2.2 Watershed Management Recommendations Summary

Section 2.1 presented a complete summary by Management Unit of all stream and infrastructure feature data mapped, assessed and described as part of the stream assessment conducted in 2001. This information is important as a baseline framework for developing a comprehensive and effective stream management strategy for the Broadstreet Hollow stream. An important next step in organizing this information is putting each set of descriptions, assessments and recommendations into context to help managers prioritize projects, especially when outside funding or cost-sharing agreements are needed to complete work in partnership with other landowners, agencies or groups. Defining potential project sites by management goals or priority areas helps lead agencies or other organizations plan work schedules, obtain funding, or identify cooperative relationships to get projects accomplished.

The table below presents a summary of the broadest categories of recommendations for selected features documented through the development of this plan (a condensed version of Tables 1 – 19). This table is presented to assist stream managers, landowners and other organizations who may wish to focus on implementing projects for a specific MU, or may choose to implement a program for all the MUs with similar recommendations or category of problems. For example, a Japanese Knotweed removal program could be implemented targeting those units that have documented occurrence of this invasive plant. A culvert or bridge replacement program could target those MUs with documented stream-related infrastructure problems. A dumpsite cleanup program could also use this table as a first step to target cleanup efforts. This table should be used with Tables 1 – 19, containing expanded summary information presented in the Management Unit Descriptions (MUDs), with a single table for each MU and specific recommendations for each category. Further, Tables 20 – 25 contain prioritized information for specific eroding banks measured in 2001. For example, a program to address clay exposures and turbidity could be refined by considering additional information collected at eroding clay sites.

Selected documented features and recommendations for 19 Management Units in Broadstreet Hollow, 2001.

Documented Features	Management Recommendations in Units:	No Recommendations in Units:
Eroding Banks	2, 4, 5, 7, 8us, 8ds, 10, 11, 14, 15, 16, 17, 18, 19	1, 3, 6, 9, 12, 13
Berms	2, 4, 5, 6, 8ds, 9, 12, 15, 17, 18, 19	1, 3, 7, 8us, 10, 11, 13, 14, 16
Clay Exposures	2, 3, 5, 6, 7, 8ds, 11, 13, 14, 15, 17	1, 4, 8us, 9, 10, 12, 16, 18, 19
Japanese Knotweed	2, 18, 19	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17
Culverts/Bridges	1, 5, 8us, 10, 11, 12, 18	2, 3, 4, 6, 7, 8ds, 9, 13, 14, 15, 16, 17, 19
Revegetation	All units but 6	6
Dumpsites	2, 5, 6, 10, 16, 17, 18	1, 3, 4, 7, 8, 9, 11, 12, 13, 14, 15, 19

2.2.1 Prioritized Management Unit Summary Tables

An important part of the 2001 stream data collection effort included identifying and mapping locations of significant bank erosion. Most of these locations were surveyed in detail to produce a record of the current shape of the channel cross section, document current conditions and predict potential for further erosion based on stream channel and vegetation characteristics. These eroding bank areas are monumented (permanently marked) and designated Monitoring Cross-sections (MCSs). A total of 29 of these MCSs were installed, surveyed, photographed, mapped and numbered to enable future monitoring of these sites to determine actual erosion rates, and reprioritize individual sites for restoration or other management.

Tables and Graphs in this section present detailed information for each MCS, in the following categories:

MCS # - MCS locations are numbered in upstream order as they occur from the mouth of the stream (the bottom, at the confluence with Esopus Creek). Locations in which both banks were eroding are marked LB or RB (left or right bank, as looking downstream).

MU # - Not all Management Units contained eroding banks that warranted monumenting or monitoring in 2001, and some contained multiple eroding banks with different characteristics. Note MUs are numbered in a downstream direction, from the top of the stream to the bottom.

BEHI Score – Data collected at each MCS included a number of delineative criteria used to determine a Bank Erodibility Hazard Index, or BEHI Score, using a methodology developed by Rosgen (1996). Variables used included bank height, vegetative rooting depth and density, bank angle, and surface protection of the bank face.

BEHI Category – Each score can be categorized, ranging from “very low” to “extreme”.

NBS/Shear Stress – Near Bank Stress (NBS) is a number calculated from the cross sectional area representing the extent to which the force of water is focused near the eroding bank. A lower number represents lower concentration of erosive force.

NBS/Shear Stress Category – NBS can be categorized, ranging from “low” to “extreme”.

Bank Location – The type of bank was documented for each MCS to put each situation into location context to help prioritize restoration by need and by difficulty (a low bank is much easier to address than a valley wall situation, but a valley wall may be a critical problem because the stream has no where else to go but down). The categories include, in order of severity/priority: valley wall, road embankment, high terrace, terrace, and floodplain bench.

Erosion Length – The length of the eroding bank is typically measured along the toe, or base, of the bank at the stream margin, expressed in feet.

Erosion Height – The height of the eroding bank is measured at the MCS location, from the deepest point in the stream at the toe of the bank to the top of bank, expressed in feet.

Erosion Area – The length and height of the eroding bank are multiplied to give an approximate areal extent of the eroding bank face.

Final Score = BEHI x NBS x Area – Each eroding bank has a final score, multiplying the BEHI score by the SNB number by the Area. This enables comparison of the relative severity of erosion only, and is not meant to represent a real feature. Multiplying the scores by the area allows a longer and taller bank to be given greater weight in the scoring scheme, because BEHI and NBS are measured at the MCS location only, and could misrepresent the actual severity of the problem if taken alone.

Stream Type – As described in Stream Morphology and Classification section, the Rosgen Stream Classification system was used to classify all 3.5 miles of the Broadstreet Hollow mainstem. Because stream type can be highly influential to stream stability, recovery potential, sensitivity to disturbance, and other factors, this is an important tool for management and prioritization for restoration work. See Volume I, Section 3.2.2, Stream Morphology and Classification for further information).

NRCS Hazard Class – The Natural Resource Conservation Service (NRCS) (formerly the Soil Conservation Service), has developed a hazard class for assessing the design standards that must be used in any stream bank stabilization project (Conservation Practice Standard – Streambank and Shoreline Protection Code 580). The 3 classes are as follows:

> "(A) Low Hazard – sites where failure of measure would result in damage to cropland, woodland, pastureland, or other lands.
>
> (B) Medium Hazard – sites where failure of measure would result in damage to uninhabited structures, farm buildings, local highways and highway structures, parks, and other improved properties.
>
> (C) High Hazard – sites where failure of measure would result in damage to residences, businesses, state and interstate highways or highway structures, or other structures which if imperiled would threaten the life and safety of people."
>
> For the purposes of MCS prioritization, B class sites are improved residential lawn areas and eroding road embankment areas. All other areas are class A.

Infrastructure Threat – All MCS locations that include eroding road embankment areas are marked as infrastructure threat sites.

Presence/Absence of clay – All MCS locations that include glacial lake clay exposures are marked as clay sites.

Table 20. Broadstreet Hollow Monitoring Cross-Sections Prioritization - Summary by MCS # - No Prioritization

MCS #	MU #	BEHI Score	BEHI Category	NBS/ Shear Stress	NBS/ Shear Stress Category	Bank Location	Erosion Length	Erosion Height	Erosion Area	Final Score = BEHI x SNB x Area	Stream Type	NRCS Hazard Class	Infrastructure Threat	Presence/ absence of clay
1.0	**19**	25.1	moderate	0.36	moderate	terrace	177	5	885	8,000	C3	B (lawn)		
2 LB	**18**	32.9	high	0.38	moderate	floodplain bench	76	6	418	5,225	F3	A		
2 RB	**18**	26.6	moderate	0.31	low	terrace	75	8	600	4,950	F3	A		
3.0	**17**	30.8	high	0.31	low	valley wall	135	12	1,620	15,487	F3	A		X
3.5	**17**	30.3	high	0.32	low	high terrace	135	10	1,350	13,095	F3	A		
4.0	**16**	24.6	moderate	0.34	moderate	terrace	132	5	660	5,518	C3b	A		
5.0	**15**	35.4	high	0.48	very high	valley wall	239	14	3,346	56,849	F3b - C3	A		X
6.0	**15**	28.9	moderate	0.61	extreme	terrace	262	6	1,572	27,714	F3b	A		
7.0	**14**	34.0	high	0.41	moderate	terrace	211	4	844	11,774	F3b	A		X
8 LB	**11**	19.7	moderate	0.42	high	terrace	15	2	30	248	F3b	A		X
8 RB	**11**	32.6	high	0.31	low	floodplain bench	29	4	116	1,174	F3b	A		
9.0	**10**	26.9	moderate	0.22	low	terrace	62	3	186	1,101	B3	B (lawn)		
10.0	**10**	25.8	moderate	0.47	very high	road emb.	76	9	684	8,290	B3	B (road)	X	
11.0	**8**	30.5	high	0.66	extreme	valley wall	308	7	2,156	43,400	F3b	A		X
12b	**8**	33.0	high	0.44	high	high terrace	308	32	9,856	143,109	F3b	A		X
13.0	**8**	30.8	high	0.41	moderate	high terrace	308	25	7,700	97,251	F3b	A		X
14.0	**8**	30.2	high	0.38	moderate	high terrace	76	15	1,140	13,099	B3c	A		
15.0	**8**	31.5	high	0.21	low	road emb.	52	8	416	2,750	C3a	B (road)	X	
16.0	**8**	41.7	very high	0.30	low	high terrace	20	6	120	1,501	F3a	A (field)		
17.0	**7**	28.8	moderate	0.25	low	terrace	59	6	354	2,545	F3/B3c	A		
18.0	**5**	34.2	high	0.29	low	valley wall	467	8	3,736	37,024	F3b	A		X
19.0	**4**	29.3	moderate	0.14	low	road emb.	24	4	96	394	B3	B (road)	X	
20.0	**4**	36.0	high	0.46	very high	terrace	126	11	1,386	22,952	F3b	A		
21.0	**4**	32.0	high	0.30	low	high terrace	87	13	1,131	10,858	B3a - F3b	A		
22.0	**2**	32.6	high	0.33	moderate	road emb.	179	11	1,969	21,206	G3	B (road)	X	X
23.0	**2**	28.9	moderate	0.36	moderate	terrace	93	7	651	6,777	F3b	B (lawn)		
24.0	**2**	25.3	moderate	0.45	high	road emb.	10	9	90	1,025	F3b	B (road)	X	
25.0	**2**	40.3	very high	0.26	low	road emb.	45	8	360	3,773	B3a	B (road)	X	
26.0	**2**	29.7	moderate	0.49	very high	terrace	122	7	854	12,443	F3b	A		
27 LB	**2**	32.6	high	0.33	moderate	terrace	103	6	618	6,656	F3b	A		
27 RB	**2**	38.8	high	0.25	low	terrace	53	3	159	1,544	F3b	A		
28.0	**2**	42.5	very high	0.20	low	road emb.	86	11	946	8,032	F3b	B (road)	X	

Table 21. Broadstreet Hollow Monitoring Cross-Sections Prioritization - Bank Location

MCS #	I.	BEHI Score	BEHI Category	NBS/ Shear Stress	NBS/ Shear Stress Category	Bank Location	Erosion Length	Erosion Height	Erosion Area	Final Score = BEHI x SNB x Area	Stream Type	NRCS Hazard Class	Infrastructure Threat	Presence/ absence of clay
5	**15**	35.4	high	0.48	very high	valley wall	239	14	3,346	56,849	F3b - C3	A		X
11	**8**	30.5	high	0.66	extreme	valley wall	308	7	2,156	43,400	F3b	A		X
18 Btm	**5**	34.2	high	0.29	low	valley wall	467	8	3,736	37,024	F3b	A		X
3	**17**	30.8	high	0.31	low	valley wall	135	12	1,620	15,487	F3	A		X
22	**2**	32.6	high	0.33	moderate	road emb.	179	11	1,969	21,206	G3	B (road)	X	X
10	**10**	25.8	moderate	0.47	very high	road emb.	76	9	684	8,290	B3	B (road)	X	
28	**2**	42.5	very high	0.20	low	road emb.	86	11	946	8,032	F3b	B (road)	X	
25	**2**	40.3	very high	0.26	low	road emb.	45	8	360	3,773	B3a	B (road)	X	
15	**8**	31.5	high	0.21	low	road emb.	52	8	416	2,750	C3a	B (road)	X	
24	**2**	25.3	moderate	0.45	high	road emb.	10	9	90	1,025	F3b	B (road)	X	
19	**4**	29.3	moderate	0.14	low	road emb.	24	4	96	394	B3	B (road)	X	
12b	**8**	33.0	high	0.44	high	high terrace	308	32	9,856	143,109	F3b	A		X
13	**8**	30.8	high	0.41	moderate	high terrace	308	25	7,700	97,251	F3b	A		X
14	**8**	30.2	high	0.38	moderate	high terrace	76	15	1,140	13,099	B3c	A		
3.5	**17**	30.3	high	0.32	low	high terrace	135	10	1,350	13,095	F3	A		
21	**4**	32.0	high	0.30	low	high terrace	87	13	1,131	10,858	B3a - F3b	A		
16	**8**	41.7	very high	0.30	low	high terrace	20	6	120	1,501	F3a	A (field)		
6	**15**	28.9	moderate	0.61	extreme	terrace	262	6	1,572	27,714	F3b	A		
20	**4**	36.0	high	0.46	very high	terrace	126	11	1,386	22,952	F3b	A		
26	**2**	29.7	moderate	0.49	very high	terrace	122	7	854	12,443	F3b	A		
7	**14**	34.0	high	0.41	moderate	terrace	211	4	844	11,774	F3b	A		X
1	**19**	25.1	moderate	0.36	moderate	terrace	177	5	885	8,000	C3	B (lawn)		
23	**2**	28.9	moderate	0.36	moderate	terrace	93	7	651	6,777	F3b	B (lawn)		
27 LB	**2**	32.6	high	0.33	moderate	terrace	103	6	618	6,656	F3b	A		
4	**16**	24.6	moderate	0.34	moderate	terrace	132	5	660	5,518	C3b	A		
2 RB	**18**	26.6	moderate	0.31	low	terrace	75	8	600	4,950	F3	A		
17	**7**	28.8	moderate	0.25	low	terrace	59	6	354	2,545	F3/B3c	A		
27 RB	**2**	38.8	high	0.25	low	terrace	53	3	159	1,544	F3b	A		
9	**10**	26.9	moderate	0.22	low	terrace	62	3	186	1,101	B3	B (lawn)		
8 LB	**11**	19.7	moderate	0.42	high	terrace	15	2	30	248	F3b	A		X
2 LB	**18**	32.9	high	0.38	moderate	floodplain bench	76	6	418	5,225	F3	A		
8 RB	**11**	32.6	high	0.31	low	floodplain bench	29	4	116	1,174	F3b	A		

Table 22. Broadstreet Hollow Monitoring Cross-Sections Prioritization - Final Score

MCS #	MU #	BEHI Score	BEHI Category	NBS/ Shear Stress	NBS/ Shear Stress Category	Bank Location	Erosion Length	Erosion Height	Erosion Area	Final Score = BEHI x SNB x Area	Stream Type	NRCS Hazard Class	Infrastructure Threat	Presence/ absence of clay
12b	**8**	33.0	high	0.44	high	high terrace	308	32	9,856	143,109	F3b	A		X
13	**8**	30.8	high	0.41	moderate	high terrace	308	25	7,700	97,251	F3b	A		X
5	**15**	35.4	high	0.48	very high	valley wall	239	14	3,346	56,849	F3b - C3	A		X
11	**8**	30.5	high	0.66	extreme	valley wall	308	7	2,156	43,400	F3b	A		X
18 Btm	**5**	34.2	high	0.29	low	valley wall	467	8	3,736	37,024	F3b	A		X
6	**15**	28.9	moderate	0.61	extreme	terrace	262	6	1,572	27,714	F3b	A		
20	**4**	36.0	high	0.46	very high	terrace	126	11	1,386	22,952	F3b	A		
22	**2**	32.6	high	0.33	moderate	road emb.	179	11	1,969	21,206	G3	B (road)	X	X
3	**17**	30.8	high	0.31	low	valley wall	135	12	1,620	15,487	F3	A		X
14	**8**	30.2	high	0.38	moderate	high terrace	76	15	1,140	13,099	B3c	A		
3.5	**17**	30.3	high	0.32	low	high terrace	135	10	1,350	13,095	F3	A		
26	**2**	29.7	moderate	0.49	very high	terrace	122	7	854	12,443	F3b	A		
7	**14**	34.0	high	0.41	moderate	terrace	211	4	844	11,774	F3b	A		X
21	**4**	32.0	high	0.30	low	high terrace	87	13	1,131	10,858	B3a - F3b	A		
10	**10**	25.8	moderate	0.47	very high	road emb.	76	9	684	8,290	B3	B (road)	X	
28	**2**	42.5	very high	0.20	low	road emb.	86	11	946	8,032	F3b	B (road)	X	
1	**19**	25.1	moderate	0.36	moderate	terrace	177	5	885	8,000	C3	B (lawn)		
23	**2**	28.9	moderate	0.36	moderate	terrace	93	7	651	6,777	F3b	B (lawn)		
27 LB	**2**	32.6	high	0.33	moderate	terrace	103	6	618	6,656	F3b	A		
4	**16**	24.6	moderate	0.34	moderate	terrace	132	5	660	5,518	C3b	A		
2 LB	**18**	32.9	high	0.38	moderate	floodplain bench	76	6	418	5,225	F3	A		
2 RB	**18**	26.6	moderate	0.31	low	terrace	75	8	600	4,950	F3	A		
25	**2**	40.3	very high	0.26	low	road emb.	45	8	360	3,773	B3a	B (road)	X	
15	**8**	31.5	high	0.21	low	road emb.	52	8	416	2,750	C3a	B (road)	X	
17	**7**	28.8	moderate	0.25	low	terrace	59	6	354	2,545	F3/B3c	A		
27 RB	**2**	38.8	high	0.25	low	terrace	53	3	159	1,544	F3b	A		
16	**8**	41.7	very high	0.30	low	high terrace	20	6	120	1,501	F3a	A (field)		
8 RB	**11**	32.6	high	0.31	low	floodplain bench	29	4	116	1,174	F3b	A		
9	**10**	26.9	moderate	0.22	low	terrace	62	3	186	1,101	B3	B (lawn)		
24	**2**	25.3	moderate	0.45	high	road emb.	10	9	90	1,025	F3b	B (road)	X	
19	**4**	29.3	moderate	0.14	low	road emb.	24	4	96	394	B3	B (road)	X	
8 LB	**11**	19.7	moderate	0.42	high	terrace	15	2	30	248	F3b	A		X

Table 23. Broadstreet Hollow Monitoring Cross-Sections Prioritization - Stream Type

MCS #	MU #	BEHI Score	BEHI Category	NBS/ Shear Stress	NBS/ Shear Stress Category	Bank Location	Erosion Length	Erosion Height	Erosion Area	Final Score = BEHI x SNB x Area	Stream Type	NRCS Hazard Class	Infrastructure Threat	Presence/ absence of clay
22	**2**	32.6	high	0.33	moderate	road emb.	179	11	1,969	21,206	G3	B (road)	X	X
12b	**8**	33.0	high	0.44	high	high terrace	308	32	9,856	143,109	F3b	A		X
13	**8**	30.8	high	0.41	moderate	high terrace	308	25	7,700	97,251	F3b	A		X
11	**8**	30.5	high	0.66	extreme	valley wall	308	7	2,156	43,400	F3b	A		X
18 Btm	**5**	34.2	high	0.29	low	valley wall	467	8	3,736	37,024	F3b	A		X
6	**15**	28.9	moderate	0.61	extreme	terrace	262	6	1,572	27,714	F3b	A		
20	**4**	36.0	high	0.46	very high	terrace	126	11	1,386	22,952	F3b	A		
26	**2**	29.7	moderate	0.49	very high	terrace	122	7	854	12,443	F3b	A		
7	**14**	34.0	high	0.41	moderate	terrace	211	4	844	11,774	F3b	A		X
28	**2**	42.5	very high	0.20	low	road emb.	86	11	946	8,032	F3b	B (road)	X	
23	**2**	28.9	moderate	0.36	moderate	terrace	93	7	651	6,777	F3b	B (lawn)		
27 LB	**2**	32.6	high	0.33	moderate	terrace	103	6	618	6,656	F3b	A		
27 RB	**2**	38.8	high	0.25	low	terrace	53	3	159	1,544	F3b	A		
8 RB	**11**	32.6	high	0.31	low	floodplain bench	29	4	116	1,174	F3b	A		
24	**2**	25.3	moderate	0.45	high	road emb.	10	9	90	1,025	F3b	B (road)	X	
8 LB	**11**	19.7	moderate	0.42	high	terrace	15	2	30	248	F3b	A		X
16	**8**	41.7	very high	0.30	low	high terrace	20	6	120	1,501	F3a	A (field)		
17	**7**	28.8	moderate	0.25	low	terrace	59	6	354	2,545	F3/B3c	A		
3	**17**	30.8	high	0.31	low	valley wall	135	12	1,620	15,487	F3	A		X
3.5	**17**	30.3	high	0.32	low	high terrace	135	10	1,350	13,095	F3	A		
2 LB	**18**	32.9	high	0.38	moderate	floodplain bench	76	6	418	5,225	F3	A		
2 RB	**18**	26.6	moderate	0.31	low	terrace	75	8	600	4,950	F3	A		
4	**16**	24.6	moderate	0.34	moderate	terrace	132	5	660	5,518	C3b	A		
15	**8**	31.5	high	0.21	low	road emb.	52	8	416	2,750	C3a	B (road)	X	
1	**19**	25.1	moderate	0.36	moderate	terrace	177	5	885	8,000	C3	B (lawn)		
14	**8**	30.2	high	0.38	moderate	high terrace	76	15	1,140	13,099	B3c	A		
5	**15**	35.4	high	0.48	very high	valley wall	239	14	3,346	56,849	F3b - C3	A		X
21	**4**	32.0	high	0.30	low	high terrace	87	13	1,131	10,858	B3a - F3b	A		
25	**2**	40.3	very high	0.26	low	road emb.	45	8	360	3,773	B3a	B (road)	X	
10	**10**	25.8	moderate	0.47	very high	road emb.	76	9	684	8,290	B3	B (road)	X	
9	**10**	26.9	moderate	0.22	low	terrace	62	3	186	1,101	B3	B (lawn)		
19	**4**	29.3	moderate	0.14	low	road emb.	24	4	96	394	B3	B (road)	X	

Table 24. Broadstreet Hollow Monitoring Cross-Sections Prioritization – NRCS Hazard Class

MCS #	MU #	BEHI Score	BEHI Category	NBS/ Shear Stress	NBS/ Shear Stress Category	Bank Location	Erosion Length	Erosion Height	Erosion Area	Final Score = BEHI x SNB x Area	Stream Type	NRCS Hazard Class	Infrastructure Threat	Presence/ absence of clay
22	2	32.6	high	0.33	moderate	road emb.	179	11	1,969	21,206	G3	B (road)	X	X
10	10	25.8	moderate	0.47	very high	road emb.	76	9	684	8,290	B3	B (road)	X	
28	2	42.5	very high	0.20	low	road emb.	86	11	946	8,032	F3b	B (road)	X	
25	2	40.3	very high	0.26	low	road emb.	45	8	360	3,773	B3a	B (road)	X	
15	8	31.5	high	0.21	low	road emb.	52	8	416	2,750	C3a	B (road)	X	
24	2	25.3	moderate	0.45	high	road emb.	10	9	90	1,025	F3b	B (road)	X	
19	4	29.3	moderate	0.14	low	road emb.	24	4	96	394	B3	B (road)	X	
1	19	25.1	moderate	0.36	moderate	terrace	177	5	885	8,000	C3	B (lawn)		
23	2	28.9	moderate	0.36	moderate	terrace	93	7	651	6,777	F3b	B (lawn)		
9	10	26.9	moderate	0.22	low	terrace	62	3	186	1,101	B3	B (lawn)		
16	8	41.7	very high	0.30	low	high terrace	20	6	120	1,501	F3a	A (field)		
12b	8	33.0	high	0.44	high	high terrace	308	32	9,856	143,109	F3b	A		X
13	8	30.8	high	0.41	moderate	high terrace	308	25	7,700	97,251	F3b	A		X
5	15	35.4	high	0.48	very high	valley wall	239	14	3,346	56,849	F3b - C3	A		X
11	8	30.5	high	0.66	extreme	valley wall	308	7	2,156	43,400	F3b	A		X
18 Btm	5	34.2	high	0.29	low	valley wall	467	8	3,736	37,024	F3b	A		X
6	15	28.9	moderate	0.61	extreme	terrace	262	6	1,572	27,714	F3b	A		
20	4	36.0	high	0.46	very high	terrace	126	11	1,386	22,952	F3b	A		
3	17	30.8	high	0.31	low	valley wall	135	12	1,620	15,487	F3	A		X
14	8	30.2	high	0.38	moderate	high terrace	76	15	1,140	13,099	B3c	A		
3.5	17	30.3	high	0.32	low	high terrace	135	10	1,350	13,095	F3	A		
26	2	29.7	moderate	0.49	very high	terrace	122	7	854	12,443	F3b	A		
7	14	34.0	high	0.41	moderate	terrace	211	4	844	11,774	F3b	A		X
21	4	32.0	high	0.30	low	high terrace	87	13	1,131	10,858	B3a - F3b	A		
27 LB	2	32.6	high	0.33	moderate	terrace	103	6	618	6,656	F3b	A		
4	16	24.6	moderate	0.34	moderate	terrace	132	5	660	5,518	C3b	A		
2 LB	18	32.9	high	0.38	moderate	floodplain bench	76	6	418	5,225	F3	A		
2 RB	18	26.6	moderate	0.31	low	terrace	75	8	600	4,950	F3	A		
17	7	28.8	moderate	0.25	low	terrace	59	6	354	2,545	F3/B3c	A		
27 RB	2	38.8	high	0.25	low	terrace	53	3	159	1,544	F3b	A		
8 RB	11	32.6	high	0.31	low	floodplain bench	29	4	116	1,174	F3b	A		
8 LB	11	19.7	moderate	0.42	high	terrace	15	2	30	248	F3b	A		X

Table 25. Broadstreet Hollow Monitoring Cross-Sections Prioritization – Clay Exposure

MCS #	MU #	BEHI Score	BEHI Category	NBS/ Shear Stress	NBS/ Shear Stress Category	Bank Location	Erosion Length	Erosion Height	Erosion Area	Final Score = BEHI x SNB x Area	Stream Type	NRCS Hazard Class	Infrastructure Threat	Presence/ absence of clay
12b	**8**	33.0	high	0.44	high	high terrace	308	32	9,856	143,109	F3b	A		X
13	**8**	30.8	high	0.41	moderate	high terrace	308	25	7,700	97,251	F3b	A		X
5	**15**	35.4	high	0.48	very high	valley wall	239	14	3,346	56,849	F3b - C3	A		X
11	**8**	30.5	high	0.66	extreme	valley wall	308	7	2,156	43,400	F3b	A		X
18 Btm	**5**	34.2	high	0.29	low	valley wall	467	8	3,736	37,024	F3b	A		X
22	**2**	32.6	high	0.33	moderate	road emb.	179	11	1,969	21,206	G3	B (road)	X	X
3	**17**	30.8	high	0.31	low	valley wall	135	12	1,620	15,487	F3	A		X
7	**14**	34.0	high	0.41	moderate	terrace	211	4	844	11,774	F3b	A		X
8 LB	**11**	19.7	moderate	0.42	high	terrace	15	2	30	248	F3b	A		X
6	**15**	28.9	moderate	0.61	extreme	terrace	262	6	1,572	27,714	F3b	A		
20	**4**	36.0	high	0.46	very high	terrace	126	11	1,386	22,952	F3b	A		
14	**8**	30.2	high	0.38	moderate	high terrace	76	15	1,140	13,099	B3c	A		
3.5	**17**	30.3	high	0.32	low	high terrace	135	10	1,350	13,095	F3	A		
26	**2**	29.7	moderate	0.49	very high	terrace	122	7	854	12,443	F3b	A		
21	**4**	32.0	high	0.30	low	high terrace	87	13	1,131	10,858	B3a - F3b	A		
10	**10**	25.8	moderate	0.47	very high	road emb.	76	9	684	8,290	B3	B (road)	X	
28	**2**	42.5	very high	0.20	low	road emb.	86	11	946	8,032	F3b	B (road)	X	
1	**19**	25.1	moderate	0.36	moderate	terrace	177	5	885	8,000	C3	B (lawn)		
23	**2**	28.9	moderate	0.36	moderate	terrace	93	7	651	6,777	F3b	B (lawn)		
27 LB	**2**	32.6	high	0.33	moderate	terrace	103	6	618	6,656	F3b	A		
4	**16**	24.6	moderate	0.34	moderate	terrace	132	5	660	5,518	C3b	A		
2 LB	**18**	32.9	high	0.38	moderate	floodplain bench	76	6	418	5,225	F3	A		
2 RB	**18**	26.6	moderate	0.31	low	terrace	75	8	600	4,950	F3	A		
25	**2**	40.3	very high	0.26	low	road emb.	45	8	360	3,773	B3a	B (road)	X	
15	**8**	31.5	high	0.21	low	road emb.	52	8	416	2,750	C3a	B (road)	X	
17	**7**	28.8	moderate	0.25	low	terrace	59	6	354	2,545	F3/B3c	A		
27 RB	**2**	38.8	high	0.25	low	terrace	53	3	159	1,544	F3b	A		
16	**8**	41.7	very high	0.30	low	high terrace	20	6	120	1,501	F3a	A (field)		
8 RB	**11**	32.6	high	0.31	low	floodplain bench	29	4	116	1,174	F3b	A		
9	**10**	26.9	moderate	0.22	low	terrace	62	3	186	1,101	B3	B (lawn)		
24	**2**	25.3	moderate	0.45	high	road emb.	10	9	90	1,025	F3b	B (road)	X	
19	**4**	29.3	moderate	0.14	low	road emb.	24	4	96	394	B3	B (road)	X	

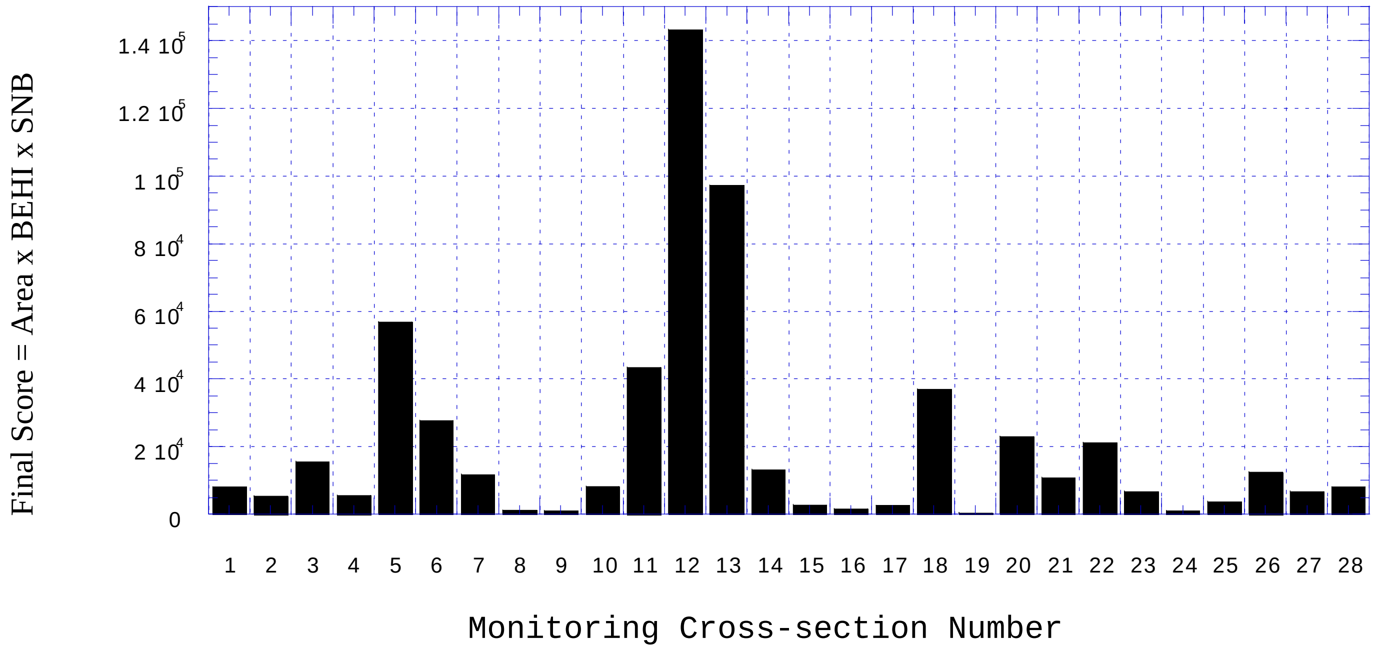

Figure 1. Final Score (BEHI x SNB x Area) for Monitoring Cross-sections, mainstem Broadstreet Hollow stream assessment, 2001. (Where two banks are measured at a single MCS, the higher scoring bank is shown.)

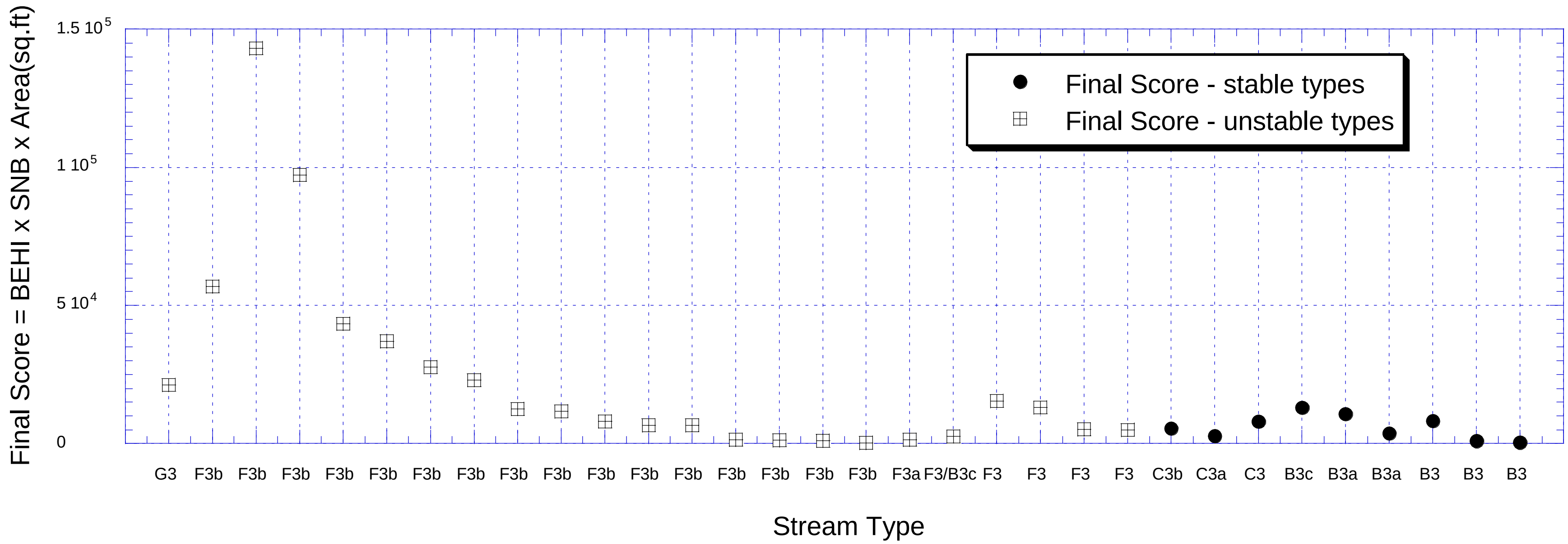

Figure 2. Final Score for Monitoring Cross-sections by stable and unstable stream types, mainstem Broadstreet Hollow stream assessment, 2001. (Additional scores reflect MCS locations with two bank measurements)

2.2.2 Riparian Vegetation Management Recommendations

Recommended riparian vegetation management concepts and practices

The following is a set of general concepts for the public, private and local government to follow when attempting to improve stream conditions through the enhancement of riparian vegetation (See Landowner Guide for additional information):

<u>Riparian buffers: Wider is better</u>

Anyone who lives next to a stream should attempt to leave as much room as possible for a vegetative buffer between their home or outbuildings and the stream. There is no magic number of feet needed, but 50 feet for vegetation is a good target distance for a stream as wide as Broadstreet Hollow. This vegetation should include a closely spaced mixture of trees, shrubs and ground cover. Native plants are suggested because they require less maintenance and are able to reproduce on their own.

In determining the location of new structures, such as a home or an outbuilding, the site plan should allow for a setback of at least 100' from the stream. At least half of this distance should be vegetated buffer. The set back should be significantly (3 to 4 times) greater if there are development limitations present, such as a flood plain or glacial lake clays. This larger setback will enable the stream to migrate and reduce the risk of damage to the structure from floods and landslides.

If there is not room for a wide riparian buffer, then make the best of what is available. Assess the quality of the buffer and consider if all the components are present. Are there trees, shrubs and ground cover? Is there space and light for more plants? Would the addition of organic material improve the quality of the soil and the vigor of the vegetation? Watch the stream during high flow events, like during spring snow melt. Where is bankfull, the point where the flow begins to spread out on the floodplain? Any planting effort should start here and work back from the stream. Before attempting to plant on a bank next to the stream make sure to seek the advice of the Soil and Water Conservation District. Disturbing the bank - even with the best of intentions - can accelerate erosion. The best time for planting is the early spring, but trees and shrubs can be planted in the early fall. Mulch and weed your plants; use tree tubes to protect young seedlings from deer browse.

Identify what plants naturally grow along the banks of the stream and use them as a guide to what should be planted. Native plant nurseries are an expanding business in the Catskills and are becoming increasingly popular. Their plants are typically very well adapted to conditions in this area. Any plant that is planted on or near the floodplain should be able to withstand moist soil conditions. Conservation plants suitable for wet areas on a limited and seasonal basis are also available from the Soil and Water Conservation District.

Protecting Riparian Buffers: Watch for Knotweed and Hemlock Woolly Adelgid

As an invasive plant that is present in the valley, Japanese knotweed, threatens to colonize many of the disturbed banks along Broadstreet Hollow. The first step toward preventing the spread of knotweed, is knowing how to identify the plant and monitoring your stream banks for its presence. Watch along the edge of the stream for young plants attempting to take root in the sand and gravel deposits. Pulling the plant - including the roots - can be accomplished when it is tender after first frost in the fall. Cutting the plant back frequently in the summer can reduce its vigor by reducing its ability to make and store food. Preventing the conditions which enable the establishment of new colonies is also very important. Refrain from disturbing the stream bank and avoid dumping fill and garden material on the stream bank or in the floodplain. Even a small piece of Japanese knotweed stem or root can become a full plant if given the chance, so be careful to dispose of any knotweed in the garbage. Perhaps the best weapon against the invasion of knotweed is a dense, vigorous riparian plant community. Knotweed does not like shade.

The presence of Hemlock Woody Adelgid has been reported in Broadstreet Hollow. If there are hemlocks growing on your property, become familiar with the appearance of the adelgid and then check the lower branches of your trees for the insect. Participate in the local monitoring program and stay abreast with their trial efforts to combat the insect. Any pure stands of hemlock located on steep slopes along the stream are areas of primary concern. Planting trees or encouraging natural regeneration on these sites through thinning may eventually be necessary to ensure future stream bank stability.

Conserve Riparian Corridors and Connections to Upland Communities

Animals use the streamside vegetation community as a corridor to move up and down the valley. Fish need cover along the stream to migrate to and from spawning locations and cool water refuge without falling prey to predators. Exposed areas become barriers to passage. Limiting access points to the stream to narrow stretches of less than 20 - 30 feet will help maintain the corridor. Likewise, riparian connections to the upland community should be conserved to enable animals to access the stream. Even though plants don't move, their genetic material moves as their seed passes across the upland - riparian interface. Roadways and lawns that separate the riparian community from the upland plant community break these linkages and make the riparian community vulnerable to competition from invasive plants and slow the recovery of vegetation from disturbance events such as floods.

Specific Program Recommendations

Streamside Vegetation Improvement Along Roads

The road up the valley frequently encroaches on the stream's floodplain and affects the streamside vegetation. The road isn't likely to be relocated, but efforts can be made to mitigate the impact of the road encroachment on the riparian vegetation community by supplemental plantings and the improved care of existing vegetation. The Town highway department has worked in cooperation with this planning effort and is aware of the value of this vegetation in reducing long term infrastructure maintenance costs. The stakeholders and sponsors of this planning effort should continue to work in cooperation with the Town highway department to identify and prescribe specific sites for action and provide funding for plantings either as buffers or as bioengineering/biotechnical stabilization projects. Sites are suggested in each Management Unit and in the Management Unit Recommendations Summary Table (Section 5.1).

Conservation of Riparian Vegetation Along Utility Lines

Like the roadway, the utility lines also impact the riparian vegetation and reduce its vigor. The stakeholders and sponsors of this plan should work in cooperation with the major utilities to prepare a plan for the maintenance of utility lines at stream crossings and other places where the lines pass through riparian vegetation. When possible, such as when poles are replaced or new spurs are established, the location of the utility lines away from streams should be considered. A first step might entail a review of the right of way and mapping of specific locations where the lines impact the streamside vegetation. A review of specifications for the maintenance of vegetation near utility lines may provide managers with a set of innovative practices that enable the utilities to mitigate the impact of the lines on the vegetation and the stream.

Streamside Gardening Program

Streamside gardening is an alternative to traditional landscaping and the extensive use of lawns as well as exotic trees and shrubs. Streamside gardening promotes the use of native plants that provide multiple benefits including: improved wildlife habitat, soil and bank stability, and the aesthetics of a natural streamside landscape. Streamside gardening does not require the use of pesticides and reduces the labor required for mowing. Streamside gardening also promotes landscape designs that allow views and access to the stream without opening up the stream bank to erosion. As stream side gardening is a relatively new concept, education and examples of successful gardens would assist the public to understand and consider adopting streamside gardening practices. For more information, contact your local SWCD or the NYC DEP SMP.

The stakeholders and sponsors of the planning effort should consider the funding of streamside gardening training for landowners in the valley and the establishment of a program for the provision of professional advice and material for the planning and creation of streamside gardens. This program might provide incentives for supporting innovative conservation practices and would result in the creation of local gardens that could act as models for the extension of these practices to the streamside landowners of Broadstreet Hollow.

Japanese Knotweed Control Program

NYC DEP and the Soil and Water Conservation Districts in the Catskill region should cooperate on the development of a joint task force to research, monitor and manage Japanese knotweed within the water supply watersheds including Broadstreet Hollow. The effort would establish a program researching the ecology of Knotweed and testing various management prescriptions. The findings of this research would be applied to management programs in the watersheds. An initial phase of the effort would entail an education and awareness program to inform landowners of the appearance, habits and impact of Japanese Knotweed. The program also would work with

NYS DEC and NYC DEP Land Management Program to ensure that the public lands in Broadstreet Hollow are included in the management efforts.

2.2.3 Infrastructure Recommendations

The management of roads, bridges, culverts and roadside drainage presents an important area of opportunity for collaboration between area stream managers working on Broadstreet Hollow. Town and county highway departments may be able to make use of resources available through the programs administered by other Project Advisory Committee members to reduce impacts of infrastructure maintenance on the stream, and in turn implement strategies that can lower their maintenance costs. The following recommendations are initial proposals, aimed at beginning the discussion of public infrastructure issues, and summarize conversations between highway department staff and the NYC DEP and UCSWCD.

Road-side ditches

Ditches are periodically cleaned to increase their ability to convey stormwater and reduce the possibility that the culverts through which they discharge will become clogged with debris. The raw soil of recently cleaned roadside ditches, however, can introduce significantly turbid stormwater into the stream. Road crews may not have the resources to adequately seed following ditch cleaning.

Recommendation: Develop programs to provide road maintenance crews with additional resources for seeding newly cleaned culverts with native ground-cover appropriate for reclamation. Make application to the Catskill Watershed Corporation's Stormwater Retrofit Grants program for funds to purchase hydroseeding equipment.

Culvert outfalls

Culvert outfalls create point sources of discharge, collected from the diffuse, or non point sources of road runoff. These outfalls can discharge significant amounts of concentrated pollutants into the stream. Other outfalls may produce strong, local intermittent flows that physically disturb the soil and plants on their way to the stream. Road crews may not have the resources to improve treatment practices at these outfalls.

Recommendation: Identify and prioritize the most critical outfalls with regard to point-source discharges and substrate stability, and which offer opportunities for mitigation. Make application to the Catskill Watershed Corporation's Stormwater Retrofit Grants program for funds to install best stormwater management practices.

Utilities

Power and telephone lines that pass through trees are at risk of being downed by falling branches during high winds. Consequently, utility managers frequently trim the branches above and around where the lines pass through the trees. The understory is also frequently cleared in the right-of-way. Excessive trimming, however, can stress the health of trees and shrubs, reducing the energy available for maintaining root mass. When these trees and shrubs are also along streambanks, and playing a critical role in streambank stability along a road embankment, protection of the utility lines and protection of roads can be at cross-purposes. Both are critical public safety concerns.

Recommendation: Identify locations where utility line right-of-ways pass through vegetation that is critical to bank stability. Develop management prescriptions for minimizing stress to these trees resulting from trimming streamside vegetation. Develop strategies and programs to replant these areas with tree and shrub species which require less maintenance, and seek resources to implement these strategies and programs.

Snow removal

Snow removal on roads in narrow valleys like the Broadstreet Hollow presents serious difficulties for road crews, especially during heavy snowfalls. Sidecast snow, which often contains a good amount of road gravel and soil, can result over time in the burying of tree roots and lower trunks, which in turn can severely stress many species of trees. When these trees are also playing a critical role in maintaining streambank stability along road embankments, snow removal sidecast may be increasing road embankment maintenance costs. Melting sidecast snow can also introduce a significant volume of fines to the stream.

Recommendation: Identify critical road embankment/streambank locations and develop strategies to strengthen the riparian vegetation through planting of native species combinations that are both hardy to having their “feet” buried, and which can serve to trap fine sediment. Seek funding to implement these strategies.

Coordination on bridge and culvert maintenance

Repair and reconstruction of bridges, culverts and abutments represents a significant expenditure for towns and county highway departments. The design of bridges and culverts usually constrain stream functions such as sediment transport and grade stability upstream and downstream. The limits of bridge right-of-ways constrain the ability of engineers to incorporate into bridge designs stream channel stabilization and restoration practices on private property. Coordination between maintenance/engineering staff and other stream managers on the PAC represents opportunities to bring additional resources into the process of bridge maintenance or replacement.

Recommendations: Institute policies and procedures whereby the schedule of activities that impact the stream is shared between agencies to allow for greater coordination. This entails bridge repair and replacement between town and county highway personnel and stream management personnel. Actively seek resources to incorporate natural channel design practices into bridge repair/replacement plans.

Revetment maintenance

In narrow valleys like Broadstreet Hollow, road maintenance includes the maintenance of significant lengths of revetted embankments, and these represent a significant expenditure for town and county highway departments. Revetted streambanks can have significant impacts on stream biological and hydraulic functions.

Recommendations: Consider, where appropriate, dumped rock revetments for upgrade to stabilization practices that permit wider shoulders, incorporate biostabilizing materials, and increase protection of both the toe of the revetment and of adjacent reaches. Seek the necessary resources to implement these upgrades, as advised by town and county highway managers.

Section 2.3 Amending and Updating the Plan

As dynamic as nature and the Broadstreet Hollow itself, this Stream Management Plan, should ideally evolve with the goals and values of the community, the policy makers and those policies that affect stream management. In order to ensure that the Plan continues to be useful to the community, the Plan needs ongoing maintenance and updating in the years ahead.

First, we recommend that the Broadstreet Hollow Project Advisory Committee (PAC) continue as an organization, meeting at least bi-annually to review progress towards implementing the plan and address new issues. A member of the PAC should be selected to serve as a Coordinator to set up meetings and ensure changes get implemented. The Broadstreet Hollow Watershed Landowner Association, naturally play a central role in keeping the Management Plan current, as the residents of the Broadstreet Neighborhood have first hand knowledge of changes and needs in the watershed. A member of this organization should be selected to work with the PAC representative to ensure meetings are held and changes or updates are made to the plan to best serve the community.

Agenda for onging meetings could include:

- Updating resource and contact information;
- Review of the recommendations in the Plan and identification of projects to implement or pursue;
- Updating inforrmation on technical assistance and grants available for stream work and stewardship, and documenting those sources both sought and received, to avoid redundancy;
- Evaluation of progress toward implementing Plan recommendations (List of accomplishments or projects completed);
- Identification of obstacles to implementation and development of strategies for overcoming these obstacles;
- Identification of emerging issues that may require new recommendations to be included in the Plan;
- Identification of recommendations that are not practicable, or are no longer relevant;
- Review of demonstration project monitoring information, and any landowner ongoing monitoring of specific sites;
- Amendment of the Plan, as needed.

As on-going active members of the PAC themselves, the Ulster and Greene County Soil and Water Conservation Districts (SWCD), the NYC DEP Stream Management Program (NYC DEP SMP) and the New York State Department of Environmental Conservation (NYS DEC) should also provide assistance to these groups, both within the PAC and as needed, and especially to the Towns of Shandaken and Lexington and the Broadstreet Hollow Watershed Landowners Association, in cooperation with which most programs or projects are most likely to be implemented. These agencies should proactively provide the other members with up-to-date information regarding funding and other resources available for stream-related activities, as well as changing regulations, guidance on best management practices (BMPs), workshops and important contact information.

As members of the Project Advisory Committee change over time, other members should orient them to the effort that went into the development of the Stream Management Plan, including its goals and strategies. As policies change and other issues arise that impact the management of the stream, these changes should be reflected, where necessary, as amendments to the Management Plan.

2.4 Stream-related Activities and Permit Requirements

NYS DEC Permit Requirements

Certain kinds of human activities can have a detrimental impact on water resources. The policy of New York State is to preserve and protect lakes, ponds, rivers and stream, as set forth in the Environmental Conservation Law (ECL) Title 5 of Article 15. To implement this policy, the New York State Department of Environmental Conservation created the Protection of Waters Regulatory Program.

All waters of the State have a classification and standard designation based on existing or expected best usage of each water or waterway segment. The classification AA or A is assigned to waters used as a source of drinking water. Classification B indicates a best usage for swimming and other contact recreation. Classification C is for waters supporting fisheries and suitable for non-contact activities.

Waters with classifications, A, B, and C may also have a standard of (T), indicating that it is able to support a trout population, or (TS) indicating that it supports trout spawning. Special requirements apply to sustain these waters that support these valuable and sensitive fisheries resources. Broadstreet Hollow has a classification and standard of C(TS), and as such is subject to the stream protection provision of the Protection of Waters regulation.

A Protection of Waters Permit is required for disturbing the bed or banks of a stream with a classification and standard of C(T) or higher. For example, 1) the construction of a bridge or placement of a culvert to allow access across a stream; 2) any type of stream bank protection, e.g. placement of rip rap, or some other revetment; 3) lowering stream banks to establish a stream crossing (i.e. creation of a ford); 4) using equipment to remove debris in a stream, all require a permit.

Some examples of activities which are exempt from the requirement to obtain a Protection of Waters permit would be: 1) agricultural activities involving the crossing and recrossing of a stream by livestock or rubber tired farm equipment at an established crossing; or 2) removal of fallen tree limbs or trunks where material can be cabled and pulled from the stream without disruption of the stream bed or banks, using equipment placed on or above the stream bank. There are occasions when permits from other state or local agencies are required; county or town permits, flood plain permits or other approvals may be necessary. The appropriate offices should be consulted. There is no charge for the Protection of Waters Permit. For permit applications and any questions regarding the permit process contact:

For Ulster County:
NYSDEC Region 3
Bureau of Habitat
21 South Putt Corners Rd
New Paltz, NY 12561-1696
(845) 256-3054

For Greene County:
NYSDEC Region 4
Bureau of Habitat
65561 St Hwy 10
Stamford, NY 12167
(607) 652-7741