

Maidstone Slide – STP 0271 (20)

Year 1 Report

**Wetland and Invasive Species Monitoring
and Control Recommendations**



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Summary Conclusions and Recommendations

Monitoring of the wetland impacted by the construction of a temporary access road was conducted in accordance with the Invasive Species Management, Planting and Monitoring Plan¹ for the Maidstone STP 0271(20) project. The temporary access road was constructed during spring 2013 and was restored following construction. During late September 2013, observation plots were used to assess the overall vegetative success in the restored wetland and the presence/absence of invasive species. A general assessment of site stability, wetland hydrology and wetland function was made by ecologist Marc Lapin.

Based on the first year of monitoring, the wetland area disturbed by the construction of the access road appeared to be successfully revegetated and was stable. Vegetative cover was estimated to be 85 percent and no invasive exotic shrubs were found in the re-vegetated area. Numerous non-native herbaceous species were observed in the restored area; however, none of these species are listed in Vermont or New Hampshire as invasive species. Control of reed canary grass and wild parsnip by hand pulling is recommended during the 2014 growing season. The diverse native wetland seed mix was useful for providing a diversity of plant species, as differential success of plants was evident along the moisture gradient.

There is no evidence that the project removed the wetland's ability to perform its previously documented functions of water storage, surface and groundwater protection and erosion control. Differences pre- and post-project in these functions are minor and are attributed to the microtopography of the wetland being altered and the presence of angular stone in the surface horizon. Alterations due to compaction and soil mounding were estimated to be less than 5% of the project area. Wildlife habitat functionality has been diminished in the short term due to a shift from a forest-dominated wetland to herbaceous vegetation. As tree and shrub cover is re-established over time, the wildlife functionality is expected to improve.

¹ Bear Creek Environmental, LLC. Biological Services Team. 2012. Invasive Species Management, Planting and Monitoring Plan for Maidstone STP 0271(20). Vermont Agency of Transportation-Slope Failure on VT Route 102 Adjacent to Connecticut River. Montpelier, Vermont.

Background

The Bear Creek Environmental, LLC Biological Services Team was retained by the Vermont Agency of Transportation to prepare an Invasive Species Management, Planting and Monitoring Plan for the Maidstone STP 0271(20) project. The Plan includes measures to reduce impacts to wetlands, to prevent the proliferation of invasive species, to restore wetland disturbed by the construction of a temporary access road, and to monitor the restored wetland. The following report provides a summary of the first year of monitoring after the construction of the temporary access road and subsequent restoration of the wetland. Monitoring of the restored wetland is a condition of the Army Corps of Engineers' Permit NAE-2011-0346 dated December 17, 2012.

The Maidstone STP 0271(20) project included the construction of a temporary road to allow construction access to repair a large slope failure on a cutbank of the Connecticut River that was threatening Route 102 in the town of Maidstone, Vermont (Figure 1). The temporary access road (Figure 2) was constructed during April 2013 and in part followed the pathway of an existing woods road that was located between VT Route 102 and the Connecticut River. The former access road was approximately 20 feet wide and included a disturbance width of between 30 and 40 feet. Following construction, the wetland was restored by removing the geotextile and road gravels down to the original grades. The site was seeded with wetland native seed mix in wetland areas and upland native seed mix in non-wetland areas adjacent to the wetland and then mulched. Straw mulch was applied to avoid the introduction of weeds and invasive species. Per the Maidstone Plan, the seeds for two uncommon species were harvested and stored for planting following construction. These uncommon species include Wiegand's wild-rye (*Elymus wiegandii*) and rough avens (*Geum laciniatum*). Marc Lapin, Ecologist with Ecosystem Conservation Science, sowed the seeds on June 23, 2013. The stabilized construction entrance was removed and planted with native trees and shrubs. The silt fence, located adjacent to the oxbow, was taken out during fall 2013 to allow flooding of the restored wetland. During the fall dormancy period, live dogwood and willow stakes were installed in the riprap in the wetland buffer.

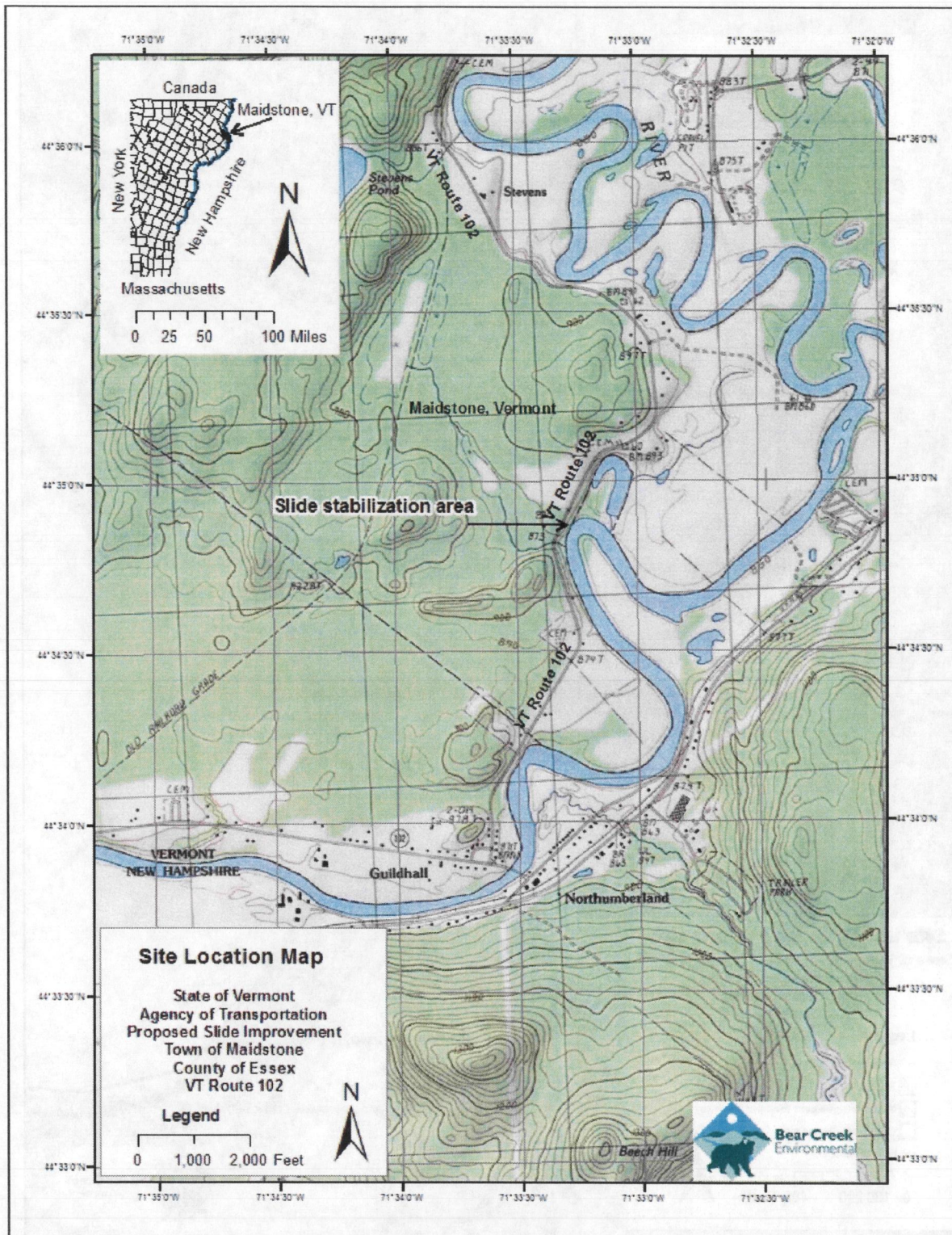


Figure 1. Site Location Map for Maidstone STP 0271(20) Project

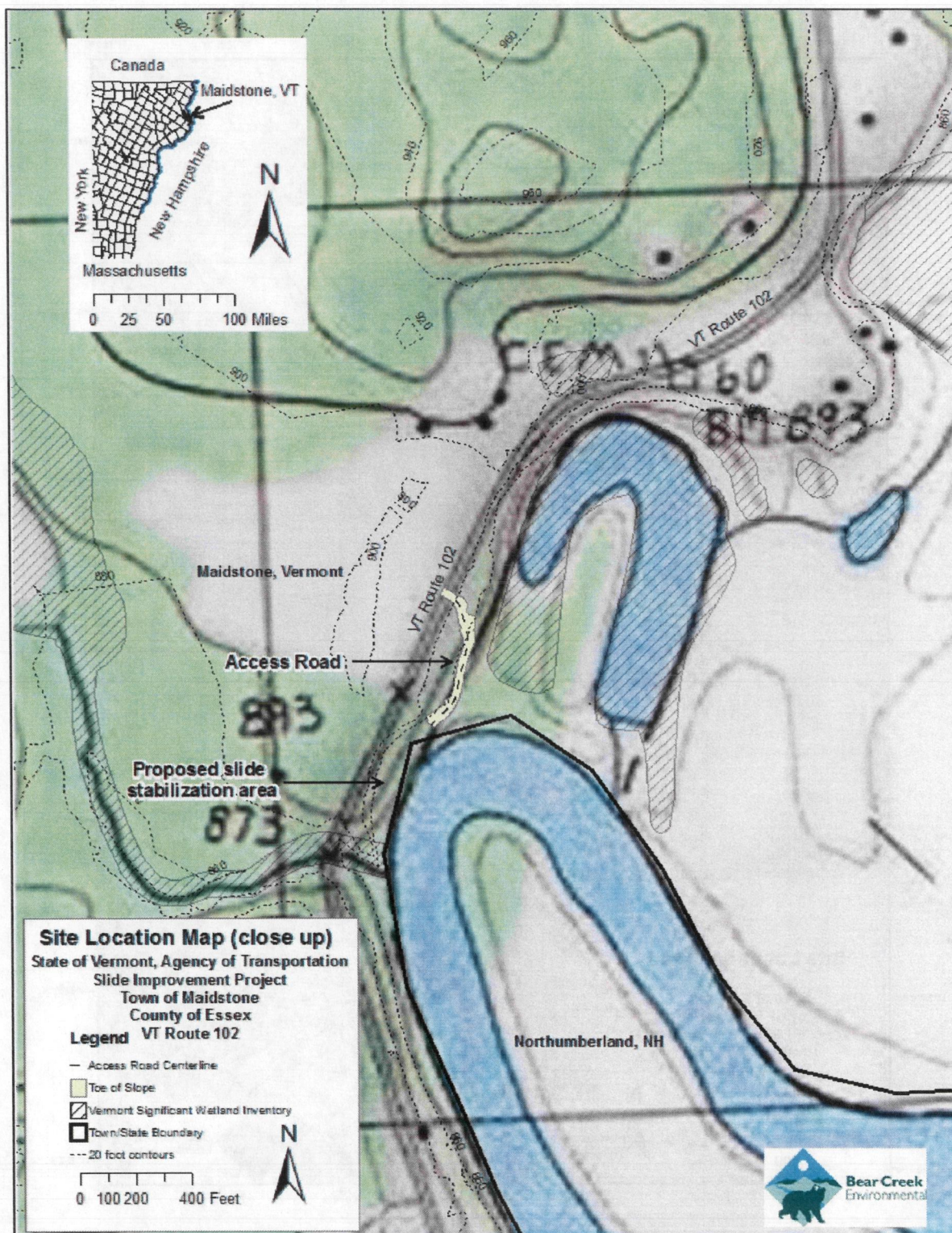


Figure 2. Location of Former Temporary Access Road

Marc Lapin of Ecosystem Conservation Science and Mary Nealon of Bear Creek Environmental, LLC visited the Maidstone site on September 27, 2013 to conduct the first year of monitoring. The site is to be monitored for five years during the growing season, beginning the first growing season following the completion of the restoration activities. There are five general monitoring objectives:

1. Evaluation of the overall vegetative success in the wetland noting relative abundance of hydrophytic plant species within the restored wetland areas with a goal of 80 percent vegetative cover by native (non-invasive) species
2. Assessment of the presence/absence of invasive species within the restored wetland areas
3. General assessment of site stability and erosion control of wetland and adjacent area
4. General assessment of the presence of hydric soils and corresponding wetland hydrology
5. General assessment of wetland function

Methods

To quantitatively evaluate plant species composition two 5 x 5 m plots were established within the restored wetland area where the access road had been removed. Each permanent observation point was marked with a stake and surveyed with a Mobile Mapper 100, GPS unit, capable of sub-meter accuracy. Documentation at the observation points included the identification of all vascular plant species present and a corresponding estimate of percent cover. An overall approximation of percent cover of invasive species on the site was made.

Presence/absence of the three recognized wetland indicators (i.e., dominance by hydrophytic vegetation, presence of hydric soils, and indication of wetland hydrology) were assessed within the restored wetland areas. Wetland function was evaluated using the U.S. Army Corps of Engineers New England District Highway Methodology Workbook (USACE 1999) as a general guide.

Re-Vegetation of the Restored Access Road

The wetland area disturbed by the construction of the temporary access road was re-vegetated with good success following removal of the road. At the end of the first growing season over 85% of the area had plant cover, with 0% cover of invasive exotic shrubs. In some re-vegetated areas within the roadway, herbaceous exotic plants, moneywort (*Lysimachia nummularia*) and wild basil (*Clinipodium vulgare*), comprised 20 to 30% of the plant cover. Neither of these abundant exotic herbs is listed as an invasive species or noxious weed in Vermont,² although moneywort is on the New Hampshire Invasive Species Committee's watch list.³

Two 5 x 5 m plots (Figure 3) were established to document vegetation and soils in a very wet portion of the restored roadway (Table 1) and a dry portion of the restored roadway (Table 2). Although there was some overlap in the common species in the two plots, each plot had different dominant species. The usefulness of a diverse native species seed mix to aid re-establishment of vegetation is apparent, since there was differential success among species along the moisture gradient.

In her wetland delineation, Gustafson⁴ documented black ash (*Fraxinus nigra*) and silver maple (*Acer saccharinum*) as tree stratum dominants. Approximately six silver maple seedlings and no black ash were observed in the 5 x 5 m Plot 1 sample. Neither species was observed in Plot 2. In the shrub stratum she recorded black ash, choke cherry (*Prunus virginiana*) and highbush-cranberry (*Viburnum trilobum*). Of these three species, only choke cherry was observed in the restored roadway; as one would expect it was in the drier area (Plot 2 and the southern part of the site) and not within the wettest part of the restored area.

² <http://www.vtinvasives.org/plants/plant-quarantine-rule>

³ http://agriculture.nh.gov/divisions/plant_industry/documents/invasive-watch-list.pdf

⁴ Gustafson, S. 2011. Memo to John Lepore, VT Agency of Transportation. Re: Maidstone Slide Wetlands Evaluation, December 31, 2011. Shelley Gustafson Environmental, Ferrisburgh, VT.

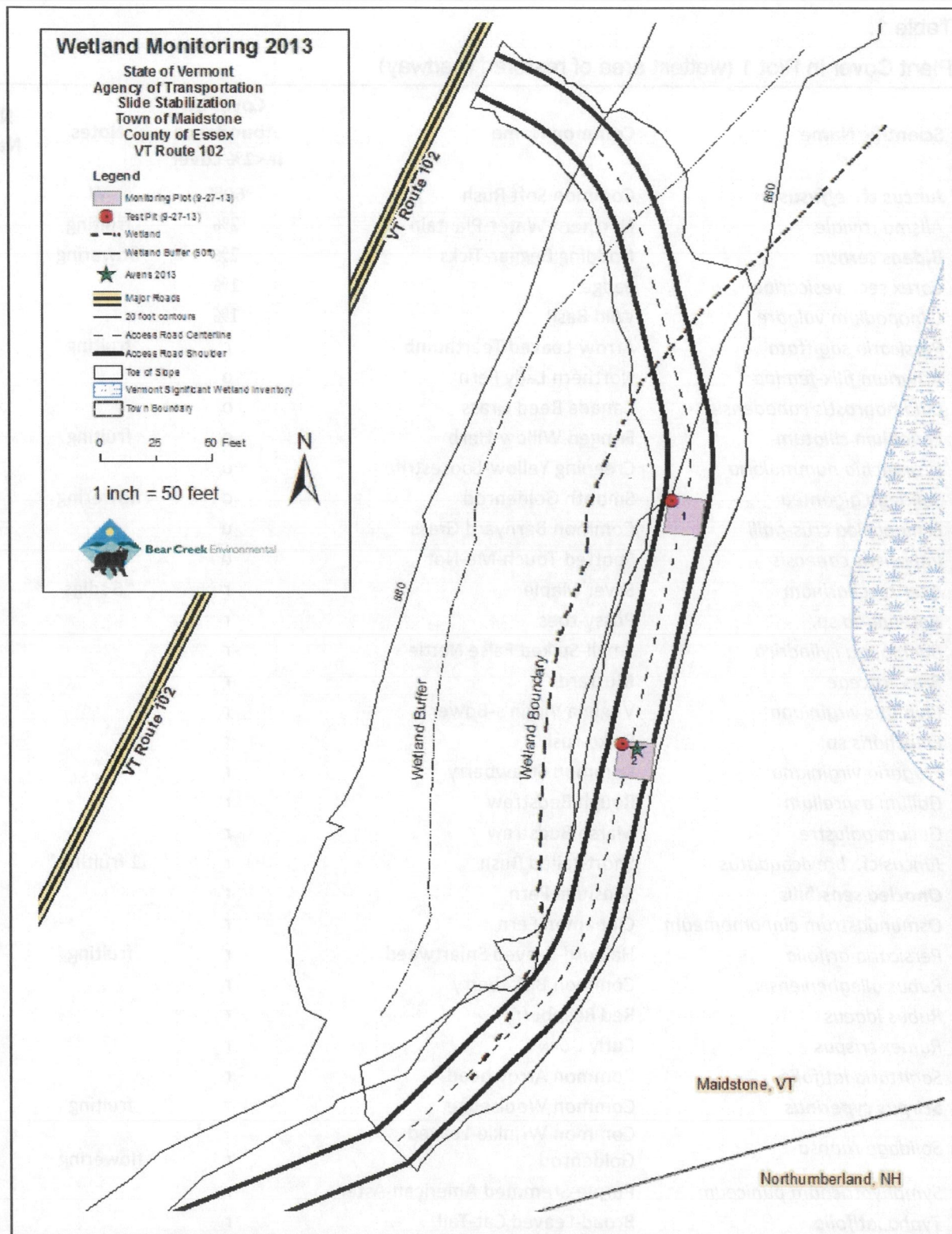


Figure 3. Wetland Monitoring Plots (September 27, 2013)

Table 1.

Plant Cover in Plot 1 (wettest area of restored roadway)

Scientific Name	Common Name	Cover or Abundance if <1% cover	Notes	Non-Native
<i>Juncus cf. effusus</i>	Common Soft Rush	60%	W	
<i>Alisma triviale</i>	Northern Water-Plantain	2%	fruiting	
<i>Bidens cernua</i>	Nodding Beggar-Ticks	2%	flowering	
<i>Carex sec. vesicariae</i>	Sedge	1%		
<i>Clinopodium vulgare</i>	Wild Basil	1%		*
<i>Persicaria sagittata</i>	Arrow-Leaved Tearthumb	c	fruiting	
<i>Athyrium filix-femina</i>	Northern Lady Fern	o		
<i>Calamagrostis canadensis</i>	Canada Reed Grass	o		
<i>Epilobium ciliatum</i>	Fringed Willow-Herb	o	fruiting	
<i>Lysimachia nummularia</i>	Creeping Yellow-Loosestrife	o		*
<i>Solidago gigantea</i>	Smooth Goldenrod	o	flowering	
<i>Echinochloa crus-galli</i>	Common Barnyard Grass	u		*
<i>Impatiens capensis</i>	Spotted Touch-Me-Not	u		
<i>Acer saccharinum</i>	Silver Maple	r	~6 sdls	
<i>Antennaria</i> sp.	Pussy-toes	r		
<i>Boehmeria cylindrica</i>	Small-Spiked False Nettle	r		
<i>Brassicaceae</i>	Mustard	r		*
<i>Clematis virginiana</i>	Virginia Virgin's-Bower	r		
<i>Eleocharis</i> sp.	Spike-rush	r		
<i>Fragaria virginiana</i>	Common Strawberry	r		
<i>Galium asprellum</i>	Rough Bedstraw	r		
<i>Galium palustre</i>	Marsh Bedstraw	r		
<i>Juncus cf. brevicaudatus</i>	Short-tailed Rush	r	1 fruiting	
<i>Onoclea sensibilis</i>	Sensitive Fern	r		
<i>Osmundastrum cinnamomeum</i>	Cinnamon Fern	r		
<i>Persicaria arifolia</i>	Halberd-Leaved Smartweed	r	fruiting	
<i>Rubus allegheniensis</i>	Common Blackberry	r		
<i>Rubus idaeus</i>	Red Raspberry	r		
<i>Rumex crispus</i>	Curly Dock	r		*
<i>Sagittaria latifolia</i>	Common Arrowhead	r		
<i>Scirpus cyperinus</i>	Common Woosedge	r	fruiting	
<i>Solidago rugosa</i>	Common Wrinkle-Leaved Goldenrod	r	flowering	
<i>Symphotrichum puniceum</i>	Purple-Stemmed American-Aster	r		
<i>Typha latifolia</i>	Broad-Leaved Cat-Tail	r		
<i>Geum</i> sp.	Avens	single plant		

Bold denotes species included in wetland seed mix

Table 2.

Plant Cover in Plot 2 (dry area in restored roadway)

Scientific Name	Common Name	Cover or Abundance if <1% cover	Non-Native
Poaceae	Grasses (Fine-leaved)	60%	
<i>Clinopodium vulgare</i>	Wild Basil	20%	*
<i>Solidago gigantea</i>	Smooth Goldenrod	20%	
<i>Leersia oryzoides</i>	Rice Cut Grass	15%	
<i>Lysimachia nummularia</i>	Creeping Yellow-Loosestrife	10%^	*
<i>Calamagrostis canadensis</i>	Canada Reed Grass	5%	
<i>Setaria</i> sp.	Foxtail Grass	2%	*
<i>Arctium lappa</i>	Great Burdock	1%	*
<i>Athyrium filix-femina</i>	Northern Lady Fern	1%	
Bidens cernua	Nodding Beggar-Ticks	1%	
<i>Clematis virginiana</i>	Virginia Virgin's-Bower	1%	
<i>Hordeum jubatum</i>	Foxtail Barley	1%	
<i>Impatiens capensis</i>	Spotted Touch-Me-Not	1%	
<i>Phalaris arundinacea</i>	Reed Canary Grass	1%	*
<i>Prunus virginiana</i>	Choke Cherry	1%	
<i>Sambucus nigra</i>	Black Elderberry	1%	
<i>Dryopteris carthusiana</i>	Spinulose Wood Fern	c	
<i>Oxalis corniculata</i>	Creeping Yellow Wood Sorrel	c	*
<i>Plantago</i> cf. <i>major</i>	Common Plantain	c	*
<i>Agrimonia gryposepala</i>	Common Agrimony	o	
Agrostis sp.	Bentgrass	o	
<i>Equisetum hyemale</i>	Tall Scouring-Rush	o	
Onoclea sensibilis	Sensitive Fern	u	
<i>Solanum dulcamara</i>	Climbing Nightshade	u	*
<i>Amphicarpaea bracteata</i>	American Hog-Peanut	r	
<i>Boehmeria cylindrica</i>	Small-Spiked False Nettle	r	
<i>Carex</i> cf. <i>lacustris</i>	Lakeside Sedge	r	
<i>Epilobium ciliatum</i>	Fringed Willow-Herb	r	
Eutrochium maculatum	Spotted Joe-Pye Weed	r	
<i>Galium asprellum</i>	Rough Bedstraw	r	
<i>Galium palustre</i>	Marsh Bedstraw	r	
<i>Matteuccia struthiopteris</i>	Ostrich Fern	r	
<i>Pastinaca sativa</i>	Wild Parsnip	r	*
<i>Persicaria hydropiper</i>	Water-Pepper Smartweed	r	
<i>Persicaria maculosa</i>	Lady's-Thumb Smartweed	r	*
<i>Rumex crispus</i>	Curly Dock	r	*

Table 2 (continued)

Scientific Name	Common Name	Cover or Abundance if >1% cover	Non-Native
<i>Solanum nigrum</i>	European Black Nightshade	r	*
<i>Symphyotrichum cordifolium</i>	Heart-Leaved American-Aster	r	
<i>Symphyotrichum lateriflorum</i>	Calico American-Aster	r	
<i>Thalictrum pubescens</i>	Tall Meadow-Rue	r	
<i>Geum</i> cf. <i>laciniatum</i>	Rough Avens	single plant	
Bold denotes species included in wetland seed mix			

^ difficult to estimate cover due to dense overtopping growth of taller plants

Gustafson recorded the following herbs in her delineation plot: Virginia virgin's-bower (*Clematis virginiana*), moneywort, ostrich fern (*Matteucia struthiopteris*), lady fern (*Athyrium filix-femina*), wild cucumber (*Echinocystis lobata*), rough bedstraw (*Galium asprellum*), tall meadow-rue (*Thalictrum pubescens*), aster (*Aster* sp.), and avens (*Geum* sp.). In Plot 1, six of the nine species were present; absent were ostrich fern, wild cucumber and tall meadow-rue (note name change of aster (*Aster*) to American-aster (*Symphyotrichum*)). In Plot 2, only wild cucumber was not present. Although it did not occur in either plot, we did observe wild cucumber in other parts of the restored roadway (Table 3). Thus, all of the dominant herbs recorded during wetland delineation were present in the restored area at the end of the first growing season. Photo documentation of the vegetation is included as Appendix 1.

Invasive Species Observations

During pre-construction plant surveys in 2012 we observed an abundance of glossy buckthorn (*Rhamnus frangula*) in the upland forest adjacent to the project site, and occasional glossy buckthorn within the wetland. We also noted Eurasian honeysuckles (*Lonicera tatarica*, and/or *L. morrowii*) in the upland and wetland, although in much lower abundances than glossy buckthorn. Because these species

fruit prolifically and are widely dispersed by birds, especially along edges and within disturbed areas, there is concern that these invasive exotic shrubs could proliferate in the restored wetland and negatively impact native species re-vegetation of the disrupted portion of floodplain forest.

Table 3.

Plants in Restored Roadway Outside of Sample Plots

Scientific Name	Common Name	Non-Native
<i>Arisaema triphyllum</i>	Jack-In-The-Pulpit	
<i>Eurybia divaricata</i>	White Wood-Aster	
<i>Alnus incana</i>	Speckled Alder	
<i>Muhlenbergia</i> sp.	Muhly	
<i>Agropyron</i> sp.	Wheat Grass	*
<i>Echinocystis lobata</i>	Wild Cucumber	

During plant survey at the end of the restoration's first growing season, we found no invasive exotic shrubs in the re-vegetated area (Tables 1-4), nor were newly established (seedlings) of the invasive exotic shrubs seen within the intact floodplain forest adjacent to the restoration zone. Previously established individuals of both glossy buckthorn and Eurasian honeysuckle do persist in the wetland adjacent to the project site. New establishment will continue to be monitored through the second growing season.

Numerous non-native herbaceous species were observed in the restored area. None of these are listed a noxious weeds or invasive species in Vermont or New Hampshire, although moneywort (*Lysimachia nummularia*) and reed canary grass (*Phalaris arundinacea*) are on the New Hampshire invasive species watch list.

Moneywort is common in floodplain forests throughout Vermont and was present at the site prior to construction. Moneywort is scattered throughout the restored area where it winds along the ground beneath taller herbs. It is part of a relatively diverse mix of species and in no places was a dominant plant at the end of the first growing season.

Reed canary grass is common in many wetland types throughout the state, but unlike moneywort the robust grass frequently dominates sites and leads to diminishment of biodiversity. Reed canary grass occurred in discrete areas and was nowhere dominant. Monitoring will continue in 2014.

Table 4.

Plants in Cleared Area Near River That Was Not Part of Road Bed

Scientific Name	Common Name	Non-Native
<i>Clinopodium vulgare</i>	Wild Basil	*
<i>Clematis virginiana</i>	Virginia Virgin's-Bower	
<i>Amphicarpaea bracteata</i>	American Hog-Peanut	
<i>Athyrium filix-femina</i>	Northern Lady Fern	
<i>Elymus wiegandii</i>	Wiegand's Wild-Rye	
<i>Elymus riparius</i>	Eastern Riverbank Wild-Rye	
<i>Matteuccia struthiopteris</i>	Ostrich Fern	
<i>Symphyotrichum cordifolium</i>	Heart-Leaved American-Aster	
<i>Solidago gigantea</i>	Smooth Goldenrod	
<i>Setaria</i> sp.	Foxtail	*
<i>Leersia oryzoides</i>	Rice Cut Grass	
<i>Dichanthelium clandestinum</i>	Deer-Tongue Rosette-Panicgrass	
<i>Equisetum hyemale</i>	Tall Scouring-Rush	
<i>Calamagrostis canadensis</i>	Canada Reed Grass	
<i>Agrostis</i> sp.	Bent Grass	
<i>Cuscuta groenovii</i>	Common Dodder	
Bold denotes species included in wetland or upland seed mix		

Wild parsnip (*Pastinaca sativa*) is a non-native plant that can dominate fields and roadsides. Several wild parsnip first-year rosettes were observed in Plot 2 (Table 2). US Department of Agriculture does not show that wild parsnip occurs in Essex County, Vermont,⁵ but it is shown as present in Coos County, New Hampshire.⁶ The few wild parsnip plants were seen only in the driest areas. Wild parsnip will continue to be monitored in 2014.

⁵ http://plants.usda.gov/java/county?state_name=Vermont&statefips=50&symbol=PASA2

⁶ http://plants.usda.gov/java/county?state_name=New%20Hampshire&statefips=33&symbol=PASA2

Invasive Species Recommended Control

No control of glossy buckthorn or Eurasian honeysuckles is necessary in the restoration area at this time since seedlings were not seen within the re-vegetated zone.

No control of moneywort is recommended at this time. The population size and density are no greater than what is seen in the undisturbed floodplain forest adjacent to the project area.

Control of reed canary grass and wild parsnip is recommended. It is likely that both can be hand-pulled by Marc Lapin when he revisits the site to monitor re-vegetation during the 2014 growing season. Easy and likely effective control would be to remove plants with shovel and place them in plastic garbage bags for off-site disposal. For both species it will be important to remove plants prior to fruit maturation and dispersal. With reed canary grass especially, full removal of underground parts is imperative. If hand-pulling is seen to be unsuccessful in year 3 (2015) monitoring, other control measures may warrant consideration.

Uncommon Species

Two uncommon species, rough avens (*Geum laciniatum*) and Wiegand's wild rye (*Elymus wiegandii*), were known from the roadway site prior to construction. Seeds of both species were collected in October 2012, stored in cool, dry conditions, and dispersed within the restoration area on June 23rd, 2013.

First-year rosettes of avens (*Geum* sp.) were observed in the restored roadway. Definitive identification to species is not possible with only vegetative material from rosettes since leaf characteristics are somewhat variable. Several of these rosettes did appear to be rough avens, and if they flower in 2014 positive identification will be made.

No plants within the actual restored roadbed area were thought to be Wiegand's wild rye. This tall grass is restricted in the floodplain forest to a narrow (approximately 5 m) band near the river at the top of the river bank. Although it is possible that there were some hidden among the other broad-leaved grasses that had established in the restored roadway, we do not think there were any, for leaf width and pubescence are very clear diagnostic characters for the species.

A vigorous population of Wiegand's wild rye was seen growing on the bank at the river's edge, in the same location where it was documented in 2012. Approximately 25 fruiting plants were observed among a diverse species mix in the riverside area that was cleared of trees and shrubs but was not part of the roadbed. The population extends from this area upstream into the undisturbed floodplain forest. It is not known if the plants in the area cleared of woody vegetation were from the dispersed stored seed or are part of the pre-existing population. Nor do we know if first-year plants of this perennial grass generally flower or if there is a perhaps overlooked juvenile phase. The Wiegand's wild rye population will continue to be monitored in 2014.

Soils in the Restored Access Road Site

Soil pits were dug outside of the northwest corner of each of the vegetation plots. Plot 1 showed more disturbance to the soil than did Plot 2. Plot 1 is in the wettest area only about 10 m from the base of the upland slope where fill had apparently been deposited to ease the transition from sloping upland to level wetland. Disturbance to the soil in Plot 1 consisted of an apparent overburden of 10 cm of mucky loam placed atop what appeared to be a mucky fine sandy loam original surface horizon (Table 5). Within what seemed to be the 10 cm of replaced soil was approximately 20% of angular stone (2-10 cm length on the long axis) that was part of the removed roadbed. Despite the soil alterations in this wettest area of the roadway, soil restoration there is close to the natural condition. Slight hydrological impacts are discussed below in the "Wetland Functions" section.

The soil pit beside Plot 2 revealed an intact alluvial soil profile (Table 6). Some alterations to microtopography may have occurred and are discussed below in the "Wetland Functions" section. The sampled soil pit was located in a location that appeared to characterize the majority of the dry area, rather than the small mounded areas that may not have been representative of the natural condition.

Table 5. Plot 1 Soil Description

Depth (cm)	Horizon	Description
0 - 10	O ₁	black (2.5Y 5/1) mucky loam with fine and medium sand; 5% reduced gray patches; 20% angular stone 2-10 cm; common very fine and fine roots; 5% gravel; 5% coarse woody debris to 4 cm dia.
10-15	O ₂	black (10YR 2/1) mucky fine sandy loam; abundant very fine and fine roots and fern rhizomes; apparently the original surface horizon
15-24	A	dark olive brown (2.5Y 3/1) fine sandy loam (95%), high organic content but not “mucky”; speckled with pale yellow sand (2.5Y 7/3) (5%); few fine roots
24+	C	medium sand within water table; faint occasional to common redoximorphic features (oxidized mottles)

Table 6. Plot 2 Soil Description

Depth (cm)	Horizon	Description
0-5	A	dark grayish brown very fine sandy loam; granular; abundant very fine roots
5-25	B ₁	dark olive brown (2.5Y 3/3) very fine sandy loam; subangular blocky; common very fine roots
25+	B ₂	olive brown (2.5Y 4/3) very fine sandy loam; common to occasional medium, fine and coarse roots (decreasing abundance with depth); dark brown organic matter in root channels

Site Stability

Site stability appears to have been nearly fully restored. Pre-construction, the site was fully forested and had no bare soil. At the end of Year 1 the site had at least 85% vegetation cover; 15% or less of the site was covered by either open water or

straw mulch. Given the location of the restored roadway—upland edge of a broad zone of floodplain forest on a large meander—site inundation is expected to deposit very fine sand and silt in the restored wetland area. Erosion of material would be expected only at the south end of the roadway, near the riverbank. That area consists of two distinct areas: 1) a portion that was disturbed by tree and shrub removal, but was not in the area of the temporary roadway and thus experienced no soil disturbance, and 2) a portion that is part of the reconstructed slope. The reconstructed river bank that was the terminus of the access road through the wetland is currently protected by coir matting and shrub plantings. This area of shrub plantings had very high survivorship at the time of our sampling (which was not long after they had been planted). Survivorship of this small part of the planted area will be assessed in 2014 as part of the wetland restoration monitoring.

Wetland Functions

Gustafson⁷ documented the following wetland functions for the project area and the adjacent larger extent of wetland:

- water storage for flood water and storm runoff
- surface and ground water protection
- wildlife habitat, and
- erosion control through binding and stabilizing the soil.

She attributed these functions to the wetland's density and persistence of vegetation which contributed to attenuation and treatment of floodwaters and to bank stabilization. The functions of water storage and water protection are certainly also related to both soils and topographic (microtopographic) characteristics of the site. Additionally, the mosaic of habitat in the full extent of the sizable floodplain-meander wetland, including both the floodplain forest disturbed at its upland edge by the project's access road and a

⁷ Gustafson, 2011. *ibid.*

nearby oxbow with marsh and permanent open water, is mentioned as offering significant resting, feeding and breeding habitat for wetland-dependant bird species and breeding habitat for predation-tolerant amphibian species.

Plant cover of 85% or greater in late September at the end of the growing season in which the temporary access roadway was restored is close to the original 100% vegetation density prior to the road construction. Non-vegetated patches were either bands of surface water within broad tire ruts or straw-covered patches supporting no vegetation. Persistence of the vegetation cannot be assessed, as there has not been enough time to judge if the re-established vegetation will persist in the restored area. Based on conditions at the end of the first growing season, we do not expect plant coverage to decrease substantially, if at all, from the present minimum of 85%.

The wildlife habitat mosaic noted by Gustafson has been little altered by the project. The restored roadway now features herbaceous cover with no tree or shrub canopy. Adjacent to the restored band, intact floodplain forest extends eastward and currently shows no signs of having been disturbed by the project. Thus, only a small portion of the habitat mosaic has been altered. Future monitoring will assess if the project has had noticeable impacts to the directly adjacent parts of floodplain forest or oxbow marsh; this will be a qualitative assessment based on vascular plant composition and structure, with particular emphasis on invasive species encroachment and signs of erosion.

Microtopography of the wetland project site has been altered to some extent. Alterations observed include small ponded areas within the former roadway that appear to be compacted truck ruts and small elevated patches that may be 20-40 cm higher than the original terrain. The rectangular compacted patches are clearly different from what was observed during pre-construction surveys; the elevated patches may or may not be substantially different from the original microtopography. These small alterations

have slight consequences for water storage and surface and ground water protection. Both compaction and soil mounding change the soil's ability to hold and filter water. The alterations were assessed to be less than 5% of the project area, and the functional changes are therefore assumed to be minimal. Natural flooding of the site will in time restore a more natural microtopography (at least it will likely fill the ruts with sand and silt carried by the floodwaters) and the site is expected to regain even more completely the pre-project water protection and storage functions.

In summary, at the end of Year 1, there are no indications that the project has removed the wetland's ability to perform its previously documented functions. Diminishment of the functional capacity for water storage, surface and ground water protection, and erosion control appear at this time to be minor and related to 1) the structural changes to vegetation, and 2) the limited areas of soil compaction and mounding in the project area. Diminishment of wildlife habitat functionality is most likely limited to the vegetation composition and structural changes which have replaced forest habitat with herbaceous habitat. The project has also resulted in the creation of edge and concomitant edge effects along the restored roadway. If the restoration proceeds as expected and tree and shrub cover is re-established, full habitat functionality should be restored, except perhaps for sensitive soil biota/microbiota that do not find the somewhat altered soil to be suitable habitat.

APPENDIX 1.

Photographic Documentation



Figure 4. Vegetation of Plot 1. The prominent flowering plant is nodding beggar-ticks.



Figure 5. Vegetation of Plot 1. Nodding beggar-ticks, wild basil and the large leaves of burdock are apparent.



Figure 6. Vegetation of Plot 1. Wettest area with common soft rush is in the middle area, between the taller vegetation and the slope rise.



Figure 7. Angular stone within the surface soil of Plot 1 soil pit.



Figure 8. Vegetation of Plot 2. Flowering goldenrods are prominent.



Figure 9. Vegetation of Plot 2. Mix of grasses, wild basil, lady fern and goldenrod is visible, along with coarse woody debris.



Figure 10. Vegetation of Plot 2. Dense growth of wild basil dominates the background, with grasses, lady fern and non-vegetated straw mulch in the foreground.



Figure 11. Vegetation of Plot 2. Choke cherry seedlings in the center with diverse herbaceous vegetation to left and right.



Figure 12. Terminus of roadway. Restored wetland in foreground with reconstructed slope at river's edge in the upper right and intact floodplain forest in upper left. Conifers in far right background are downstream of the reconstructed slope.

ERRATUM

December 18, 2013

Lapin and Nealon. 2013. Maidstone Slide Wetland and Invasive Species Monitoring and Control – Year 1. Bear Creek Environmental LLC. Biological Services Team. Montpelier, VT

Page 12. *Phalaris arundinacea* (reed canary grass) was incorrectly listed as only being on the New Hampshire invasive species watch list. *Phalaris arundinacea* is also listed on the Vermont watch list.