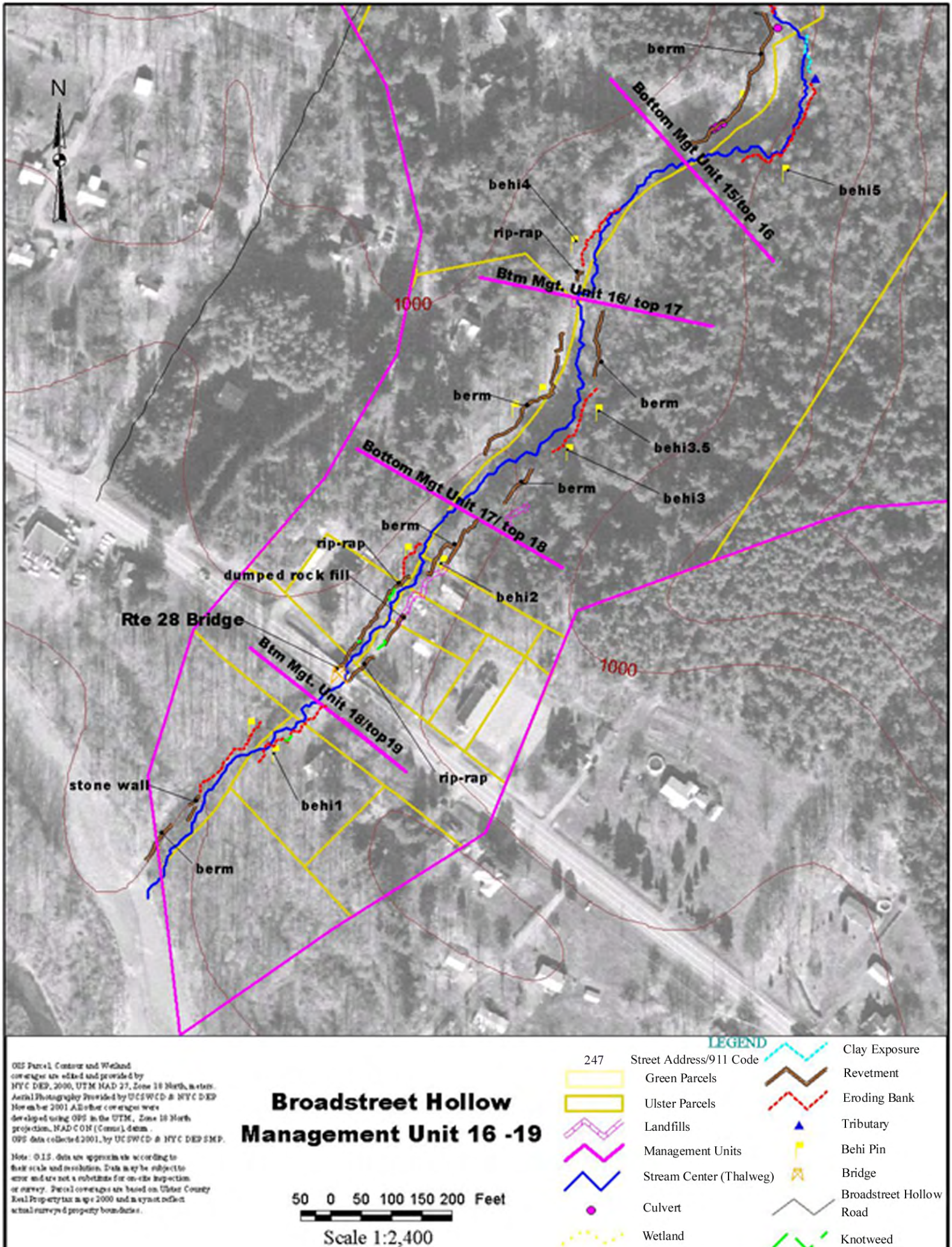
N
berm
Bottom Mgt Unit 15/top 16
behi5
behi4
rip-rap
Btm Mgt. Unit 16/ top 17
1000
berm
berm
behi3.5
Bottom Mgt Unit 17/ top 18
berm
behi3
berm
rip-rap
dumped rock fill
behi2
Rte 28 Bridge
Btm Mgt. Unit 18/top19
1000
rip-rap
stone wall
behi1
berm
GIS Parcel Contour and Wetland coverages are edited and provided by NYC DEP, 2000, UTM NAD 27, Zone 18 North, in feet. 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 16 -19
50 0 50 100 150 200 Feet
Scale 1:2,400
LEGEND
247 Street Address/911 Code
Green Parcels
Ulster Parcels
Landfills
Management Units
Stream Center (Thalweg)
Culvert
Wetland
Clay Exposure
Revetment
Eroding Bank
Tributary
Behi Pin
Bridge
Broadstreet Hollow Road
Knotweed

Broadstreet Hollow Management Unit 19

General Description:

Management Unit 19 (MU19) is the last management unit before the confluence, or joining, of the Broadstreet Hollow with the Esopus Creek (Photo 1). MU19 extends approximately 463 feet downstream from the Route 28 Bridge to the mouth of the Broadstreet Hollow[1&2].

Photo 1. Looking downstream at the bottom of MU19, into the confluence of the Broadstreet Hollow with the Esopus Creek (flowing right to left).

The structural shape, or *morphology*, of the stream (i.e., slope, width and depth) is uniform in this unit, comprising one large section, or *reach*, with distinct structural character, or *stream type*[5]. The broad, flat valley, an overflow area, or *floodplain*, for the Esopus Creek, influences and characterizes stream shape for MU19 (Photo 2). This is a unique setting in the Broadstreet Hollow, but is typical for small side streams, or headwater *tributaries*, to large valley bottom streams like the Esopus Creek. Typically stable stream types associated with this type of valley are relatively wide, and not very steep, with riffles and pools, and broad, flat *floodplain* areas in addition to some stream banks formed into low benches, or *discontinuous floodplains*, that function as overflow areas during floods and provide areas for healthy streamside, or *riparian*, vegetation (Photo 3). Less steep valleys with more floodplain contain more space in which streams can evolve to maintain good condition, or *stability* [5&7]. Floodplain benches and broader floodplain areas are often maintained inside a larger channel flanked by the floodplain of the larger stream, as a *terrace* for the tributary, which functions as a floodplain for the tributary only at higher flows[5].

Photo 2. Looking upstream into the top of MU19, showing wide stream shape, with broad flat valley areas on both banks. Route 28 bridge is visible, marking the bottom of MU18.

Though this should be a setting in which the stream should be able to sustain a stable morphology, this section does have some erosion and some development activities that reduce stream stability.

Photo 3. Looking upstream from the bottom of MU19 at the confluence with Esopus Creek. Note healthy riparian vegetation on both banks, with some floodplain bench features visible to the left.

I. Flooding and Erosion Threats

A. Infrastructure and Private Property

The course of the Broadstreet Hollow stream forms a boundary for three privately owned properties (land parcels) associated with MU19 (not including the New York State right of

way for maintenance of NYS Route 28 and the bridge that crosses the stream at the bottom of MU18). All of these properties are within the 100-year flood boundary of the Esopus Creek, according to FEMA Floodplain Maps from 1985. There is one home within 150 feet of the stream, on the left bank terrace (looking downstream) within the Esopus Creek 100-year floodplain. There are no bridges or culverts draining to MU19[1&2].

B. History of Stream Work

Approximately 130 feet of the stream bank in MU19 have been altered from their natural condition, in three individual sections on the right bank (looking downstream) near the bottom of the unit.

A privately maintained pond has been constructed in the Esopus floodplain, just off the Broadstreet Hollow stream, with two small rock walls and a 73-foot section of mounded earth material, or *berm*, to protect the pond inlet (Photo 4). Though bermed areas typically constrict the stream, causing entrenchment and reducing floodplain functions, the short length of this berm, and the floodplain access maintained on the opposite bank reduce potential impacts from the berm structure alone. However, stream confluence areas are unstable by nature's design, as the tributary stream delivers sediment and flood pulses to the main stream, and the interaction of floods on the main stream cause added stress and sometimes unpredictable impacts to the stream bed and banks of the tributary stream[3&5].

Photo 4. Hand laid stone walls at the pond inlet, pond is behind the walls. Note the angled structure of the wall, which mimics the natural stable structure of stream laid stones (as a fish scale pattern, called "imbrication"). Stream flow is from right to left.

C. Exposed Banks

Stream assessment conducted in 2001 revealed approximately 350 feet (40%) of the stream bank in MU18 is actively eroding, in two sections on opposite sides of the stream near the top of the unit (Photos 5 and 6). A representative location was chosen and permanently marked, or *monumented*, for future monitoring (designated as "monitoring cross-section 1) to determine erosion rate and priority for potential restoration[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

Photo 5. Eroding left bank at residential lawn area, monitoring cross-section 1. Stream flow is from left to right.

assessment survey in 2001[4]. This site received a BEHI ranking of "moderate" for potential for further erosion.

The left bank appears to be eroding primarily due to a lack of deeply rooted riparian vegetation, despite a few large trees set back from the face of the bank. Erosion on the right bank opposite is not as severe, and really represents an extended undercut bank, held in place by a more dense network of various sized riparian tree roots, and probably adds to aquatic habitat quality in this area[9].

Photo 6. Mildly eroding left bank at forested terrace (Esopus Creek floodplain), monitoring cross-section 1. Stream flow is from right to left.

II. Water Quality

A. Sediment

The eroding left bank in MU19 may contribute to increased turbidity from fine sediment sources from stream bank and bed material, especially during high flows. The amount of sediment available from the right bank is probably not significant, due to the mitigating influence of the riparian vegetation[5].

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 Route 28 that may contain salts or other pollutants was not specifically investigated, but heavy salt usage and traffic and the close proximity of the road and bridge to the stream could result in higher pollutant loadings and a reduced capacity for riparian areas to absorb or slow the input of contaminants to the stream.

III. Stream Ecology

A. Aquatic habitat and populations

No specific aquatic habitat or population monitoring was conducted in MU15 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)[6].

These data show that 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 has on these aquatic organisms or their communities is unknown in this unit, particularly the eroding right bank area with inadequate riparian vegetation at monitoring cross-section 1. Undercut banks along the opposite bank at monitoring cross-section 1, however, may actually provide valuable cover and shade to the stream, though this was not assessed as part of the stream assessment in 2001.

If there are barriers to passage of trout migrating up headwater tributaries during high water flows in the spring, these are often removed by hand where possible. Trout Unlimited chapter members seasonally open the mouths of tributaries to the Esopus Creek, including the Broadstreet Hollow, to ensure trout have clear access to their headwater spawning areas.

B. Riparian Vegetation

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, qualitative observations, riparian vegetation in MU19 appears to be generally sufficient to provide the benefits of a healthy riparian area, except in the eroding left bank section at the residential lawn at monitoring cross-section 1. This lawn area should be re-vegetated with a mixture of native tree species, rather than shrubs, to both ensure deep root systems to hold deep terrace soils, as well as to preserve the view of the stream from the house.

Japanese Knotweed, a non-native, invasive plant, was documented along 15 feet (2%) of the banks in this unit during stream assessment in 2001, in the middle of the left eroding bank area at monitoring cross-section 1. This species is an invasive exotic, and damaging to riparian integrity[7]. Japanese Knotweed is fast growing, can crowd out native vegetation and the roots provide little or no soil-anchoring action.

Japanese Knotweed is aggressive and spreads easily; pieces break off, wash downstream and can take root where they land, especially in disturbed areas (such as eroding banks or continually disturbed maintenance areas). To avoid further spread of this plant to downstream areas that may be vulnerable to colonization and further spread in this disturbed eroding bank area, Japanese Knotweed at this reach should be removed, and the area replanted with a mix of competitive native species to prevent re-colonization. Additional maintenance of this area may be needed, as Japanese Knotweed is very difficult to remove successfully.

[1]Broadstreet Hollow Management Unit 19 Map
[2] Volume II Appendix 3.1.5 Management Unit 19 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