
EIGHTEENMILE CREEK RESTORATION PROJECT TOWN OF NEWFANE NIAGARA COUNTY, NEW YORK

PLANTING PLAN FOR THE EIGHTEENMILE CREEK RESTORATION WORK AREA



Prepared For:
Niagara County Department of Planning,
Development and Tourism
November 20, 2003

Prepared By:



ecology and
environment, inc.

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1. Introduction

This document has been prepared for Niagara County to direct the planting of vegetation within the active restoration area (see Figures 1 and 2), and along the access trail between the Fishermans Park access ramp to the vicinity of Burt Dam. Specifically, the planting plan provides Phase I and Phase II planting approaches, species selection criteria, plant forms, and installation procedures. In addition, specific bioengineering techniques are described that have been integrated into the transition zone between terrestrial and aquatic habitats within the riparian zone of the restoration work area.

Background

In 2003, Niagara County Department of Planning, Development, and Tourism (Niagara County) initiated preliminary site work and restoration activities associated with the Eighteenmile Creek Restoration Project in the Town of Newfane in Niagara County, New York. A survey of existing vegetation in the Eighteenmile Creek riparian corridor was completed in the Fall 2002 and Summer 2003 by Ecology and Environment, Inc. (E & E) (see Table 1). Survey activities also included aquatic habitat and stream channel characterization. Based on the findings of the surveys, and the restoration objectives of the project, a list of suitable plant species was developed during the Summer 2003 to guide landscape restoration within the restoration work area (see Table 2). Site preparation and construction in the project work area began in August of 2003. By early October (2003) erosion control measures were installed and the Fall planting (Phase I) was completed to stabilize the erodible slopes and access trail. The balance of landscape restoration (Phase II of the planting plan) will be completed in Spring of 2004.

A planting plan was designed and submitted as part of the permitting document package that was submitted prior to construction. The plan was reviewed by the New York State Department of Environmental Conservation (DEC), the U.S. Army Corps of Engineers (USACE), and various members of the project implementation team (i.e., Niagara County Soil and Water Conservation District). Given the timing of construction, the planting plan included a phased approach to vegetation community restoration. Phase I of the plan was implemented during site preparation and through the end of the construction and restoration activity. Phase I of the plan was specifically designed to address soil erosion and sediment control conditions resulting from site work related to haul road construction and bank stabilization efforts.

2. Site Restoration Objectives

A prominent goal of the Eighteenmile Creek Restoration Project is to provide safe access to the thousands of visitors that are attracted to Fisherman's Park and the stream reach below Burt Dam. Trail stabilization, stream bank protection, erosion control, habitat enhancement and regeneration of a native riparian plant community are the stated objectives of the project design. The overall restoration design includes the planting plan, (involving a combination of traditional planting techniques, native species selections, erosion control geotextiles) and a flat stone and riprap-stepped wall, developed to address the stabilization and sedimentation issues associated with the most

Figure 1 – Site Map

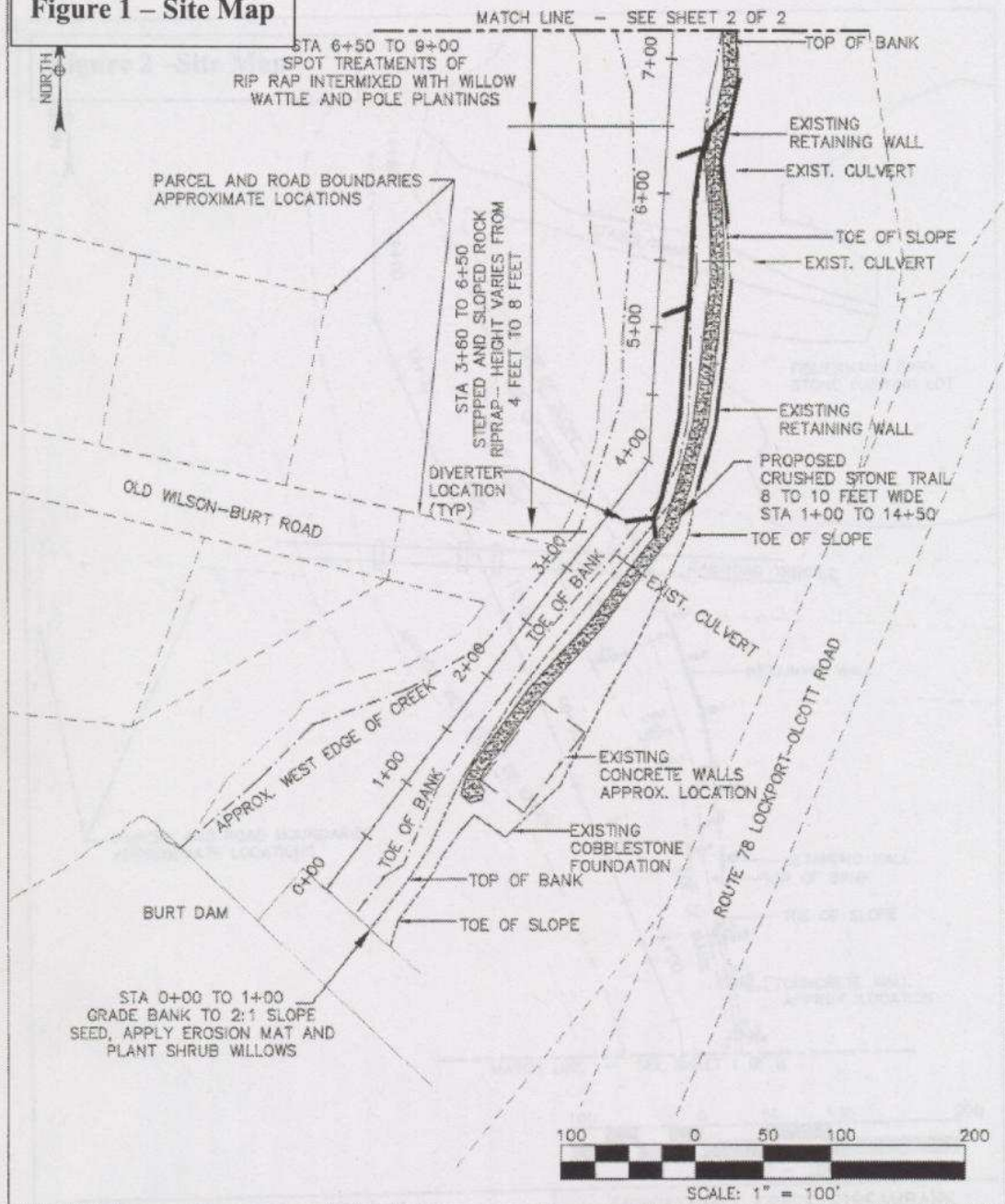


FIGURE: SITE PLAN - SHEET 1 OF 2
 DATE: MAY 2, 2003
 SCALE: 1" = 100'
 BY: NIAGARA COUNTY SOIL & WATER CONSERVATION DISTRICT

EIGHTEENMILE CREEK STREAMBANK
 STABILIZATION AND HABITAT
 RESTORATION PROJECT

Figure 2 - Site Map

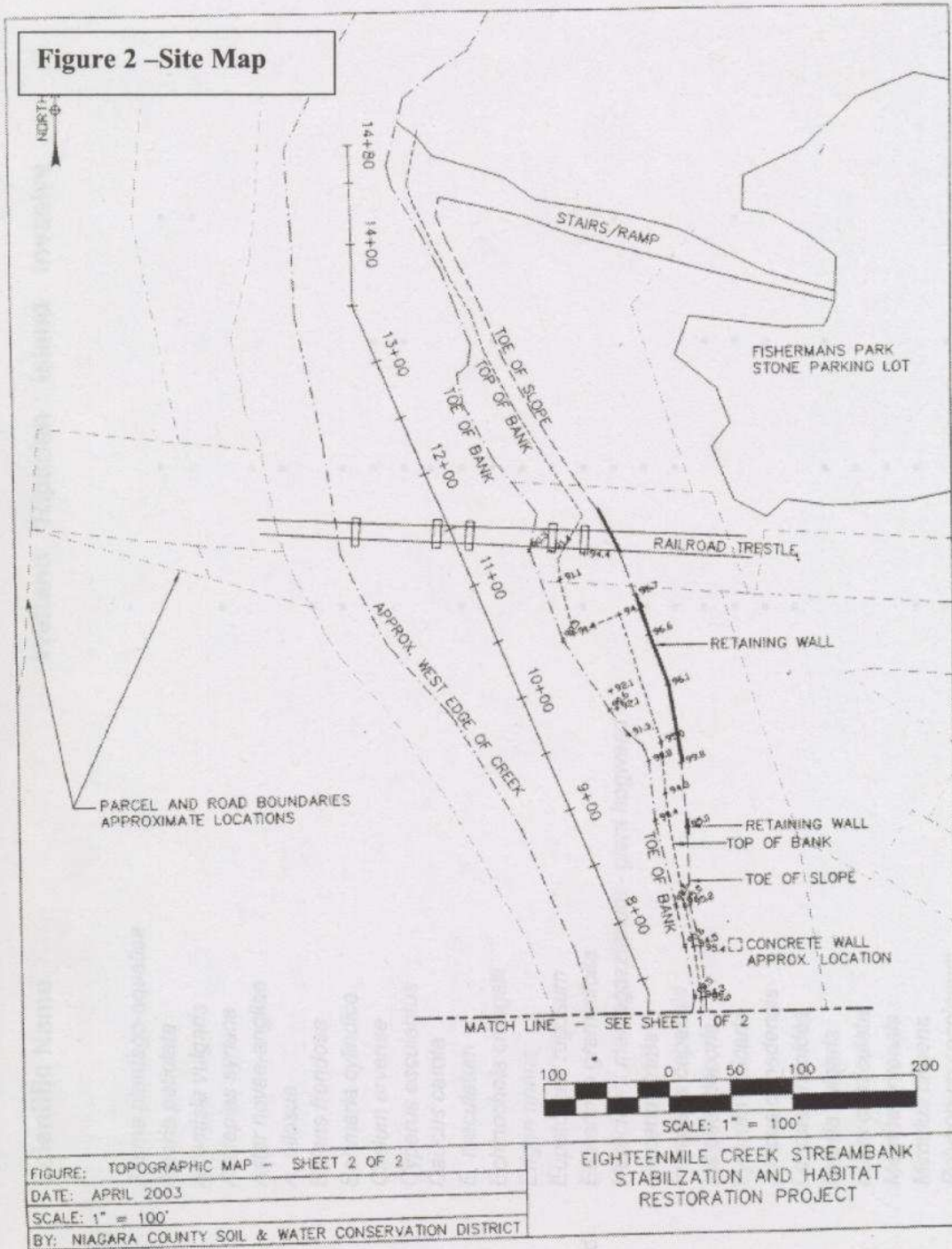


Table 1. Results of Qualitative Riparian Zone Vegetation Survey from Burt Dam to One Mile below Burt Dam, Eighteenmile Creek, Niagara County

Common Name	Scientific Name	Wetland	Riparian	Island	Invasive
Herbaceous Layer					
water plantain	<i>Alisma plantago-aquatica</i>	*			
garlic mustard	<i>Alliaria petiolata</i>		*		*
mugwort	<i>Artemisia vulgaris</i>		*		*
swamp milkweed	<i>Asclepias syriaca</i>	*			
new england aster	<i>Aster novae-angliae</i>		*		
heath aster	<i>A. pilosus</i>		*		
beggar ticks	<i>Bidens frondosa</i>	*			
False-Nettle	<i>Bohmeria cylindrica</i>	*			
Canada thistle	<i>Cirsium arvense</i>		*	*	
chufa flatsedge	<i>Cyperus esculentus</i>		*	*	
queen ann's lace	<i>Daucus carota</i>		*		
boneset	<i>E. maculatum</i>	*	*		
barnyard grass	<i>Echinochola crusgalli</i>		*	*	
daisy fleabane	<i>Erigeron annuus</i>		*		
white snakeroot	<i>Eupatorium rugosum</i>		*		
lance-leaved goldenrod	<i>Euthamia graminifolia</i>	*	*		
giant hogweed	<i>Heracleum mantegazzianum - giant hogweed</i>		*		*
fowl meadow grass	<i>Glyceria striata</i>	*	*		
jewelweed	<i>Impatiens capensis</i>	*	*		
yellow flag iris	<i>Iris pseudacoris</i>	*	*	*	
purple loosestrife	<i>Lythrum salicaria</i>	*	*	*	*
Canada rush	<i>Juncus canadensis</i>	*	*	*	
rice cutgrass	<i>Leersia orizoides</i>	*	*	*	
butter and eggs	<i>Linaria vulgaris</i>		*	*	
crownvetch	<i>Lotus corniculata</i>		*	*	
mint	<i>Mentha arvensis</i>		*	*	
monkey flower	<i>Mimulus ringens</i>	*	*	*	
swamp smartweed	<i>Polygonum coccineum</i>	*	*	*	*
mild water pepper	<i>P. hydropiperoides</i>	*	*	*	*

climbing false buckwheat	<i>P. scandens</i>	*	*
Virginia creeper	<i>Parthenocissus spp.</i>	*	*
common reed	<i>Phalaris arundinacea</i>	*	*
reed canary grass	<i>Phragmites australis</i>	*	*
cleaweed	<i>Pilea pumila</i>	*	*
pickeral weed	<i>Pontedaria cordata</i>	*	*
multiflora rose	<i>Rosa spp.</i>	*	*
blackberry/raspberry	<i>Rubus spp.</i>	*	*
curled dock	<i>Rumex crispus</i>	*	*
grass leaved arrowhead	<i>Sagittaria graminea</i>	*	*
arrowhead	<i>S. latifolia</i>	*	*
lizard tail	<i>Saururus cernuus</i>	*	*
river bulrush	<i>Scirpus fluviatilis</i>	*	*
water parsnip	<i>Sium suave</i>	*	*
bittersweet nightshade	<i>Solanum dulcamara</i>	*	*
Canada goldenrod	<i>Solidago canadensis</i>	*	*
zig zag glidenrod	<i>S. flexicaulis</i>	*	*
bur-reed	<i>Sparganium americanum</i>	*	*
poison ivy	<i>Toxicodendron radicans</i>	*	*
coltsfoot	<i>Tussilago farfara</i>	*	*
stinging nettle	<i>Urtica dioica</i>	*	*
moth mullein	<i>Verbascum blattaria</i>	*	*
wild rice	<i>Zizania aquatica</i>	*	*
Shrub Layer			
button bush	<i>Cephalanthus occidentalis</i>	*	*
pagoda dogwood	<i>Cornus alternifolia</i>	*	*
silky dogwood	<i>C. amomum</i>	*	*
redosier dogwood	<i>C. sericea</i>	*	*
spicebush	<i>Lindera benzoin</i>	*	*
morrow's honeysuckle	<i>Lonicera morrowii</i>	*	*
glossy buckthorn	<i>Rhamnus frangula</i>	*	*
pussy willow	<i>Salix discolor</i>	*	*
elderberry	<i>Sambucus canadensis</i>	*	*
American cranberry bush	<i>Viburnum trilobum</i>	*	*

Tree Layer

box elder			*
red maple		*	*
tree of heaven		*	*
Hop Hornbeam			*
staghorn sumac			*
black walnut			*
butternut			*
sycamore			*
eastern cottonwood			*
sweet cherry		*	*
choke cherry			*
sargent's cherry			*
black cherry			*
carolina buckthorn			*
red oak			*
bur oak			*
black locust			*
black willow			*
basswood			*
slippery elm		*	*
<i>Acer negundo</i>			*
<i>A. rubrum</i>			*
<i>Alianthus altissima</i>			*
<i>Ostrya virginiana</i>			*
<i>Rhus typhina</i>			*
<i>Juglans nigra</i>			*
<i>J. cinerea</i>			*
<i>Plantanus occidentalis</i>			*
<i>Populus deltoides</i>			*
<i>Prunus avium</i>			*
<i>P. virginiana</i>			*
<i>P. 'sargentii'</i>			*
<i>P. serotina</i>			*
<i>Rhamnus cathartica</i>			*
<i>Quercus rubra</i>			*
<i>Q. macrocarpa</i>			*
<i>Robinia pseudo-acacia</i>			*
<i>Salix nigra</i>			*
<i>Tilia americana</i>			*
<i>Ulmus fulva</i>			*

Table 2. Suitable Species for Erosion Control and Habitat Enhancement, Eighteenmile Creek, Niagara County

Botanical Name	Common Name	Wetland Indicator*	Planting Zone**
<i>Alnus incana</i> ssp. <i>rugosa</i>	Speckled Alder	FACW	1, 2
<i>Aronia melanocarpa</i>	Black Chokeberry	FAC	2, 3
<i>Celtis occidentalis</i>	Hackberry	FACU	2, 3
<i>Cephalanthus occidentalis</i>	Button Bush	OBL	1
<i>Cornus alternifolia</i>	Pagoda Dogwood	FAC	3
<i>Cornus amomum</i>	Silky Dogwood	FAC	2, 3
<i>Cornus stolonifera</i> (<i>C. sericea</i>)	Redosier Dogwood	FACW	2
<i>Ilex verticillata</i>	Winterberry	FACW	2
<i>Lindera benzoin</i>	Spicebush	FACW	3
<i>Myrica pensylvanica</i>	Northern Bayberry	FAC	3
<i>Physocarpus opulifolius</i>	Common Nine Bark	FACW	2, 3
<i>Prunus pennsylvanica</i>	Pin Cherry	FACU	3
<i>Prunus virginiana</i>	Choke Cherry	FACU	3
<i>Quercus bicolor</i>	White Swamp oak	FACW	2
<i>Quercus macrocarpa</i>	Bur Oak	FAC	2, 3
<i>Quercus palustris</i>	Pin Oak	FACW	3
<i>Rubus allegheniensis</i>	Common Blackberry	FACU	3
<i>Salix purpurea</i>	'streamco' Streamco Willow	OBL	1, 2
<i>Sambucus canadensis</i>	Elderberry	FACW	2, 3
<i>Sambucus racemosa</i>	Red-Berried Elder	FACU	3
<i>Viburnum acerifolium</i>	Maple-leaved Viburnum	UPL	3
<i>Viburnum trilobum</i>	American Cranberry	FACW	3
* Indicator Categories:			
Obligate Wetland (OBL). Almost always occurs in wetlands (estimated probability > 99%) under natural conditions.			
Facultative Wetland (FACW). Usually occurs in wetlands (estimated probability 67% - 99%), but occasionally found in non-wetlands.			
Facultative (FAC). Equally likely to occur in wetlands (estimated probability 34% - 66%) or non-wetlands.			
Facultative Upland (FACU). Usually occur in non-wetlands (estimated probability 67% - 99%), but occasionally found in wetlands (estimated probability 1% - 33%).			
**Planting Zones 1 - OBL emergent 2 - PSS palustrine/shrub-scrub 3 - FAC/FACU upland trail corridor and slopes			

severely eroded steep slopes in this reach of the stream. The stream reach within the project area is located in the area between the stairway descending from Fishermen's Park and the Burt Dam. A bioengineering approach featuring innovative techniques has been integrated to modify the stone armoring design for the eroded stream bank. Planting pockets were created to cover exposed stone and boulders, which will reduce heat loading as well as vegetate the exposed portion of the stepped wall.

The landscape restoration design has been developed to establish a diverse, native plant community within this unique canyon-like habitat. The species prescribed in the planting plan will complement existing vegetation layers, especially the mature tree forms, to increase botanical diversity and habitat value. Enhanced biological function will increase biological integrity due to the beneficial associations between floral and faunal species in both the aquatic and terrestrial habitats occurring within the riparian corridor. The stream restoration and the implementation of the planting plan will directly benefit a variety of resident and migratory songbirds, waterfowl, beneficial pollinating insects, mammals, and benthic macroinvertebrates.

3. Landscape Restoration Work Area

The Eighteenmile Creek restoration work area is identified in the attached Site Plan (see Figures 1 and 2). The landscape design and the planting plan were developed to provide controlled public access, erosion control, a native plant community, and wildlife habitat. The existing trail section targeted for restoration is located along the east side of the creek channel and measures approximately 1,400 lineal feet (LF) beginning at the base of the access stairs/ramp and ending at Burt Dam. The stepped riprap and flat stone wall begins approximately 850 LF from the access stairs and ends approximately 300 LF downstream from the dam. The planting plan involves streamside sections within the project work area from the access point to the dam.

For the purposes of developing the planting plan, the restoration work area is divided into three planting zones. The planting zones are characterized by different hydrologic regimes and corresponding tolerances of species assemblages, and landscape position. Plant species selected for use in the three planting zones are associated with the United States Fish and Wildlife Service (USFWS) wetland indicator classification for plant species that occur in this region. Definitions of the wetland indicator classifications are provided in Tables 2 and 3. The planting zones are described below.

- Planting Zone 1 represents the shallow in-stream toe of slope creek-bank interface and is recommended to consist of obligate (OBL) and facultative wetland (FACW) plant species. This zone is also found in an area along trail sections where the trail and streamside are adjacent to each other, and at similar elevations.
- Planting Zone 2 is upgradient from Zone 1 and represents a transition area along the stream bank that is, under normal flow conditions, above the stream inundation zone but is characterized by saturated-to-moist soil conditions. The elevations and slopes associated with this zone typically lack the hydrology to support OBL species but can sustain facultative (FAC) and FACW species.

Table 3. Plant Species Selected for Shrub Layer Restoration within Riparian Zone, Eighteenmile Creek, Niagara County

Botanical Name	Common Name	Indicator*	Zone**
<i>Alnus incana</i> ssp. <i>rugosa</i>	Speckled Alder	FACW	1, 2 S
<i>Cephalanthus occidentalis</i>	Button Bush	OBL	1 FS
<i>Cornus alternifolia</i>	Pagoda Dogwood	FAC	3 S
<i>Cornus amomum</i>	Silky Dogwood	FAC	2, 3 FS
<i>Cornus stolonifera</i>	Redosier Dogwood	FACW	2 FS
<i>Lindera benzoin</i>	Spicebush	FACW	3 S
<i>Myrica pensylvanica</i>	Northern Bayberry	FAC	3 S
<i>Rubus allegheniensis</i>	Common Blackberry	FACU	3 S
<i>Salix purpurea</i> 'streamco'	Streamco Willow	OBL	1, 2 FS
<i>S. sericea</i>	Silky Willow	OBL	2, 3 F
<i>Sambucus canadensis</i>	Elderberry	FACW	2, 3 S
* Indicator Categories:			
Obligate Wetland (OBL). Almost always occurs in wetlands (estimated probability > 99%) under natural conditions.			
Facultative Wetland (FACW). Usually occurs in wetlands (estimated probability 67% - 99%), but occasionally found in non-wetlands.			
Facultative (FAC). Equally likely to occur in wetlands (estimated probability 34% - 66%) or non-wetlands.			
Facultative Upland (FACU). Usually occur in non-wetlands (estimated probability 67% - 99%), but occasionally found in wetlands (estimated probability 1% - 33%).			
** Planting Zones and Planting Schedule: F – Fall 2003, S – Spring 2004			
1 - OBL emergent, 2 - PSS palustrine/shrub-scrub, 3 - FAC/FACU upland trail corridor			

- Planting Zone 3 is upgradient of Planting Zones 1 and 2 and represents areas that are typically drier than Zones 1 and 2 due to the distance from, and elevation above, the stream channel, and due to normal flow conditions and slope. These elevations and slopes are more likely to support FAC, facultative upland (FACU) or upland (UPL) plant communities. This planting zone, which includes areas immediately above the trail, will be planted with native species that exhibit erosion control properties.

4. Landscape Restoration Design and Project Timeline

The landscape design/planting plan was initially developed on an anticipated construction start date of late Spring or early Summer. Construction, however, did not begin until September 2003. The shift in seasons resulted in the development of a phased approach to implementing the planting plan and completing landscape restoration. Phase I efforts involved employment of soil stabilization methods during and after construction. Erosion and sediment control included the installation of a silt curtain within in the creek and an erosion control blanket on all disturbed soil surfaces, seeding, planting of rooted cuttings, dug plants, and propagated grasses in plug form. Phase II will involve a combination of over seeding and planting of dormant and containerized plants in the Spring 2004.

Phase I

Site preparation began with clearing a haul road over a severely eroded existing access trail 15 LF wide by 15 LF in height for heavy equipment access. Valuable trees and shrubs along the travel corridor and at streamside were flagged and protected from damage during construction. The haul road and staging area was aligned with the access trail to minimize disturbance. All vegetation that was cut to accommodate the ingress and egress of construction vehicles was used in installation of bioengineering structures along the stream channel or as brush piles for habitat value in the riparian zone. An erosion control seed mix suitable for late season planting in western New York was seeded in all disturbed soil in October 2003. A coir fiber erosion control blanket was installed over all disturbed soil areas after seeding was completed. Approximately 150 rooted cuttings of a mixture of silky dogwood (*Cornus amomum*), redosier dogwood (*C. stolonifera*), buttonbush (*Cephalanthus occidentalis*), silky willow (*Salix sericea*), and streamco willow (*S. purpurea*) were planted in designated planting zones. Some plants were planted in soil through openings cut into the erosion control mat. Photographs are included in this document to present representative areas along the restoration work area (see Photographs, Appendix A). Over 200 switch grass (*Panicum virgatum*) plants were planted into the erosion control mat in late September.

Phase II

Seed mixes from Ernst Conservation Seed, Inc. (see Table 4) have been selected for seeding to complement plant restoration of disturbed areas in spring of 2004 within each of the three identified planting zones. A combination of plant forms will be used during spring planting to complete the landscape restoration effort that includes: live stakes, rooted cuttings, container grown plant material and seedling plugs.

According to 2002 statistics recorded by the Town of Newfane on the number of people checked into the parking area which accesses the project area, it is expected that

Table 4. Grass and Forb Seed Mixes Selected for Spring 2004 Planting, Eighteenmile Creek, Niagara County

Planting Zone No. 1		
SPECIALIZED WETLAND MIX OR SHADED OBL-FACW MIX: ERNMX-137		
25%	<i>Carex vulpinoidea</i>	Fox Sedge
25%	<i>Elymus virginicus</i>	Virginia Wild Rye
8%	<i>Sparganium americanum</i>	Eastern Bur Reed
7%	<i>Juncus effusus</i>	Soft Rush
6.5%	<i>Onoclea sensibilis</i>	Sensitive Fern
5%	<i>Aster umbellatus</i>	Flat Topped/Umbrella Aster
5%	<i>Scirpus polyphyllus</i>	Many Leaved Bulrush
5%	<i>Carex comosa</i>	Cosmos Sedge
5%	<i>Carex lurida</i>	Lurid Sedge
3%	<i>Sagittaria latifolia</i>	Duck Potato/Arrowhead
2%	<i>Carex lupulina</i>	Hop Sedge
1%	<i>Carex crinita</i>	Fringed Sedge
1%	<i>Dulichium arundinaceum</i>	Three Way Sedge
0.5%	<i>Cinna arundinacea</i>	Wood Reedgrass
0.5%	<i>Juncus canadensis</i>	Canada Rush
0.5%	<i>Caltha palustris</i>	Marsh Marigold
Planting Zone No. 2		
OBL-FACW PERENNIAL FOOD AND COVER WETLAND MIX: ERNMX-120		
20%	<i>Elymus virginicus</i>	Virginia Wild Rye
12%	<i>Onoclea sensibilis</i>	Sensitive Fern
11%	<i>Carex vulpinoidea</i>	Fox Sedge
8%	<i>Sparganium eurycarpum</i>	Giant Bur Reed
7%	<i>Verbena hastata</i>	Blue Vervain
6%	<i>Bidens cernua</i>	Nodding Bur Marigold
6%	<i>Scirpus cyperinus</i>	Wool Grass
5%	<i>Polygonum arifolium</i>	Tearthumb
5%	<i>Sparganium americanum</i>	Eastern Bur Reed
4%	<i>Aster umbellatus</i>	Flat Topped/Umbrella Aster
4%	<i>Juncus effusus</i>	Soft Rush
3%	<i>Asclepias syriaca</i>	Common Milkweed
3%	<i>Carex comosa</i>	Cosmos Sedge
3%	<i>Carex lurida</i>	Lurid Sedge
2%	<i>Carex lupulina</i>	Hop Sedge
1%	<i>Carex crinita</i>	Fringed Sedge
Planting Zone No. 3		
FLOOD PLAIN WILDLIFE MIX: ERNMX-154		
15%	<i>Panicum clandestinum</i>	Tioga Deer Tongue
15%	<i>Carex vulpinoidea</i>	Fox Sedge
9%	<i>Elymus riparius</i>	Riverbank Wild Rye
8%	<i>Elymus canadensis</i>	Canada Wild Rye
8%	<i>Elymus villosus</i>	Silky Wild Rye
7%	<i>Asclepias syriaca</i>	Common Milkweed
5%	<i>Verbesina alternifolia</i>	Wingstem
5%	<i>Aster umbellatus</i>	Flat Topped/Umbrella Aster
5%	<i>Bidens cernua</i>	Nodding Bur Marigold
3%	<i>Andropogon gerardii</i>	Big Bluestem
3%	<i>Eupatorium maculatum</i>	Spotted Joe Pye Weed
3%	<i>Rudbeckia hirta</i>	Black Eyed Susan
3%	<i>Monarda fistulosa</i>	Wild Bergamot
2%	<i>Panicum virgatum</i>	Switch Grass
2%	<i>Senna marilandica</i>	Maryland Senna
2%	<i>Vernonia noveboracensis</i>	New York Ironweed
2%	<i>Zizia aurea</i>	Golden Alexanders
1%	<i>Aster novae-angliae</i>	New England Aster
1%	<i>Silphium perfoliatum</i>	Cup Plant
1%	<i>Geum laciniatum</i>	Rough Avens

approximately 10,000 anglers will visit the project site annually. Monitoring of fishing activity and foot traffic patterns will allow the project team to adjust the final planting design, as necessary. Adjustments to the planting design may involve attempts to influence foot travel access patterns to prevent damage to vegetation and to steer visitors away from sensitive streamside habitat features.

5. Bioengineering Techniques

The overall concept in the design and construction phases of the project was to "do no harm". Essentially, this involves the documentation of existing natural functions within the project area and to ensure that no action is taken that would result in the degradation of the stream or adjacent riparian zone. The following bioengineering techniques were employed during construction within the restoration work area to enhance aquatic and terrestrial habitat. The first three techniques described are attributed to Dave Derrick, a stream restoration specialist with the USCAE Waterways Experiment Station in Vicksburg Mississippi. Mr. Derrick was instrumental in providing input and direction on the bioengineering aspects of this project.

Locked Limb/Locked Log

This method consists of small trees and/or small woody debris. Limbs with leaves, sections of small tree trunks, and tree tops that were cut for trail clearing were anchored along the toe of the bank and within the stream channel. The limbs/logs were set in such a way so as to protrude into deeper scoured areas to provide in-stream cover, vertical and horizontal structure, and refuge areas for fish and other aquatic species. Locked limbs are typically less than 2" inches in diameter; locked logs are greater than 2 inches in diameter

Instant Shade and Extreme Instant Shade

Prior to construction trees along the streamside were flagged and protected wherever possible. The bases of some trees were located within the area that was to be used for the construction haul road and access trail. These trees were pushed into a near horizontal position over the water surface and buttressed near the root zone with stone to prevent them from falling into stream channel, and backfilled with topsoil. A proportionate amount of foliar mass especially on the underside, or waterside, of the "pushed trees" was removed in relation to root system loss to encourage recovery by reducing excessive transpiration.

An "extreme instant shade" (terminology borrowed from Derrick) method was implemented using a particular black willow as a reference tree. It appeared that some time ago, the mature reference tree had fallen into the channel on top of a log in an area of the stream that is approximately 18 inches deep. The willow in time had grown horizontal but formed a dense foliar mass in the shape of an umbrella, which provided dense shade and habitat for a variety of aquatic species. The project team salvaged a number of 20-foot sections of black willow cut from the new trail corridor. The poles were approximately 6 to 8 inches in diameter. The butt ends were keyed into cavities excavated at streamside within the moist soil zone in areas that were already eroded or disturbed. The poles extended 12 to 15 feet into the stream where they rested above water level on a placed boulder.

Stump Habitat

Large stumps and root wads were cut and removed from the route of the new trail corridor. These large structures were placed in the stream channel close to the bank so that they are partially submerged. It is expected that these structures will encourage colonization of aquatic plant species thereby encouraging beneficial insects as well as producing in stream structure and habitat for a variety of benthic and other aquatic organisms.

Pole Planting in Riprap and Stepped Wall

Streamco willow (*Salix purpurea*) poles were harvested from a donor site in 20 foot plus lengths prior to construction. Although it is recommended to propagate cut poles during the dormant season, it was decided to utilize the available poles because of the construction timeline. An innovative method that involved cutting apical growth and presoaking wrapped poles for a minimum of 10 days was used to increase survivability.

The poles were placed in cavities along the stepped wall in appropriate locations with butt ends driven into the moist soil zone at water level. The cavities were back filled with topsoil. Within a few weeks of planting, the poles had sprouted new growth. Root growth is anticipated as well. Monitoring of the pole plantings will begin in Spring 2004.

Live Stakes

Donor sites have been identified for harvest of dormant live stakes to supplement purchase from vendors for early the Spring 2004 (Phase II) planting. Buttonbush (*Cephalanthus occidentalis*), Silky Dogwood (*Cornus amomum*), Red Osier Dogwood (*C. stolonifera*), Speckled Alder (*Alnus incana*), and Silky Willow (*Salix sericea*) will be planted primarily in those areas disturbed by construction activities or erosion according to individual species suitability.

6. Conclusions

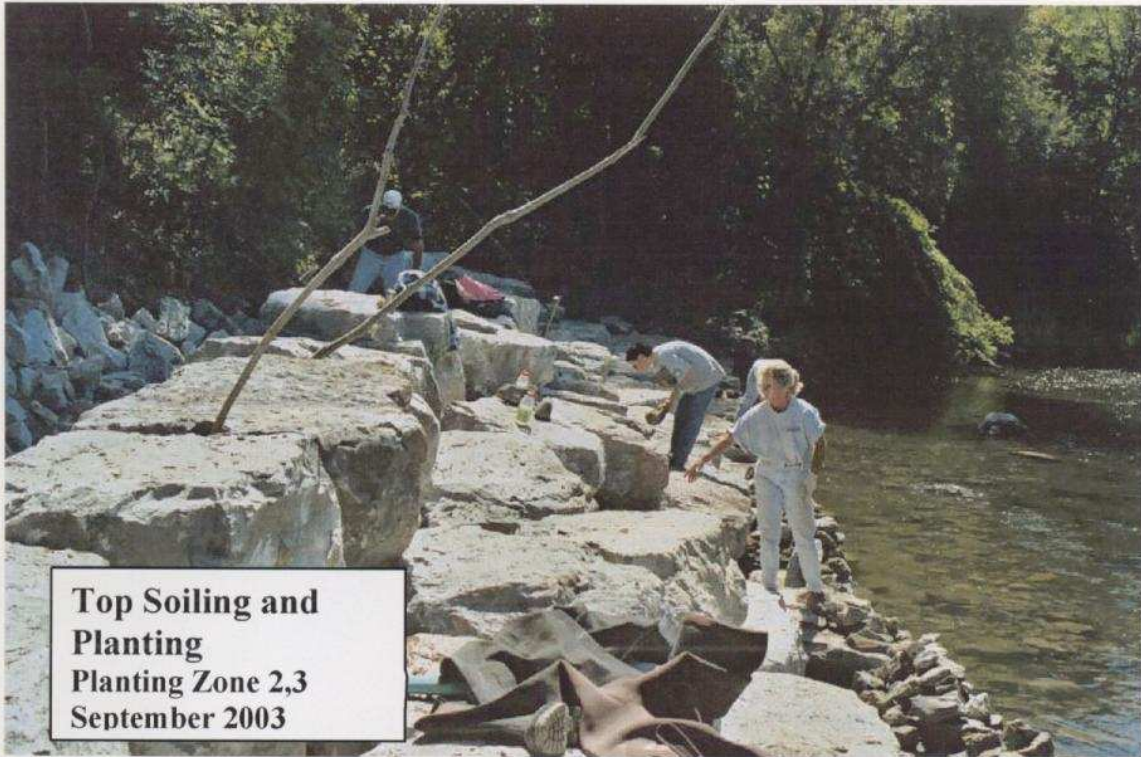
The planting plan and bioengineering methods implemented within the restoration work area are compatible components of the overall trail restoration and stabilization design. An enhanced native plant community will be in place upon completion of the Phase II planting in Spring 2004. The species assemblages will improve habitat for aquatic and terrestrial faunal species within the riparian zone. Significant improvement in sediment and erosion control and bank stabilization will be realized as well due to the integration of deep rooted plant species with the stone, riprap, and stepped wall construction. Selected grass, forb, and shrub species were chosen for access trail apron and streamside zones. Cavity or pocket planting in stone or armored areas with adequate sun exposure will assist in attenuating storm water run off and stabilizing the soil. The existing native species seed bank will be significantly improved by these additions, and seed dispersal is likely to occur within the riparian corridor. It is expected that these plants will become established relatively quickly in this environment and tolerate seasonal recreational (i.e., fishing access) traffic that occurs primarily after the growing season.

A restoration-monitoring plan will be developed by members of the project team that will document the survival and establishment of vegetation to ensure compliance with contractor warranties or obligations. Stewardship opportunities will be identified where stakeholders will be engaged to perform a variety of management tasks to ensure landscape establishment and overall restoration design performance.

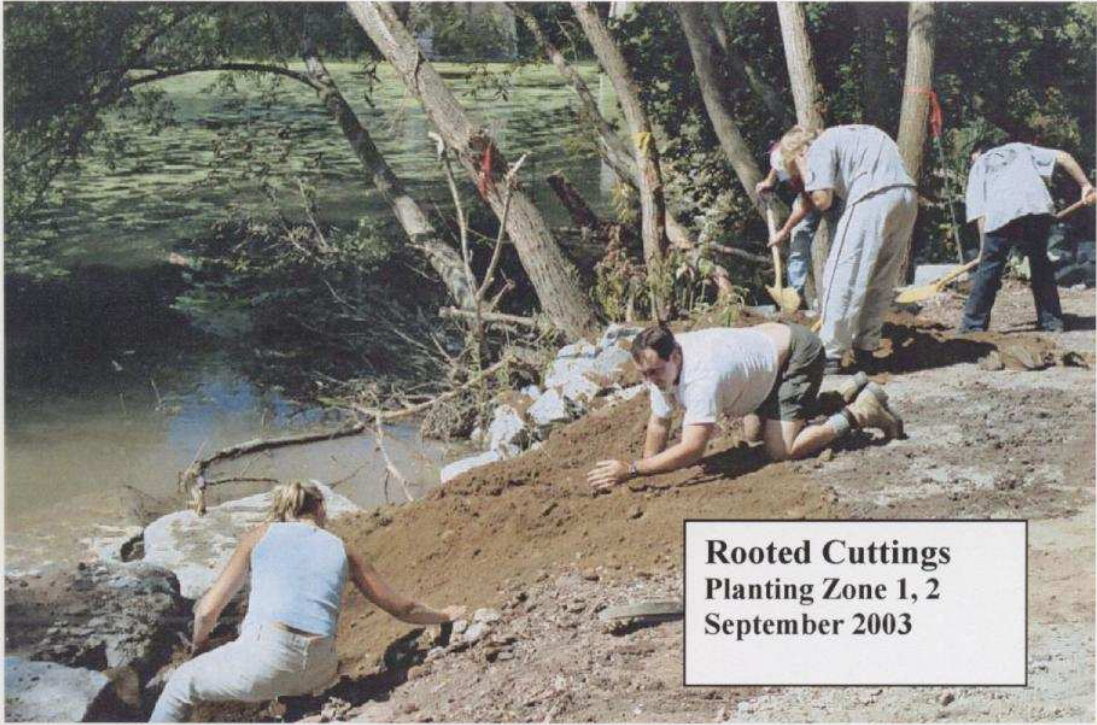
Appendix A

Representative Photographs of Phase I Landscape Restoration Activities in September and October 2003

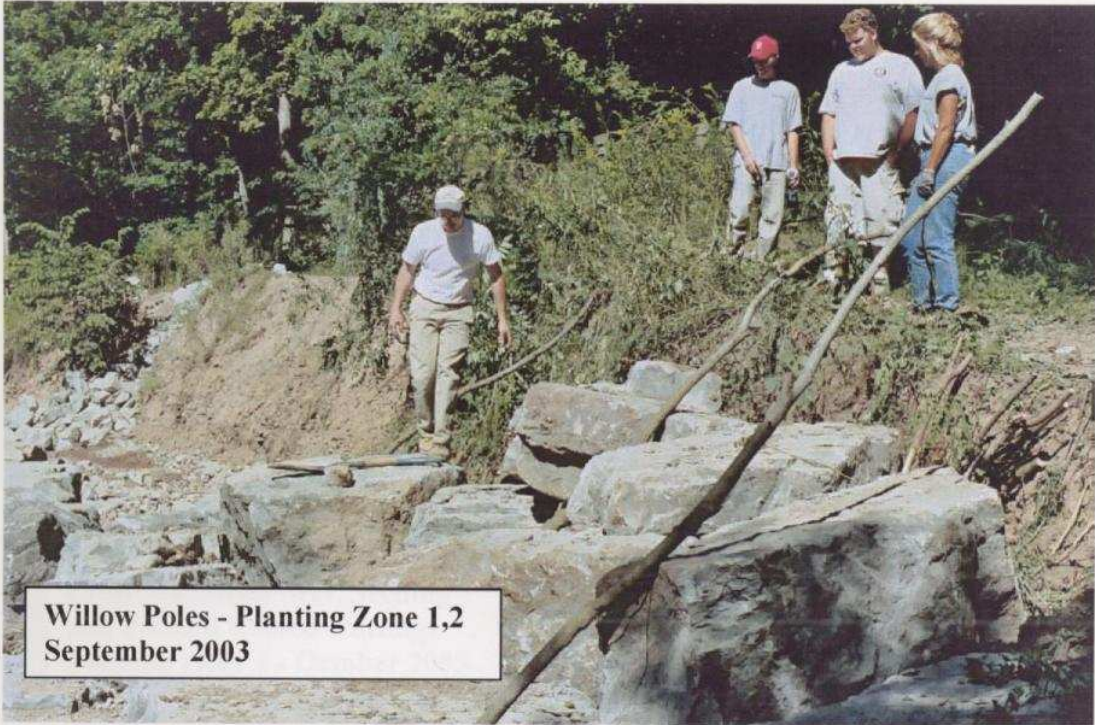
Top Soiling and
Planting
Planting Zone 2,3
September 2003



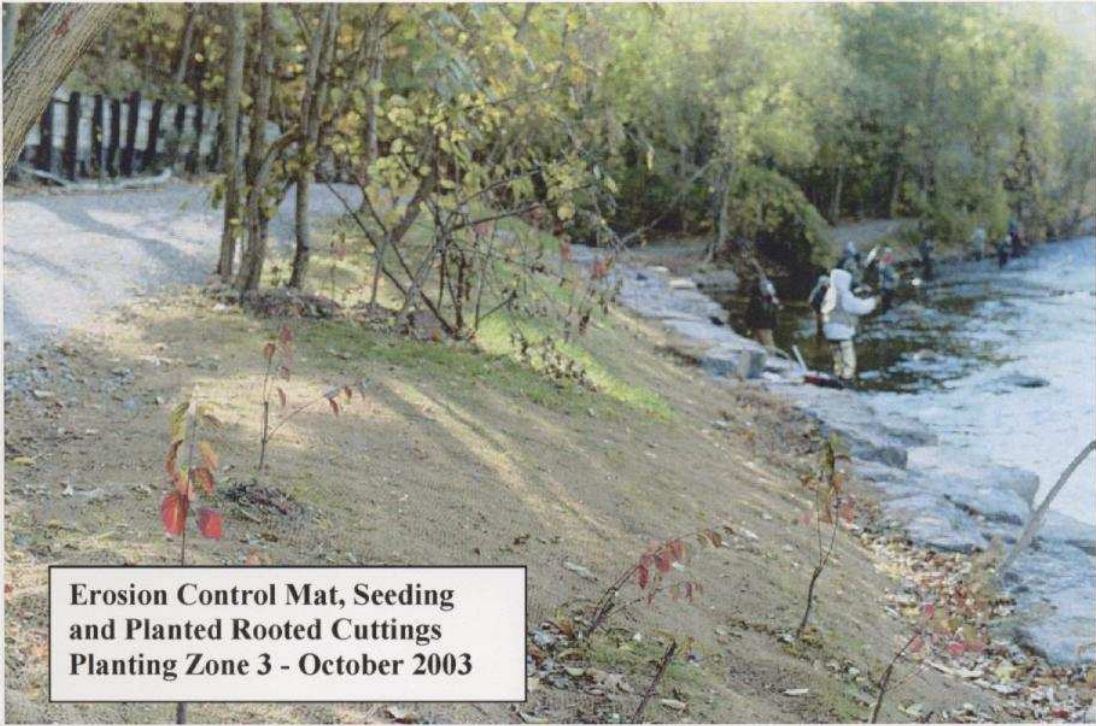
**Top Soiling and
Planting
Planting Zone 2,3
September 2003**



**Rooted Cuttings
Planting Zone 1, 2
September 2003**



**Willow Poles - Planting Zone 1,2
September 2003**



**Erosion Control Mat, Seeding
and Planted Rooted Cuttings
Planting Zone 3 - October 2003**