i.e., slope, width and depth) is uniform in this unit, having a distinct character, or *stream type*[5]. This uniform section, or reach, is typical of a fairly healthy, or *stable*, stream in this type of valley. Though the valley isn't narrow through MU14, the stream runs against the valley wall on the left (looking downstream) opposite the road, and has cut into its bed enough that the wide flat area between the road and the stream that used to be the floodplain is now a *terrace*, functioning as a floodplain only at during very high flows (Photo 2). The result is that the stream maintains an *entrenched* stream shape, though can sustain a primarily stable bed form.

Photo 2. Right bank, showing development of low floodplain bench area inside the larger stream channel, with forested old floodplain terrace above. Stream flow is from right to left.

Typically stable stream types associated with this type of valley are relatively narrow and fairly steep, primarily with *riffles* and *pools* interspersed with some small waterfalls ("steps"). Important features of these streams include banks formed into low benches, or *discontinuous floodplains*, that function as small overflow areas during floods. These features are particularly important in the absence of long expanses of floodplain area (as is now the terrace area in MU14). MU14 has developed some of these discontinuous floodplains along both banks, as well as some vegetated gravel bar areas within its entrenched channel, that perform critical floodplain functions (Photo 3)[5].

Photo 3. Looking downstream from the top of MU14, showing vegetated gravel bar to the right, with healthy riparian forest.

Floodplains function to reduce flood velocity, increase absorption of floodwaters, encourage deposition of silt and fine sediments (keeping them from being washed further downstream) and decrease flood stage in downstream areas. The majority of Broadstreet Hollow floodplains consist of small, low, discontinuous floodplain benches that perform the important floodplain functions in small mountain streams.

I. Flooding and Erosion Threats

A. Infrastructure and Private Property

The stream in MU14 runs through two properties (land parcels) with two different owners. Most of MU14 is contained within these two properties.

The centerline of Broadstreet Hollow Road ranges from 180 to 210 feet in distance from the deepest part of the stream, or *thalweg*[2]. There are no bridges crossing the stream in this unit, and no road fill, or embankment, areas. Additionally, stream assessment in 2001 did not document any culverts draining to this unit, though there could be culvert drainage along the road to the terrace away from the stream – assessment did not extend to the road in Management Units that are farther than approximately 150 feet from the stream throughout their length, assuming impacts to stream morphology or water quality would be minimal from individual culvert drainage at that distance.

B. History of Stream Work

There is no evidence of historic stream bank work in MU14, except a few cut tree stumps, and no development on either bank that would indicate past management.

C. Exposed Banks

Stream assessment in 2001 documented approximately 210 feet, or 20% of the stream bank length in MU14, in a single eroding bank area with a significant exposure of highly erodible *glacial lake clay* (Photo 4). This clay forms a layer, over which the riparian forest is sliding into the stream in large flat sections (almost like a sled), with large cracks, or failure scarps, visible behind them parallel to the stream (Photo 5).

Photo 4. Eroding bank with unvegetated, glacial lake clay exposure sloping up from the stream bed, densely forested hillside on a "shelf" above, held together by a dense mat of tree roots. Stream flow is from left to right.

The stream continues to erode between the clay layer and the top layer of soil held together by forest tree roots, causing the slope to continue to migrate slowly streamward. Trees on the stream bank show a classic “pistol butt” curved shape, indicating the slope has been moving downward toward the stream very slowly, and the trees have been continuously readjusting to grow upward for many years (Photo 6).

The density of the riparian forest, and relative health and vigor of the trees, provides substantial stability to this bank, holding material in place long after stream and hillslope processes should have washed it away. The undercut bank visible in this section is five feet deep at its farthest, with this shelf of land still supporting, and being supported by, the large trees on the surface.

Photo 5. Left bank, upstream from area in Photo 4. Note trees leaning toward the stream, a long crack in the hillside behind them, parallel to the stream, demonstrating the downslope streamward motion of large sections of the hillside, held together by tree roots. Stream flow is from left to right.

Photo 6. Left bank, downstream from area in Photo 4, showing trees on a large section of hillside migrating streamward, with "pistol butt" shape of tree trunks demonstrating slow, continuous downslope movement. Stream flow is from left to right.

A representative location was chosen and permanently marked with metal rebar, or *monumented*, for future monitoring (designated as "monitoring cross-section 7") to determine erosion rates and priority for potential restoration (see Photo 7, orange flagging on bank marks cross-section location) [3]. This site has been assessed and ranked based on calculation of a *Bank Erodibility Hazard Index* (BEHI) using data collected at the time of the stream assessment survey in 2001[4].

Photo 7. Close-up of eroding left bank, showing deep undercut forming a "shelf" held together by dense tree roots. The shelf is up to five feet deep, straight back into the bank. Note reddish clay exposure above the stream cobbles. Stream flow is from left to right.

This bank received a BEHI rank of "high" potential for further erosion, though the greatest threat from this bank is to water quality from the clay (see discussion below). No structures or other development are currently threatened by erosion at this site.

II. Water Quality

A. Sediment

Stream assessment conducted in 2001 showed the eroding bank at monitoring cross-section 7 contains a significant bank and stream bed exposure of glacial lake clay, which comprises the length of this 210-foot bank, or 20% of the total bank length in MU14 (see Photos 4 – 7 above). This clay exposure may cause increased *turbidity*

in this reach and downstream from fine *sediment* (silt and clay) coming from stream bank and bed material, especially during high flow events[4]. Bare clay material does not support vegetation readily[7], and consistent disturbance from high flows impinging on the bank prevent soil formation on exposed clay at the surface.

B. Landfills/Dumping Sites

The stream assessment conducted in 2001 did not reveal any current dumping sites in or near the stream in MU9 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 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 pollutants was not specifically investigated. However, the long distance from the road, and the density and health of the riparian vegetation, definitely provides some protection from such runoff [7](Photo 8).

Photo 8. Densely wooded right bank terrace, showing a higher terrace with a house in the background. Broadstreet Hollow Road is on the higher terrace, about 200 feet from the stream. Stream flow is from right to left.

III. Stream Ecology

A. Aquatic Habitat and Populations

No specific aquatic habitat or population monitoring was conducted in MU14 as a part of the stream assessment in 2001. However, fishery and aquatic insect population data have been gathered yearly since 1998 within the stable reference reach (MU1), the project site (MU3), and the control reach (MU17).

These data show the Broadstreet Hollow self-supports, without stocking, populations of all three common trout species (rainbow, brook and brown) as well as a healthy and diverse community of aquatic insects[9]. The impact that stream bed and bank instability in this unit, particularly the eroding clay bank area at monitoring cross-section 7, has on these aquatic organisms or their communities is unknown. Undercut banks along this section, however, may actually provide valuable cover and shade to the stream.

B. Riparian Vegetation

Stream assessment conducted in 2001 did not investigate specific streamside (riparian) plant species or density condition, 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 observations, riparian vegetation

throughout MU14 appears to be in good condition along both banks, sufficient to provide the full benefits of a healthy riparian zone [7] (Photo 9).

No *Japanese Knotweed* [7], a non-native, *invasive* plant, was noted in this unit at the time of the assessment survey. Source populations of this plant have been documented upstream, increasing the potential for colonization of any disturbed or under-vegetated areas in MU14 such as the bare bank areas associated with monitoring cross-section 7, though open disturbed areas, with less shade, are generally preferred by Knotweed.

Photo 9. Looking upstream near the middle of MU14, showing dense, healthy riparian forest on both banks.

[1]Broadstreet Hollow Management Unit 14 Map
[2] Volume II Appendix 3.1.5 Management Unit 14 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