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2015 Wetland Monitoring Report

Filed with the U. S. Army Corps of Engineers – New England District

Fitchburg Expansion Project

Permit Number NAE-2007-3029

Town of Lunenburg, Worcester County, Massachusetts

Submitted By:

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1.0 General Information

This 2015 Wetland Monitoring Report has been developed by AECOM Environment (AECOM) on behalf of Tennessee Gas Pipeline Company (Tennessee) as a requirement of the Individual Permit (NAE-2007-3029) issued by the U.S. Army Corps of Engineers (USACE or Corps) for the Fitchburg Expansion Project (Project). The Project involved the in-situ replacement of approximately 5.1-miles of Tennessee's existing six-inch outside diameter (OD) pipeline with a 12-inch OD pipeline within their existing permanent easement in the Town of Lunenburg, Massachusetts. Construction of the Project was completed in September of 2009, and wetland restoration procedures (i.e., re-grading and re-vegetation of wetlands impacted within the right-of-way [ROW]) concluded in November of 2009. A condition of the approved *August 2009 Wetland Mitigation Plan* for the Project requires Tennessee to annually document the post-construction conditions of the wetlands impacted by the Project and provide the USACE with a detailed assessment of the of the restored wetland areas for five (5) years following restoration of the Project.

1.1 2015 Project Objectives

On May 19, 2015, an onsite meeting was held between AECOM, Tennessee and the USACE to review all wetland restoration sites associated with the Project. The objective of the meeting was to review each restored mitigation site to determine the status of each location and develop a mutually agreeable plan to be implemented for the remainder of the monitoring period (2015 and 2016) for site locations in need of additional restoration efforts. Primarily, evaluations were made relative to the following site concerns:

- The colonization of invasive species, as well as site-specific management techniques for wetlands with high-density off-ROW populations of invasive species; and
- Unauthorized third-party site activity resulting in the degrading of wetlands, waterbodies and erosion control concerns.

Following onsite reviews, a wetland-specific action plan for the 2015 and 2016 monitoring period was submitted to the USACE on June 8, 2015 for review, comment and approval. Details of the action plan approved by the USACE included the following:

- Invasive Species Management
 - Due to the existing high-density colonization of reed canary grass at specific off-ROW agricultural and commercial landuse locations crossed by the Project, management of this species will be reserved to locations where populations are not dominant within the mitigation areas and areas that are independent of high-density off-ROW neighboring infestations;
 - Wetland restoration sites that are dominated by purple loosestrife will be treated via the use of biological control methods (e.g., *Galerucella* sp. beetles) with selective manual removal/herbicide use for shrub and sapling species; and
 - Wetland restoration sites that are free of purple loosestrife or contain low-density populations, but are infested with alternative invasive species managed by the Project will receive manual removal as well as herbicide use for observed herb, shrub, and sapling species.
- Unauthorized Third-Party Site Disturbances
 - To deter continued off-road vehicle traffic through wetlands and waterbodies monitored for the Project, access deterrents consisting of signage, gates or other permanent barriers to access will be installed at specific locations with the ROW to discourage unauthorized activity within protected resource areas;
 - Wetland and waterbody features subject to past disturbances will be stabilized and restored to post-construction condition to allow for proper restoration of the ROW; and
 - ROW disturbances associated with the development of the beaver impoundment will be corrected via removal of the dam and debris materials contained within culvert system.



Implementation of this action plan for the Project is anticipated to bring all restoration sites into compliance with the Project's Wetland Mitigation Plan and permit conditions, such that all Project objectives mutually agreed to by Tennessee and the USACE at the outset of 2015 are achieved and no further site monitoring will be required beyond the 2016 growing season.

1.2 Reporting Requirements

As conditioned by the Individual Permit authorization for the Project, Tennessee is required to provide the USACE with a detailed assessment of the restored wetland areas annually for a period of five (5) years post-restoration establishment to ensure success of the restoration plantings, adequate year-over-year survivorship of individuals, document any significant changes in hydrology and hydric soils, and to monitor for invasive species colonization. Observations are to occur at least two (2) times during the growing season – in late spring/early summer and again in late summer/early fall. The annual monitoring report shall be submitted no later than December 15 of the year being monitored. Failure to perform the monitoring and submit monitoring reports constitutes permit non-compliance.

As required by the Permit, remedial measures were implemented as soon as practicable to promote the success standards described below within three growing seasons after completion of wetland restoration. Should remedial measures be required within the first three years of the monitoring period, the monitoring period will be extended for two (2) additional years of monitoring. Measures requiring earth movement or changes in hydrology were not to be implemented without prior written approval from the Corps. Undisturbed areas of wetland directly adjacent to the wetland restoration areas have served as a reference site during post-construction monitoring.

1.3 Mitigation Success Standards

As defined by the Permit, success shall be measured as follows:

1. The proposed vegetation diversity and/or density goals for woody plants from the proposed mitigation plan are met. Unless otherwise specified in the mitigation plans, there should be at least 500 trees and shrubs per acre, of which at least 400 per acre are trees for proposed forested cover types, that are healthy and vigorous and are at least 18" tall in 75% of each planned woody zone AND at least the following number of non-exotic species including planted and volunteer species. Volunteer species should support functions consistent with the design goals.

To count a species, it should be well represented on the site (e.g., at least 50 individuals of that species per acre).

# species planted	minimum # species required (volunteer and planted)
2	2
3	3
4	3
5	4
6	4
7	5
8	5
9 or more	6

Vegetative zones consist of areas proposed for various types of wetlands (shrub swamp, forested swamp, etc.). The performance standards for density can be assessed using either total inventory or quadrant sampling methods, depending upon the size and complexity of the site.



2. a. Each mitigation site has at least 80% areal cover, excluding open water areas, by non-invasive species.
- b. Emergent areas on each mitigation site have at least 80% cover by non-invasive hydrophytes.
- c. Scrub-shrub and forested cover types have at least 60% cover by non-invasive hydrophytes, of which at least 15% are woody species.

For the purpose of this success standard, invasive species of hydrophytes are:

Common Reed -- *Phragmites australis*;
Purple Loosestrife -- *Lythrum salicaria*;
Reed Canary Grass -- *Phalaris arundinacea*; and
Buckthorn -- *Rhamnus frangula*.

3. Common reed, Purple loosestrife, Russian and autumn olive (*Elaeagnus spp.*), Buckthorn, Japanese knotweed (*Polygonum cuspidatum*), and/or Multiflora rose (*Rosa multiflora*) plants at the mitigation site(s) are being controlled. Per field discussions that occurred for the Project with AECOM, Tennessee and the USACE on May 19 2015, control of reed canary grass will be limited to select restoration sites containing low-density populations of this species that are also free of neighboring high-density off ROW infestations. Additional details pertaining to invasive species control measures can be found in Section 4.2 and locations receiving management for reed canary grass have been detailed in table 2.1.1.
4. For this standard, small patches must be eliminated during the entire monitoring period. Large patches must be aggressively treated and the treatment documented.
5. All slopes, soils, substrates, and constructed features within and adjacent to the mitigation site(s) are stable.
6. The post-construction hydrology of the temporarily impacted wetland(s) is restored to a substantially equivalent state as the pre-construction hydrologic conditions sufficient to support the pre-construction wetland type.

2.0 Post-Construction Project Overview

As mitigation for the temporary and permanent impacts to wetlands associated with the Project, Tennessee restored the area of temporary impact within wetlands through restoring and replanting of the disturbed area in accordance with USACE wetland replication standards (see Section 1.2). Post-construction wetland mitigation planting activities occurred from November 10th to November 23rd of 2009. Since completion of restoration activities AECOM has conducted numerous onsite evaluations of the Project areas to document the status of the restoration efforts associated with the Project. In response to the annual site monitoring performed by AECOM, additional revegetation and restoration efforts were implemented by Tennessee in 2010, 2011 and 2015 at specific Project locations subject to erosion or not meeting the necessary revegetation densities. Locations subject to additional post-construction restoration efforts base on monitoring observations from 2010 to 2015 included the following:

- 2010 Restoration Activities
 - Supplemental seeding/erosion control matting was installed in 2010 along the banks and immediate floodplain corridors of waterbody S-4 to restore unstable locations associated with the crossing; and



- Additional revegetation efforts were performed within upland locations adjacent to the waterbody S-5 crossing, as locations were noted in 2010 as lacking the required vegetated groundcover.
- 2011 Restoration Activities
 - Grading and seeding of locations within wetland WL-WR-12 were performed in 2011 as a result of unauthorized off-road vehicle traffic noted in 2010;
 - Re-seeding of bare residential landscaped locations occurred in 2011, up-gradient of wetland WL-WR-12 as this location did not properly revegetate following restoration of the Project in 2009;
 - Revegetation efforts were conducted along bare slopes up-gradient of waterbody S-8 and wetland WL-WR-14 in 2011 as a result of 2010 site monitoring;
 - Re-seeding and the installation of erosion control matting at locations up-gradient of wetland WL-WR-15 as a result of 2010 monitoring observations; and
 - Additional revegetation efforts were conducted up-gradient of WL-WR-17 in 2011 to provide stabilization up slope of wetland resource areas.
- 2014 Restoration Activities
 - Re-seeding disturbed locations within wetlands WL-WR-12, WL-WR-20 and WL-WR-28 in 2014 that were subject to unauthorized off-road vehicle traffic; and
 - The hand pulling of low-density infestations of purple loose strife within multiple wetlands during spring and fall site reviews.
- 2015 Restoration Activities
 - Distribution of 6,000 *Galerucella* sp. beetles in 2015 to aid in the control of purple loosestrife at seven (7) specific wetland locations;
 - The removal of a beaver impoundment to return natural post-construction flow conditions through an existing culvert at Waterbody S-4;
 - The installation of signage and permanent barriers at road crossings between Pleasant Street and Electric Avenue to deter off-road vehicles from traveling through wetlands WL-WR-28, WL-WR-29 and WL-WR-31; and
 - Restoration work at wetlands WL-WR-28, WL-WR-29 and WL-WR-31, and waterbodies S-14, S-15 and S-16 to mitigate for impacts associated with continued unauthorized disturbances from off-road vehicle traffic within the ROW.

Site evaluations conducted by AECOM for the 2015 monitoring season focused on the above detailed locations that required additional mitigation/restoration efforts, as well as the remainder of the mitigation sites that were meeting the revegetation success standards. The following sections provide a summary of AECOM's findings during the 2015 monitoring season, and Tables 2.1-1 and 2.1-2 describe the current condition of each wetland and waterbody impacted by construction of the Project.

2.1 Summary Data

2.1.1 Wetlands

Overall, the restored wetland areas were found in good health, displaying saturated soils with high-density native herbaceous ground cover. Shrubs and trees planted during fall 2009 restoration activities were found healthy, and re-sprouting was observed on stumps that were left in place during initial tree clearing operations. Additionally, the establishment of volunteer tree and shrub species was observed in virtually all of the restored scrub-shrub/forested wetland locations. Invasive species observations within the mitigation areas were consistent with previous site monitoring events and dominantly included purple loosestrife, reed canary grass and multiflora rose. Significant occurrences of these species were limited to discrete restoration areas with past documented infestations and pre-existing dominant communities located adjacent to undisturbed Project areas. Generally, restored wetland mitigation sites that contained invasive species were comprised of populations that were less than, or equivalent to neighboring wetland locations that were not directly impacted



or otherwise disturbed by construction of the Project. The majority of the locations documented during past monitoring seasons as lacking the necessary vegetative area cover and/or susceptible to erosion were found adequately vegetated in 2015, with total densities equal to, or exceeding the ground cover of undisturbed locations outside the immediate Project area. Table 2.1-1 below provides a complete overview of the wetland mitigation areas associated with the Project, site activities that have occurred during the 2015 monitoring period, a determination as to whether or not each mitigation site is currently meeting the restoration performance standards, as well as the anticipated mitigation efforts planned for the 2016 monitoring season. In addition to this information, photographs of the abovementioned locations have been included in Appendix B for review. Restored wetland areas were evaluated for the following:

- Estimates of percent cover, documentation of plant mortalities, evidence of animal browse or animal-related disturbances, and summary of dominant plant species within the mitigation sites;
- Evaluation of the hydrology and the associated soil conditions both within the mitigation area and the adjacent wetland systems;
- Documentation of invasive species, including estimates of percent cover and a comparison of species within adjacent wetland communities;
- Documentation of erosion control concerns and identification of potential causes of erosion; and
- Comments on the general health and condition of the mitigation sites and suggested remedial measures to correct erosion control problems, unauthorized disturbances, and/or the control of invasive species.

Table 2.1-1 Wetlands Crossed by the Fitchburg Expansion Project and 2015 Restoration Status

Wetland ID/ Cover Type*	Approximate Milepost	Percent Cover / Summary of Species Present	Evaluation of Hydrology	Invasive Species Concerns	Erosion Control Concerns	2015 Restoration Activities	Wetland Area Currently Meeting the Revegetation Success Standards	Anticipated 2016 Restoration Activities
WL-WR-01A	-0.0	Avoided- no restoration or monitoring required.						
WL-WR-01/ PEM	0.0 – 0.01	Restoration limited to distribution of wetland seed mix. Herbaceous cover is dense (approximately 100%) and dominant species include cattails (<i>Typha</i> sp.), soft rush (<i>Juncus effusus</i>), spike rush (<i>Eleocharis</i> sp.), sensitive fern (<i>Onoclea sensibilis</i>), horsetail sp. (<i>Equisetum</i> sp.), late goldenrod (<i>Solidago gigantea</i>), tall goldenrod (<i>Solidago altissima</i>) reed canary grass and purple loosestrife.	Adequate hydrology present. Saturated soils and dense wetland cover consistent with pre-construction conditions.	Purple loosestrife and reed canary grass identified within the wetland system. Purple loosestrife populations have increased since previous observations in 2014 and currently represent approximately 30% of the total vegetative cover. The management of reed canary grass will not occur at this location.	None observed	In June of 2015, Tennessee coordinated the release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife in this wetland.	No; adequate hydrology and vegetation densities are present and no erosion control issues have been noted; however, invasive species densities are currently exceeding the threshold limits identified for the Project.	Tennessee will continue to monitor the success of the biological controls and conduct selective spot treatment via herbicide use and/or hand removal of invasive shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-02	0.15	Avoided- no restoration or monitoring required.						
WL-WR-03/ PEM	0.16 – 0.17	Restoration limited to the distribution of wetland seed mix. Herbaceous cover is dense (approximately 90-100%) and dominant species include cattail, joe-pye weed (<i>Eupatorium maculatum</i>), common boneset (<i>Eupatorium perfoliatum</i>), jewel weed (<i>Impatiens capensis</i>), arrow-leaf tearthumb (<i>Persicaria sagittata</i>), late goldenrod, reed canary grass, and purple loosestrife.	Hydrology is associated with a hillside seep and intermittent waterbody S-1. Semi-arid soil conditions consistent with late summer precipitation totals, and open/sun exposure of PEM wetland system.	Purple loosestrife, autumn olive, multiflora rose and reed canary grass identified within the wetland. Species populations have increased since previous observations, representing approximately 25-35% of the total vegetative cover. The management of reed canary grass will not occur at this location.	None observed	In June of 2015, Tennessee coordinated the release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife in this wetland.	No; adequate hydrology and vegetation densities are present and no erosion control issues have been noted; however, invasive species densities are currently exceeding the threshold limits identified for the Project.	Tennessee will continue to monitor the success of the biological controls and conduct selective spot treatment via herbicide use and/or hand removal of invasive shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-04/ PEM	0.19 – 0.21	Restoration limited to the distribution of wetland seed mix. Herbaceous cover is at 80% and dominant species are limited to sensitive fern, tall golden rod and purple loosestrife.	Hydrology associated with hillside seep and intermittent waterbody S-1. Saturated soils observed, hydrology appears to be unaffected by construction.	Purple loosestrife has developed within the wetland representing approximately 40% of the total vegetative cover.	None observed	In June of 2015, Tennessee coordinated the release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife in this wetland.	No; adequate hydrology and vegetation densities are present and no erosion control issues have been noted; however, invasive species densities are currently exceeding the threshold limits identified for the Project.	Tennessee will continue to monitor the success of the biological controls and conduct selective spot treatment via herbicide use and/or hand removal of invasive shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-05	0.22	Avoided- no restoration or monitoring required.						

Table 2.1-1 Wetlands Crossed by the Fitchburg Expansion Project and 2015 Restoration Status

Wetland ID/ Cover Type*	Approximate Milepost	Percent Cover / Summary of Species Present	Evaluation of Hydrology	Invasive Species Concerns	Erosion Control Concerns	2015 Restoration Activities	Wetland Area Currently Meeting the Revegetation Success Standards	Anticipated 2016 Restoration Activities
WL-WR-06/ PEM/ PSS/PFO	0.27 – 0.57	Restoration consisted of the distribution of wetland seed mix and planting of 1,365 shrubs and tree species individuals. Installed shrubs are in good health, less than 10 mortalities observed (less than 1% of planted population). The majority of the planted trees and shrubs are difficult to review due to the density of herbaceous development. Herbaceous cover is 90-100% and is dominated by soft rush, wool grass (<i>Scirpus cyperinus</i>), Canada rush (<i>Juncus canadensis</i>), spike rush, lurid sedge (<i>Carex lurida</i>), purple loosestrife, goldenrod sp. (<i>Solidago</i> sp.), smartweed (<i>Polygonum</i> sp.), spotted joe-pye weed, tussock sedge (<i>Carex stricta</i>), common boneset, cinnamon fern (<i>Osmunda cinnamomea</i>), umbrella sedge (<i>Cyperus</i> sp.), royal fern (<i>Osmunda regalis</i>), broadleaf cattail, jewel weed, arrow-leaf tearthumb, rice cutgrass (<i>Leersia oryzoides</i>), rough barnyard grass (<i>Echinochloa muricata</i>) and mannagrass sp. (<i>Glyceria</i> sp.).	Hydrology appears to be unaffected by construction. Extremely saturated soils with mucky substrate/pools of standing water present. Condition consistent with adjacent wetlands and pre-construction conditions.	Multiflora rose was observed along the western edge of the wetland restoration site (less than 10% of the total localized vegetative cover). Purple loosestrife communities have continued to develop within the southern portion of the wetland (approx. 10-20% localized cover) and reed canary grass densities have increased (approx. 20-30% localized cover) at the northern extent of the wetland, along the flood plain corridor adjacent to Easter Brook. A new stand of common reed has developed at the northern end of the restored wetland (approx. 20' x 50' in area). The management of reed canary grass will not occur at this location.	None observed	In June of 2015, Tennessee coordinated the release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife in this wetland.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will continue to monitor the success of the biological controls and conduct selective spot treatment via herbicide use and/or hand removal for common reed and invasive shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-07/ PEM	0.60 - 0.61	Restoration limited to the distribution of wetland seed mix. Herbaceous cover is dense (approximately 80-100%) and dominant species include wool grass, common cattail, soft rush, lurid sedge, umbrella sedge, sensitive fern, common boneset, joe-pye weed, arrow-leaf tearthumb, and reed canary grass. Volunteer species individuals of speckled alder were also observed within the wetland.	Soils found saturated and hydrology appears consistent with adjacent resource areas and pre-construction conditions.	Reed canary grass populations have increased within the restored wetland (approx. 25% cover) and the adjacent uplands. Small populations of purple loosestrife (less than 10% cover) and autumn olive (less than 10% cover) were also observed within and along the fringe of the restored wetland. The management of reed canary grass will not occur at this location.	None observed	No restoration activities performed during the 2015 monitoring season.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-08	1.11	Avoided- no restoration or monitoring required.						
WL-WR-09/ PEM/ PSS/PFO	1.17 – 1.18	Restoration consisted of the distribution of wetland seed mix and the planting of 35 shrub and tree species individuals. The plantings appear in good health (no mortalities observed). 80-100% herbaceous cover observed with voluntary species of speckled alder and common winterberry (<i>Ilex verticillata</i>) establishing within the restored wetland. Dominant species include reed canary grass, arrow-leaf tearthumb, lurid sedge, fringe sedge, common boneset, soft rush, goldenrods, common cattail and wool grass.	Hydrology is associated with intermittent waterbody S-3. Wetland hydrology is consistent with surrounding unimpacted resource areas and pre-construction conditions.	Reed canary grass identified within the restored portions of wetland system. Densities range from 20-40% cover and have increased since previous site observations in 2014. Autumn olive shrubs are developing along the fringe of the wetland. The management of reed canary grass will not occur at this location.	None observed	No restoration activities performed during the 2015 monitoring season.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-10/PEM	1.33 – 1.39	Restoration limited to the distribution of wetland seed mix. Herbaceous cover is dense (approximately 100%) and dominant species include wool grass, arrow-leaf tearthumb, reed canary grass and common cattail.	Hydrology is associated with a hillside seep. Soil comprised of muck, underlain by mineral substrate. No impact to hydrology observed - adequate saturation present.	Reed canary grass identified in restored wetland locations. Densities appear to be greatest in the eastern portion of wetland and have increased from past observations to approximately 40-60% of the vegetative cover. The management of reed canary grass will not occur at this location.	None observed	No restoration activities performed during the 2015 monitoring season.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.

Table 2.1-1 Wetlands Crossed by the Fitchburg Expansion Project and 2015 Restoration Status

Wetland ID/ Cover Type*	Approximate Milepost	Percent Cover / Summary of Species Present	Evaluation of Hydrology	Invasive Species Concerns	Erosion Control Concerns	2015 Restoration Activities	Wetland Area Currently Meeting the Revegetation Success Standards	Anticipated 2016 Restoration Activities
WL-WR-11/PEM	2.00 – 2.06	Restoration limited to the distribution of wetland seed mix. Herbaceous cover is dense (approximately 90-100%) and dominant species include wool grass, soft rush, lurid sedge, umbrella sedge, sensitive fern, spotted joe-pye weed, common boneset, spike rush (<i>Eleocharis spp.</i>) and royal fern. Volunteer individuals of speckled alder and red maple observed within the restored wetland.	Hydrology is associated with adjacent wetlands and intermittent waterbody S-6. Soils are mucky and moderately saturated. No impact to hydrology observed, as wetland is consistent with undisturbed ROW conditions.	Minimal populations of multiflora rose observed. Communities are contributing to less than 10% of the total vegetative cover and no purple loosestrife or reed canary grass identified.	None observed	No restoration activities performed during the 2015 monitoring season.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-12/PEM/ PSS/PFO	2.14 – 2.16	Restoration consisted of the distribution of wetland seed mix and the planting of 65 shrub and tree species individuals. The plantings appear in good health, no mortalities observed. Herbaceous cover is dense (approximately 80-100%) and has continued to improve from 2014 field observations, which displayed disturbances and less than 50% vegetative ground cover. Emergent vegetation is dominated by wool grass, soft rush, lurid sedge, umbrella sedge, sensitive fern, spotted joe-pye weed, common boneset, broadleaf cattail tussock sedge and royal fern.	Hydrology is associated with adjacent wetlands. No impact to hydrology observed, as soils appear adequately saturated, equivalent with neighboring undisturbed wetland conditions.	Purple loosestrife populations are present within the mitigation area; however, they are currently representing less than 5% of the total vegetative cover. Multiflora rose communities are present outside the restored ROW along the western edge, but populations have not affected the restored mitigation site.	Past disturbances noted in 2014 associated with unauthorized off-road vehicle activities have ceased at this location. Previously seeded areas have established a dense herbaceous cover.	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-13/PEM/ PSS/PFO	2.29 – 2.30	Restoration consisted of the distribution of wetland seed mix and the planting of 49 shrub and tree species individuals. The plantings are good health, no mortalities observed. Densely vegetated herbaceous cover observed, (90-100%), dominated by jewel weed, soft rush, sensitive fern, goldenrods, arrow-leaf tearthumb, fringe sedge, lurid sedge and purple-stem aster (<i>Symphoricarpos puniceum</i>).	Hydrology is associated with intermittent waterbody S-7. Saturated mineral soils observed - hydrology appears unaffected by construction.	Populations of multiflora rose observed within upland portions of the ROW, immediately adjacent to the wetland - less than 5% of the areas total vegetative cover.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-14/PEM/ PSS/PFO	2.93 – 2.96	Restoration consisted of the distribution of wetland seed mix and the planting of 136 shrub and tree species individuals. The plantings are in excellent condition, no mortalities or evidence of deer browse observed. Herbaceous cover is at 100% and dominated by wool grass, soft rush, lurid sedge, umbrella sedge, sensitive fern, spotted joe-pye weed, common cattail, goldenrods, jewel weed, blue vervain (<i>Verbena hastata</i>) tussock sedge and royal fern.	Hydrology is associated with intermittent waterbody S-8 and influence from adjacent forested wetlands. Soils range from muck to mineral substrate and all surface locations are highly saturated.	Isolated populations of glossy buckthorn have developed within the wetland system (less than 10% of the total vegetative cover).	None observed	Site activities were limited to the hand-pulling of observed species of glossy buckthorn.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.

Table 2.1-1 Wetlands Crossed by the Fitchburg Expansion Project and 2015 Restoration Status

Wetland ID/ Cover Type*	Approximate Milepost	Percent Cover / Summary of Species Present	Evaluation of Hydrology	Invasive Species Concerns	Erosion Control Concerns	2015 Restoration Activities	Wetland Area Currently Meeting the Revegetation Success Standards	Anticipated 2016 Restoration Activities
WL-WR-15/PEM	3.18 - 3.20	Restoration limited to the distribution of wetland seed mix. Locations are fully restored, displaying 100% herbaceous cover. Dominant species include reed canary grass, wool grass, rough barmyard grass, sensitive fern, and eastern bur-reed (<i>Sparganium americanum</i>), and soft rush.	Hydrology is associated with adjacent forested wetland system. Saturated soils and ponded conditions observed within restored area.	Populations of reed canary grass have decreased within restored wetland areas and adjacent uplands from past documented observations. Densities currently range from 5-10%.	None observed	No restoration activities performed during the 2015 monitoring season.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-16	3.26 - 3.29	Avoided- no restoration or monitoring required.						
WL-WR-17/PEM/ PSS/PFO	3.41 - 3.42	Restoration consisted of distribution of wetland seed mix and the planting of 85 shrub and tree species individuals. The plantings appear in good health, no mortalities observed. 100% vegetative cover dominated by jewel weed, soft rush, common boneset, joe-pye weed, blue vervain, wool grass, arrow-leaf tearthumb, purple-stem aster, lurid sedge, and sensitive fern. Volunteer/stump sprouting of speckled alder and red maple individuals observed within the restored wetland area.	Hydrology is associated with perennial waterbody S-9 and adjacent forested wetland system. Soils appear saturated - no impact to hydrology noted as a result of construction.	Communities of multiflora rose were observed within the wetland fringe and surrounding upland areas within the ROW. Extensive populations are present within undisturbed portions of wetland and surrounding upland. Additionally, communities of purple loosestrife have continued to develop in the restored wetland area. Combined species represent approximately 10% of the total vegetative cover.	None observed	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	Yes; adequate hydrology is present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-18/PEM/ PSS/PFO	3.44 - 3.48	Restoration consisted of distribution of wetland seed mix and the planting of 176 shrub and tree species individuals. The plantings appear in good health, no mortalities observed. Dense herbaceous cover noted, (80-100%) dominated by jewel weed, soft rush, common boneset, joe-pye weed, blue vervain, wool grass, arrow-leaf tearthumb, purple-stem aster, lurid sedge, and sensitive fern. Volunteer speckled alder and red maple individuals observed within the restored wetland area.	Hydrology is associated with adjacent wetlands and appears to be unaffected by construction. Saturated soils observed within the wetland.	Communities of multiflora rose and purple loosestrife were observed within the wetland fringe and surrounding upland areas within the ROW. Extensive populations are present within undisturbed portions of the wetland. Both species appear to be contributing to approximately 25% of the total vegetative cover and densities have increased since 2014 site observations.	None observed	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	No; adequate hydrology and vegetation densities are present and no erosion control issues have been noted; however, invasive species densities are currently exceeding the threshold limits identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-19/PEM/ PSS/PFO	3.66 - 3.67	Restoration consisted of distribution of wetland seed mix and the planting of 6 shrub and tree species individuals. Herbaceous cover is dense (approximately 100% cover). Dominant species include goldenrods, purple-stem aster, reed canary grass, jewel weed, soft rush, purple loosestrife and sensitive fern.	Hydrology is associated with intermittent waterbody S-10 and abutting forested wetlands. Soils appear slightly arid, but consistent within surrounding open meadow habitat.	Developing populations of purple loosestrife and multiflora rose noted within wetland and associated stream channel. Combined species currently contributing to less than 15% of the total vegetative cover.	None observed	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	Yes; adequate hydrology and vegetation densities are present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and therefore meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.

Table 2.1-1 Wetlands Crossed by the Fitchburg Expansion Project and 2015 Restoration Status

Wetland ID/ Cover Type*	Approximate Milepost	Percent Cover / Summary of Species Present	Evaluation of Hydrology	Invasive Species Concerns	Erosion Control Concerns	2015 Restoration Activities	Wetland Area Currently Meeting the Revegetation Success Standards	Anticipated 2016 Restoration Activities
WL-WR-20/PEM/ PSS/PFO	3.94 – 3.95	Restoration consisted of distribution of wetland seed mix and the planting of 16 shrub and tree species individuals. Shrubs are in good condition with volunteer species of red maple, and northern arrowwood (<i>Viburnum recognitum</i>) establishing near the existing tree line. Dense herbaceous cover present, (80-90%) which is dominated by jewel weed, soft rush, lurid sedge, sensitive fern, common boneset, joe-pye weed, common cattail and wool grass. Bare locations within wetland are rocky, and appear to be associated with periodic overland flow and unauthorized ATV travel.	Hydrology is associated with overland flow and adjacent transitional wetlands. Saturated mineral soils present and evidence of flow within the wetland observed.	Small communities of purple loosestrife noted within wetland. Populations contributing to less than 10% of the total vegetative cover.	Minimal site disturbance (two track) from unauthorized off-road traffic.	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	Yes; adequate hydrology and vegetation densities are present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and therefore meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-21/PEM/ PSS/PFO	3.98 – 3.99	Restoration consisted of distribution of wetland seed mix and the planting of 32 shrub and tree species individuals. Shrubs in good condition—no mortalities observed. Dense herbaceous cover present, (80-100%) which is dominated by jewel weed, soft rush, sensitive fern, and common boneset.	Hydrology is associated with overland flow and adjacent transitional wetlands. Mineral soils found semi-arid. Soil conditions consistent with upper reaches of undisturbed wetland, north of the restored workspace.	Communities of purple loosestrife noted within the wetland. Species contributing to 10-20% of the total vegetative cover.	None observed	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	Yes; adequate hydrology and vegetation densities are present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and therefore meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-22	4.02	Avoided- no restoration or monitoring required.						
WL-WR-23/PEM	4.02 – 4.03	Restoration limited to distribution of wetland seed mix. Herbaceous cover is estimated at 100% and dominated by goldenrods, common boneset, wool grass, arrow-leaf tearthumb, reed canary grass, jewel weed, soft rush, and purple loosestrife.	Hydrology is associated with overland flow and adjacent transitional wetlands/roadside drainage. Semi-arid soil conditions consistent with upper reaches of undisturbed wetland/drainage ways, north of the restored workspace.	Small communities of purple loosestrife and reed canary grass noted within wetland. Combined species contributing to less than 10% of the total vegetative cover.	None observed	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	Yes; adequate hydrology and vegetation densities are present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and therefore meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-24/PEM/ PSS/PFO	4.06 – 4.08	Restoration consisted of distribution of wetland seed mix and the planting of 51 shrub and tree species individuals. The plantings appeared in good health, no mortalities observed. 90% herbaceous cover present. Restored locations are dominated by wool grass, soft rush, lurid sedge, umbrella sedge, sensitive fern, spotted joe-pye weed, tussock sedge, cinnamon fern blue vervain, and royal fern. Volunteer species of red maple, northern arrowwood, speckled alder, and yellow birch (<i>Betula alleghaniensis</i>) observed within the ROW.	Hydrology is associated with intermittent waterbody S-11. Mucky soils found saturated throughout the entire wetland - no impact to hydrology noted.	Communities of purple loosestrife have been estimated at 25% of the total cover within restored portions of the wetland.	None observed	In June of 2015, Tennessee coordinated the release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife within the restored wetland.	No; adequate hydrology and vegetation densities are present and no erosion control issues have been noted; however, invasive species densities are currently exceeding the threshold limits identified for the Project.	Tennessee will continue to monitor the success of the biological controls and conduct selective spot treatment via herbicide use and/or hand removal for invasive shrub/sapling species observed in the restored wetland during the 2016 growing season.

Table 2.1-1 Wetlands Crossed by the Fitchburg Expansion Project and 2015 Restoration Status

Wetland ID/ Cover Type*	Approximate Milepost	Percent Cover / Summary of Species Present	Evaluation of Hydrology	Invasive Species Concerns	Erosion Control Concerns	2015 Restoration Activities	Wetland Area Currently Meeting the Revegetation Success Standards	Anticipated 2016 Restoration Activities
WL-WR- 25/PEM/ PSS/PFO	4.14 – 4.19	Restoration consisted of distribution of wetland seed mix and the planting of 200 shrub and tree species individuals. The plantings appeared in good health, with less than 10 mortalities (5% of the planted population) observed. Herbaceous cover is dense, (approximately 100% cover) and is dominated by wool grass, soft rush, lurid sedge, sensitive fern, purple loosestrife, arrow-leaf tearthumb, blue vervain, spotted joe-pye weed, tussock sedge cinnamon fern, common cattail, goldenrods, common boneset, dotted St. John's-wort (<i>Hypericum punctatum</i>) and royal fern. Sprouting, and/or volunteer species of red maple, speckled alder, northern arrowwood, silky dogwood (<i>Cornus amomum</i>) observed within the wetland.	Hydrology is associated with adjacent wetlands and perennial waterbody S-12. Soils appear saturated, and conditions are equivalent to undisturbed wetlands north/south of the restored wetland area.	Communities of purple loosestrife, (ranging from 10-15% cover) multiflora rose, (less than 5% of total cover) and reed canary grass (less than 5% of total cover) found throughout the entire wetland.	None observed	Site activities were limited to the hand-pulling of observed species of purple loosestrife.	Yes; adequate hydrology and vegetation densities are present and no erosion control issues have been noted. The combined totals for the invasive species managed for the Project are below the allowable threshold limits and therefore meet the mitigation success standards identified for the Project.	Tennessee will conduct selective spot treatment as necessary via herbicide use and/or hand removal for invasive herb/shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-26	4.19 – 4.21	Avoided- no restoration or monitoring required.						
WL-WR-27	4.52 – 4.54	Avoided- no restoration or monitoring required.						
WL-WR- 28/PEM/ PSS/PFO	4.61 – 4.72	Restoration consisted of distribution of wetland seed mix and the planting of 311 shrub and tree species individuals. Low to moderate herbaceous cover established (50-70%) due to 2015 restoration activities. Surface locations outside of restoration areas are stable and vegetated with moderate density herbaceous cover (approximately 80%). Dominant species include wool grass, reed canary grass, soft rush, lurid sedge, spike rush, sensitive fern, spotted joe-pye weed, purple loosestrife, goldenrods, arrowleaf tearthumb, rough banyard grass, tussock sedge, cinnamon fern and royal fern.	Hydrology is associated with waterbodies S-13, S-14 and S-15. Soil saturation ranged from slightly arid in the eastern portion of the wetland, to highly saturated along the floodplain locations in the west.	Significant communities of purple loosestrife and reed canary grass located within and adjacent to the restored wetland areas. Population densities range from 10-30% of the total vegetative cover and have increased since past site monitoring observations. The management of reed canary grass will not occur at this location.	None observed, however non-vegetated locations are present due to recent restoration work.	In June of 2015, Tennessee coordinated the release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife within the restored wetland. In September of 2015, Tennessee preformed ROW restoration activities within wetland WL-WR-28 to address concerns relative to site disturbances from unauthorized off-road vehicle access. Impacted locations were re-graded, seeded, mulched and matted with jute netting. Following the completion of restoration activity, Tennessee installed "No Trespassing" signage and permanent barricades across the ROW near the public roadway access locations to deter unauthorized vehicle activity	No; adequate hydrology is present; however, recently restored and seeded locations are lacking the necessary ground cover densities and invasive species populations are currently exceeding the threshold limits identified for the Project.	Tennessee will continue to monitor the success of the restoration work and conduct supplemental stabilization activities as necessary to ensure proper restoration of wetland WL-WR-28. Tennessee will continue to monitor the success of the biological controls and conduct selective spot treatment via herbicide use and/or hand removal of invasive shrub/sapling species observed in the restored wetland during the 2016 growing season.

Table 2.1-1 Wetlands Crossed by the Fitchburg Expansion Project and 2015 Restoration Status

Wetland ID/ Cover Type*	Approximate Milepost	Percent Cover / Summary of Species Present	Evaluation of Hydrology	Invasive Species Concerns	Erosion Control Concerns	2015 Restoration Activities	Wetland Area Currently Meeting the Revegetation Success Standards	Anticipated 2016 Restoration Activities
WL-WR-29/PEM	4.86 – 4.91 4.97 – 5.01	Restoration limited to distribution of wetland seed mix. Moderate to complete herbaceous ground cover present- 50-100%. Bare/sparsely vegetated locations are limited to travel areas function as an existing access road within the overhead electric transmission easement. Surface wetland areas north of the easement are densely vegetated with emergent vegetation. Dominant species include wool grass, reed canary grass, soft rush, lurid sedge, umbrella sedge, fringe sedge, sensitive fern, goldenrods, spotted joe-pye weed, common boneset, purple-stem aster, purple loosestrife, common cattail, tussock sedge and royal fern.	Hydrology is associated with adjacent forested wetland system. Saturated soils and dense wetland cover consistent with pre-construction conditions.	Significant communities of purple loosestrife and reed canary grass located within and adjacent to the restored wetland areas within the ROW. Population densities range from 10-20% of the total vegetative cover. The management of reed canary grass will not occur at this location.	None observed, however non-vegetated locations are present due to recent restoration work.	In June of 2015, Tennessee coordinated the release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife within the restored wetland. In September of 2015, Tennessee performed minor grading of rutted locations and seeding of bare locations within wetland WL-WR-29. Following the completion of restoration activity, Tennessee installed "No Trespassing" signage and permanent barricades across the ROW near the public roadway access locations to deter unauthorized vehicle activity.	No; adequate hydrology is present; however, recently restored and seeded locations are lacking the necessary ground cover densities and invasive species populations are currently exceeding the threshold limits identified for the Project.	Tennessee will continue to monitor the success of the restoration work and conduct supplemental revegetation activities as necessary to ensure proper restoration of wetland WL-WR-29. Tennessee will continue to monitor the success of the biological controls and conduct selective spot treatment via herbicide use and/or hand removal of invasive shrub/sapling species observed in the restored wetland during the 2016 growing season.
WL-WR-30	4.94 – 4.96	Avoided- no restoration or monitoring required.						
WL-WR-31/PEM	5.02 – 5.03	Restoration limited to distribution of wetland seed mix. Wetland locations have been degraded, displaying less than 20% herbaceous cover. The mitigation area has been impacted by ongoing off-road vehicle traffic, as it is located with an existing access road associated with the overhead electric easement.	Hydrology is associated with overland flow and adjacent drainage-saturated mineral soils present.	None observed	None observed, however non-vegetated locations are present due to recent restoration work.	In September of 2015, Tennessee performed minor grading of rutted surface areas and seeding of bare locations within wetland WL-WR-31. Following the completion of restoration activity, Tennessee installed "No Trespassing" signage and permanent barricades across the ROW near the public roadway access locations to deter unauthorized vehicle activity.	No; adequate hydrology is present; however, recently restored and seeded locations are lacking the necessary ground cover densities for the Project.	Tennessee will continue to monitor the success of the restoration work and conduct supplemental revegetation activities as necessary to ensure proper restoration of wetland WL-WR-31.

* Coverdin et. al's "Classification of Wetlands and Deepwater habitats of the United States" was used to classify wetlands along the survey corridor. Identified wetlands were classified as Palustrine Forested (PFO), Palustrine Emergent (PEM), and Palustrine Scrub-Shrub (PSS).



2.1.2 Waterbodies

The majority of the waterbodies impacted by construction of the Project were found fully functional during the 2015 monitoring, with stabilized channels and well-vegetated floodplain corridors. Erosion/stabilization problems were limited to four waterbodies and all locations were repaired to post-construction condition prior to the conclusion of the 2015 monitoring season. In 2015, waterbodies S-14, S-15 and S-16 were regraded, seeded and stabilized following restoration work of wetland WL-WR-28, which was completed to repair disturbances associated unauthorized off-road vehicle activity. In 2014, one previously undocumented disturbance of a waterbody was noted at the Project crossing of waterbody S-4, which has been subject to dam-building and subsequent erosion due to beaver (*Castor canadensis*) activity. In 2015, Tennessee coordinated with the landowner to remove obstructions from the existing culvert crossing and return natural post-construction flow conditions back to waterbody S-4. Table 2.1-2 below provides a complete overview of all the waterbodies associated with the Project, a determination as to whether or not each restored waterbody is currently meeting the restoration performance standards and a summary of any anticipated mitigation efforts planned for the 2016 monitoring season. Waterbodies impacted by construction were evaluated for the following:

- Evaluation of the waterbody to ensure proper channelization has been restored, analysis of the immediate floodplain areas to determine if adequate vegetation is present, and review of the stream channel and bank structure to ensure stabilization.
- Documentation of erosion control concerns, and identification of potential causes of erosion within the stream and the immediate floodplain areas.
- Comments on the general condition of the waterbody, observations of unauthorized disturbances and suggested remedial measures to correct erosion control problems.

Table 2.1-2 Waterbodies Crossed by the Fitchburg Expansion Project and 2015 Monitoring Status

Waterbody ID	Approximate Milepost	Waterbody Type	Evaluation of Waterbody	Erosion Control Concerns	2015 Restoration Activities	Waterbody Area Currently Meeting the Restoration Success Standards	Anticipated 2016 Restoration Activities
CH 1A	-0.0	Intermittent	Avoided- no restoration or monitoring required.				
OW-1	0.16	open water	Avoided- no restoration or monitoring required.				
S-1	0.19	Intermittent	Upland drainage associated with a hillside seep within WL-WR-3. Stream culverted under farm road to irrigation pond. Channel and culvert system are stabilized and fully restored to pre-construction condition. No flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
OW-2	0.20	open water	Avoided- no restoration or monitoring required.				
S-2	0.53	Perennial	Waterbody identified as Easter Brook. Feature flows east intersecting the ROW through WL-WR-6. Waterbody has been fully restored. Immediate floodplain areas are fully vegetated and banks are stable and not actively eroding. Low/clear flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
S-3	1.17	Intermittent	Waterbody intermittently drains east, intersecting the ROW at WL-WR-9. Stream channel fully functional - banks stable and vegetated. No flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
S-4	1.26	Perennial	Waterbody flows east intersecting the ROW and is crossed by a two-track farm road via an existing culvert and earthen fill bridge. The farm road crossing was previously subject to extensive beaver activity, such that upstream locations were observed in the spring of 2015 ponded and the culvert system had lost all function. Impacts associated with the dam were corrected and restored in the fall of 2015.	None observed, previously noted concerns relative to overland flows and loss of use of the existing culvert system as a result of beaver activity within the ROW were corrected by Tennessee in September of 2015.	In an effort to resolve the erosion and backwater flooding concerns associated with the construction of the beaver impoundment, Tennessee coordinated the removal of the beaver dam and obstructions within the existing culvert system with the affected landowner in September of 2015.	Yes; the waterbody has been fully restored to pre-construction condition.	Tennessee will continue to monitor beaver activity at this location to ensure waterbody bed and bank locations within the restored ROW remain stable.
S-5	1.77	Intermittent	Waterbody is culverted within the ROW. All banks and immediate floodplain areas are stable. No flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
S-6	2.03	Intermittent	Stream flows to the north and intersects ROW within WL-WR-11. Stream banks and immediate floodplain areas are fully stabilized and vegetated. No flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
S-7	2.29	Intermittent	Well-defined intermittent drainage flows west, intersecting the ROW within WL-WR-13. Stream banks and immediate floodplain areas are fully stabilized and vegetated. Low/clear flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.

Table 2.1-2 Waterbodies Crossed by the Fitchburg Expansion Project and 2015 Monitoring Status							
Waterbody ID	Approximate Milepost	Waterbody Type	Evaluation of Waterbody	Erosion Control Concerns	2015 Restoration Activities	Waterbody Area Currently Meeting the Restoration Success Standards	Anticipated 2016 Restoration Activities
S-8	2.95	Intermittent	Intermittent drainage flows west, intersecting the ROW within WL-WR-14. Stream banks and immediate floodplain areas are fully stabilized and well vegetated. No flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
OW-3	3.27	Open water	Avoided- no restoration or monitoring required.				
OW-4	3.38	Open water	Avoided- no restoration or monitoring required.				
S-9	3.41	Perennial	Waterbody flows west, intersecting the ROW within WL-WR-17. Stream channel is stable, banks are well defined, and immediate floodplain locations are densely vegetated.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
S-10	3.66	Intermittent	Small intermittent channel which drains west under a residential driveway, intersecting the ROW within WL-WR-19. No flow was observed at the time of inspection. Immediate flood plain areas are vegetated and stream banks are stabilized.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
S-11	4.14	Intermittent	Waterbody drains north across the ROW within WL-WR-24. Immediate flood plain areas are well vegetated and stream banks are stable. No flow observed at the time of inspection.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
OW-5	4.13	Man-made pond	Avoided- no restoration or monitoring required.				
S-12	4.18	Perennial	Waterbody drains southwest across the ROW within WL-WR-25. Low/clear flow was observed at the time of inspection. Immediate flood plain areas are vegetated and stream banks are stable.	None observed	No restoration activities performed during the 2015 monitoring season	Yes; the waterbody has been fully restored to pre-construction condition.	No restoration activities proposed.
S-13	4.20	Perennial	Avoided- no restoration or monitoring required.				
N/A	4.26	Detention Basin	Avoided- no restoration or monitoring required.				
N/A	4.27	Detention Basin	Avoided- no restoration or monitoring required.				
S-14	4.60	Intermittent	Waterbody drains south across the ROW within WL-WR-28. Multiple sections of the bank were previously observed in the spring of 2015 rutted and degraded by off-road vehicle traffic. Sediment deposits (2-4" deep) were observed within stream channel. Undisturbed bank/flood plain areas are stable and well vegetated with herbaceous ground cover. Impacts associated with the unauthorized travel were corrected and restored in the fall of 2015 following the restoration of wetland WL-WR-28.	None observed	Waterbody S-14 bed and bank locations within the restored ROW were graded, seeded and mulched following the completion of restoration site work at wetland WL-WR-28.	No; site conditions are stable; however, recently restored and seeded bank and floodway locations are lacking the necessary ground cover densities as site work was completed in November of 2015.	Tennessee will continue to monitor the success of the restored waterbody during the 2016 monitoring season and if necessary implement additional restoration measures to ensure proper restoration.

Table 2.1-2 Waterbodies Crossed by the Fitchburg Expansion Project and 2015 Monitoring Status							
Waterbody ID	Approximate Milepost	Waterbody Type	Evaluation of Waterbody	Erosion Control Concerns	2015 Restoration Activities	Waterbody Area Currently Meeting the Restoration Success Standards	Anticipated 2016 Restoration Activities
S-15	4.65	Perennial	Waterbodies drains north through the ROW within WL-WR-28. Multiple portions of the stream banks were previously observed in the spring of 2015 rutted by off-road vehicle traffic. Sediment/muck deposits were observed within the stream channels. The off-road vehicle traffic had exaggerated waterbody width and eliminated confining banks, resulting in the formation of ponded locations within the ROW. Impacts associated with the unauthorized off-road vehicle travel were corrected and restored in the fall of 2015 following the restoration of wetland WL-WR-28.	None observed	Waterbody S-4 bed and bank locations within the restored ROW were graded, seeded and mulched following the completion of restoration site work at wetland WL-WR-28.	No; site conditions are stable; however, recently restored and seeded bank and floodway locations are lacking the necessary ground cover densities as site work was completed in November of 2015.	Tennessee will continue to monitor the success of the restored waterbody during the 2016 monitoring season and if necessary implement additional restoration measures to ensure proper restoration.
S-16	4.66	Perennial		None observed	Waterbody S-4 bed and bank locations within the restored ROW were graded, seeded and mulched following the completion of restoration site work at wetland WL-WR-28.	No; site conditions are stable; however, recently restored and seeded bank and floodway locations are lacking the necessary ground cover densities as site work was completed in November of 2015.	Tennessee will continue to monitor the success of the restored waterbody during the 2016 monitoring season and if necessary implement additional restoration measures to ensure proper restoration.
Tributary to Pearl Hill Brook	4.92	Perennial	Avoided- no restoration or monitoring required.				



3.0 Post-Construction Assessment

3.1 Wetlands

3.1.1 Emergent Wetland Areas

According to the USACE mitigation standards, restored emergent wetland areas are to have at least 80% cover by non-invasive hydrophytes to meet the mitigation goals of this Project. To mitigate for emergent wetland impacts associated with the Project, Tennessee restored and seeded all temporarily impacted emergent wetland locations with wetland seed mix to establish the necessary native emergent ground cover. Based on the findings outlined in Table 2.1-1 above, seven (7) of the ten (10) emergent wetland mitigation sites have been fully restored to their preexisting condition, and contain vegetation densities that meet or exceed the thresholds outlined by the USACE relative to percent cover and the presence of invasive species monitored for this Project. Emergent mitigation sites not meeting the regulatory success standards for restoration are limited to locations subject to biological control methods in June of 2015 and have been detailed in Table 3.1-1 below.

3.1.2 Forested Wetland Areas

According to the USACE mitigation standards, each forested mitigation site must have at least 60% cover excluding open water areas, by non-invasive species and restored forested wetland areas are to have at least 500 trees per acre, of which at least 400 per acre are trees for proposed forested cover types, which are healthy and vigorous.

To mitigate for forested impacts associated with the Project, Tennessee replanted approximately 4.43 acres of temporarily impacted forested wetland with a total of 4,091 shrub and tree species individuals. The majority of the plantings associated with the mitigation areas were found in good health during the 2015 monitoring, with an overall low number of mortalities and/or little evidence of animal browse, disease or insect infestation. Of the 4,091 shrubs planted in 2009, less than 100 mortalities have been observed to date (less than 3% overall). The majority of the deceased plantings appeared to be associated with heavy snowfall following the initial planting in 2009, unauthorized off-road vehicle activity at specific locations, or significant inundation during the spring 2010.

Results of the 2015 monitoring efforts showed shrubs damaged during the initial year of development, either recovered or were sprouting new growth from the base. Volunteer species (specifically red maple, northern arrowwood, common winterberry and speckled alder) were observed thriving in the majority of the restored wetlands. Additionally, sprouting was observed at most of the wetland sites where tree stumps were left within the ROW.

Based on the findings outlined in Table 2.1-1 above, ten (10) of the thirteen (13) scrub-shrub/forested wetland mitigation sites have been restored to their pre-existing condition, and are currently meeting or exceeding the mitigation success standards identified by the USACE. Scrub-shrub/forested mitigation sites not currently meeting the USACE mitigation standards are coincident with locations that:

- Contained invasive species populations in 2014 that exceeded the regulatory threshold densities to be considered successful and were therefore treated via biological control methods in 2015; or
- Fall partially within a co-located overhead electric utility easement, which has been subject to past off-road vehicle travel and as a result was subject to grading and restoration measures in 2015 (see Table 3.1-1 below).



Table 3.1-1 Summary of Wetlands Subject to 2015 Mitigation Activities			
Wetland ID/ Cover Type	Approximate Milepost	Site Issues	Mitigation Activities
WL-WR-01/PEM	0.0 – 0.01	Invasive species populations currently exceeding the threshold limits for the Project.	Release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife.
WL-WR-03/PEM	0.16 – 0.17		
WL-WR-04/PEM	0.19 – 0.21		
WL-WR-18/PEM/PSS/PFO	3.44 – 3.48		
WL-WR-24/PEM/PSS/PFO	4.06 – 4.08	Invasive species populations currently exceeding the threshold limits for the Project. Site disturbances associated with unauthorized off-road vehicle travel.	Release of <i>Galerucella</i> Beetles to function as a biological control method for the developing populations of purple loosestrife. Re-grading, seeding, mulching and erosion control matting of site locations impacted by unauthorized third-party site activities.
WL-WR-28/PEM/PSS/PFO	4.61 – 4.72		
WL-WR-29/PEM	4.86 – 5.01		
WL-WR-31/PEM	5.02 – 5.03		

3.1.3 Waterbodies

As identified in Table 2.1-2 above, the majority of the waterbodies impacted by construction of the Project were found fully functional, with stabilized channels and well-vegetated floodplain corridors. Erosion/stabilization problems were limited to four (4) of the fifteen (15) waterbodies crossed by the Project, all of which received corrective actions in 2015 as detailed Table 3.1-2 below.

Table 3.1-2 Summary of Waterbodies Subject to 2015 Mitigation Activities				
Waterbody ID	Approximate Milepost	Waterbody Type	Site Issues	Mitigation Activities
S-4	1.26	Perennial	Construction of a beaver impoundment/obstruction of culvert within the ROW	Removal of the beaver impoundment and obstructions within the culvert system which crosses the ROW.
S-14	4.60	Intermittent	Site disturbances associated with unauthorized off-road vehicle travel.	Re-grading, seeding, mulching and erosion control matting of site locations impacted by unauthorized third-party site activities.
S-15	4.65	Perennial		
S-16	4.66	Perennial		



4.0 Conclusion and Post-Construction Assessment Plan

As described in Tables 2.1-1 and 2.1-2 above, a significant portion of the wetlands and waterbodies impacted by construction of the Project have been fully restored, and are currently meeting or exceeding the mitigation goals and requirements outlined by the USACE and the Project's Wetland Mitigation Plan. Portions of the restored wetlands within the ROW where invasive species are more prominent are generally limited to specific areas where pre-construction existing conditions, land use or management practices (i.e., previous infestations with invasive species, agricultural lands and utility ROWs) have provided opportunities for the colonization (or recolonization) and propagation within the ROW of invasive species, or provided off-road vehicle access as a result of pre-existing utility corridors. The following sections provide a summary of the problematic mitigation sites, a summary of the remediation measures implemented in 2015, and additional mitigation efforts that are anticipated to occur during the 2016 growing season.

4.1 Erosion and Site Disturbances Corrected in 2015

Wetland mitigation sites with ongoing management challenges are limited to three (3) discrete wetlands (WL-WR-28, 29 and 31) and three (3) associated waterbodies (S-14, 15, and 16) that are co-located with a neighboring overhead electric utility easement. Since initial restoration of the Project in 2009, these wetlands and waterbodies were continuously subjected to frequent use by non-Project related off-road vehicle traffic, resulting in rutting of wetland surface locations and stream bank and channel degradation, preventing complete revegetation of the wetland mitigation sites, and affected the flow and channelization waterbodies.

To control and mitigate for the continued unauthorized off-road vehicle traffic along ROW locations that are co-located with the overhead electric utility easement, Tennessee implemented the following remediation measures in the fall of 2015:

- "No Trespassing Police Take Notice" signage was installed within the restored ROW at public access points off Pleasant Street and Electric Avenue, as well as within the pipeline ROW at established trail crossings to discourage continued activity;
- Permanent concrete blocks and a gate was installed at both ROW points of intersection with public roadways to eliminate easy access for vehicles from both Pleasant Street and Electric Avenue; and
- Impacted wetlands (WL-WR-28, 29 and 31) and waterbodies (S-14, 15, and 16) were regraded, seeded, mulched and matted (as appropriate) to return surface elevation contours, drainage patterns and flow conditions to the post-construction site conditions to allow the wetlands and waterbodies to properly revegetate/stabilize and meet the mitigation goals identified for the Project.

In 2014, a site disturbance associated with the construction of a beaver dam at the crossing of waterbody S-4 was identified for the Project. Waterbody S-4 is intersected by a farm road via a pre-existing culvert and earthen fill bridge system in place to presumably provide site access for the dairy farming operation on the property. Beavers constructed a dam adjacent to the west side of the access road, which obstructed flow within the culvert system, resulting in overland flows at the access road during high flow events. Subsequently, the periodic overland flows caused surface erosion along portions of the access road that are in-line with the waterbody crossing.

In the fall of 2015, Tennessee reviewed the beaver activity at the S-4 waterbody crossing location with the landowner to determine the ability to manage and restore function to the culvert system. Following evaluation of the site, Tennessee employed an equipment operator to utilize a light-duty backhoe to dismantle the beaver



dam along the west side of the access road and dislodge the obstructed materials within the culvert system. Following removal of the dam and culvert obstructions, waterbody levels receded to typical flow elevations and flow/channel conditions were returned to the post-construction configurations. The access road travel ways and road shoulders will be evaluated during the 2016 monitoring season to determine if further stabilization is necessary at this crossing location.

4.2 Invasive Species Management Conducted in 2015

Eight (8) of the restored wetland mitigation sites have occurrences of invasive species at or above the density levels described in USACE mitigation standards and the Project's approved Wetland Mitigation Plan. A significant portion of the remaining restored wetlands contain trace populations or population densities that are on the threshold of exceeding the acceptable levels for invasive species colonization for the Project. All mitigation sites with documented populations of invasive species are also colonized by invasive species in locations outside of those areas disturbed during Project construction. Due to the linear nature of the Project, Tennessee can only implement invasive species management to locations within the restored ROW. Long-term management of invasive species within the ROW to the density levels specified by the Corps is not likely to be significantly different than populations outside of the existing easement. Due to such natural processes inherent to invasive species that make the spread of these species difficult to control (e.g., production of prolific amounts of seed and subsequent seed drift, fast growth rates, asexual reproduction/propagation, lack of natural predators, etc.) in combination with the presence of populations of these species immediately outside of the ROW, Tennessee's overall short-term goal is to control the invasive species to a level that the restored wetlands are not dominated by the invasive species such that the function of the system is compromised and if present, the invasive species are within the acceptable density levels permitted by regulatory agencies.

The 2014 site monitoring activities demonstrated that a significant number of wetland restoration sites had increased occurrences or densities of invasive species (dominantly reed canary grass and purple loosestrife). In June of 2015, Tennessee obtained a permit from the United States Department of Agriculture Animal and Plant Health Inspection Service to obtain a shipment of 6,000 *Galerucella* sp. beetles from the New Jersey Department of Agriculture to function as a biological control agent for purple loosestrife populations within the restored ROW. To avoid the swarming of the released *Galerucella* sp. beetles to alternative site locations outside the desired control areas, the insects were distributed at specific wetland locations that contained documented high-density populations of purple loosestrife. Successful use of these insects as a biological control agent requires their release occur at sizeable stands of purple loosestrife vegetation as it is utilized by the beetles as an exclusive food source as well as for the development of all life cycles including overwintering. The total count of *Galerucella* sp. beetles acquired by Tennessee was obtained following GIS analysis and review of the acreages of purple loosestrife infestations along the restored ROW by AECOM, which was then provided to the New Jersey Department of Agriculture to assist the agency in providing the estimated totals necessary to effectively control the purple loosestrife communities. Locations where the release of *Galerucella* sp. beetles occurred will not receive aerial herbicide application treatments in 2016 for other invasive herb species (as indicated in table 2.1-1) and Tennessee will monitor the success of the biological controls during the 2016 monitoring period.

In the summer of 2015, Tennessee also coordinated review of the Project locations listed in Tables 2.1-1 and 3.1-1 with two (2) invasive species management contractors to determine the appropriate and available control measures for each affected mitigation site, and to determine the effectiveness of implementing control given treatment will be limited to locations within Tennessee's restored ROW. Locations found to warrant the use of herbicides for invasive species control will be reviewed by Tennessee with the affected landowners to ensure management techniques are approved prior to implementation during the 2016 monitoring season. Where implemented, Tennessee will ensure invasive species control measures are conducted in accordance with the Project-approved Invasive Species Management Plan and all activities relative to the control of invasive



species will be documented by Tennessee and submitted to USACE for review in the 2016 Monitoring Report for the Project.

Appendix A
Inventory of Dominant Volunteer Species



INVENTORY OF DOMINANT VOLUNTEER PLANT SPECIES ASSOCIATED WITH MITIGATION SITES ^{ab}			
Common Name	Scientific name	Community Type	Wetland Indicator Status ^c
Red Maple	<i>Acer rubrum</i>	Seedling/Shrub	FAC
Yellow Birch	<i>Betula alleghaniensis</i>	Seedling/Shrub	FAC
Grey Birch	<i>Betula populifolia</i>	Seedling/Shrub	FAC
White Oak	<i>Quercus alba</i>	Seedling/Shrub	FACU
Bebb Willow	<i>Salix bebbiana</i>	Seedling/Shrub	FACW
Black Birch	<i>Betula lenta</i>	Seedling/Shrub	FACU
Silky Dogwood	<i>Cornus amomum</i>	Seedling/Shrub	FACW
Northern Arrowwood	<i>Viburnum recognitum</i>	Seedling/Shrub	FACW
Speckled Alder	<i>Alnus incana</i>	Seedling/Shrub	FACW
Common Cattail	<i>Typha latifolia</i>	Herb	OBL
Common Ragweed	<i>Ambrosia artemisiifolia</i>	Herb	FACU
Spike Rush Sp.	<i>Eleocharis sp.</i>	Herb	N/A
Field Horsetail	<i>Equisetum arvense</i>	Herb	FAC
Beggar Tick	<i>Bidens frondosa</i>	Herb	FACW
Jewelweed	<i>Impatiens capensis</i>	Herb	FACW
Common Smartweed	<i>Polygonum hydropiper</i>	Herb	OBL
Goldenrod Sp.	<i>Solidago sp.</i>	Herb	N/A
Deertongue	<i>Panicum clandestinum</i>	Herb	FAC
Eastern Poison Ivy	<i>Toxicodendron radicans</i>	Vine	FAC
Common Greenbriar	<i>Smilax rotundifolia</i>	Vine	FAC
Arrowleaved Tearthumb	<i>Polygonum sagittatum</i>	Vine	OBL

a: Dominant volunteer plant species must include at least 5% of their vegetative cover.

b: Volunteer species are those species found in a portion of the restored wetlands that were not incorporated in the wetland restoration seed mix or planted individuals.

c: Indicator status identified using the U.S. Army Corps of Engineers 2012 National Wetland Plant List Northcentral-Northeast Region.

Appendix B

2015 Site Photographs of Mitigation Areas

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 1	Date: 6-23-15		
Photo Aspect: Southwest			
Description: View of dense herbaceous cover within WL-WR-01			

Photo No. 2	Date: 6-23-15	
Photo Aspect: North		
Description: View emergent vegetation within WL-WR-03.		

PHOTOGRAPHIC LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 3	Date: 6-23-15		
Photo Aspect: South			
Description: View of dense herbaceous cover within WL-WR-06.			

Photo No. 4	Date: 6-23-15	
Photo Aspect: North		
Description: Additional view of vegetation within WL-WR-06.		

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 5	Date: 6-23-15		
Photo Aspect: South			
Description: View of dense herbaceous cover within WL-WR-07.			

Photo No. 6	Date: 9-13-15	
Photo Aspect: East		
Description: View of PEM vegetation recently mowed by landowner within WL-WR-04.		

PHOTOGRAPHIC LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 7	Date: 6-23-15		
Photo Aspect: North			
Description: View of dense emergent wetland cover within WL-WR-09.			

Photo No. 8	Date: 6-23-15	
Photo Aspect: South		
Description: View of beaver activity within waterbody S-4 prior to site restoration in September of 2015.		

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 9	Date: 6-23-15		
Photo Aspect: North			
Description: View of emergent wetland communities within WL-WR-10.			

Photo No. 10	Date: 9-13-15	
Photo Aspect: South		
Description: View of well vegetated floodplain/bank locations associated with waterbody S-5.		

PHOTOGRAPHIC LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 11	Date: 6-23-15		
Photo Aspect: North			
Description: View of re-vegetated locations within WL-WR-11 which were previously disturbed by off-road vehicle activities in 2011/2014.			

Photo No. 12	Date: 6-23-15	
Photo Aspect: Northwest		
Description: View of off-road vehicle activity within WL-WR-12.		

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 13	Date: 6-23-15		
Photo Aspect: North			
Description: View of restored buffer zone locations which were re-vegetated in response to the 2011/2014 monitoring observations- NW of WL-WR-12.			

Photo No. 14	Date: 6-23-15	
Photo Aspect: North		
Description: View of robust herbaceous wetland cover within WL-WR-13.		

PHOTOGRAPHIC LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 15	Date: 6-23-15		
Photo Aspect: South			
Description: View of robust herbaceous cover within WL-WR-14.			

Photo No. 16	Date: 6-23-15	
Photo Aspect: North		
Description: View of re-vegetated wetland/buffer zone locations associated with WL-WR-15, which were restored in response to 2011 monitoring observations.		

PHOTOGRAPHIC LOG

Client / Project:
Fitchburg Expansion Project

Location:
Lunenburg, Massachusetts

Project No.
60136976

Photo No.
17

Date:
9-13-12

Photo Aspect:
South

Description:
View of dense herbaceous wetland cover within WL-WR-17 and along banks/flood plain areas of waterbody S-9.



Photo No.
18

Date:
6-23-15

Photo Aspect:
North

Description:
View of dense cover within WL-WR-18.



PHOTOGRAPH LOG

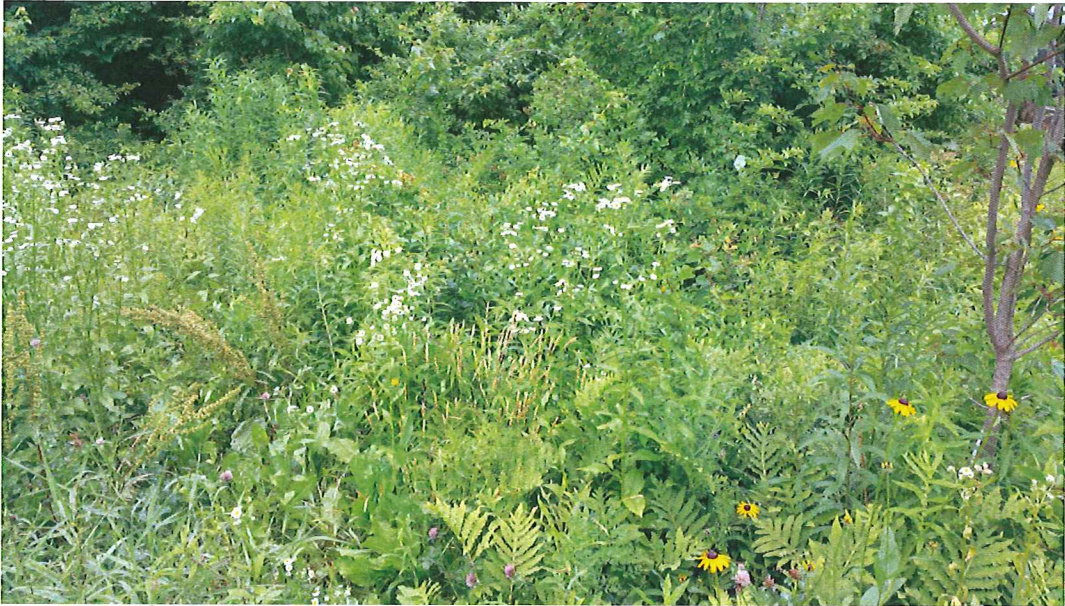
Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 19	Date: 6-23-15		
Photo Aspect: East			
Description: View of thriving wetland cover within WL-WR-19 and waterbody S-10.			

Photo No. 20	Date: 6-23-15	
Photo Aspect: East		
Description: View of re-vegetated herbaceous cover within WL-WR-20 which was hand-seeded in 2014.		

PHOTOGRAPHIC LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 21	Date: 6-23-15		
Photo Aspect: North			
Description: View of emergent wetland vegetation within WL-WR-21.			

Photo No. 22	Date: 6-23-15	
Photo Aspect: North		
Description: View emergent vegetation at WL-WR-23.		

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 23	Date: 6-23-15		
Photo Aspect: East			
Description: View of shrubs/saplings and herbaceous development within WL-WR-24.			

Photo No. 24	Date: 6-23-15	
Photo Aspect: East		
Description: View of shrubs/saplings and herbaceous development within WL-WR-25.		

PHOTOGRAPHIC LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 25	Date: 6-23-15		
Photo Aspect: West			
Description: View of site disturbances within wetland WL-WR-28 and waterbody S-14 prior to fall 2015 restoration activities.			

Photo No. 26	Date: 6-23-15	
Photo Aspect: West		
Description: Additional view of site disturbances within wetland WL-WR-28 and waterbodies S-15 and S-16 prior to fall 2015 restoration activities.		

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 27	Date: 6-23-15		
Photo Aspect: West			
Description: View of degraded wetland locations due to unauthorized off-road vehicle traffic within WL-WR-29 prior to fall 2015 restoration activities			

Photo No. 28	Date: 6-23-15	
Photo Aspect: East		
Description: View of travel ways within wetland WL-WR-31 prior to fall 2015 restoration activities.		

Appendix C

Site Photographs of 2015 Restoration Activities

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 1	Date: 6-24-15		
Photo Aspect: Northeast			
Description: View of the release of <i>Galerucella</i> sp. beetles onto purple loosestrife plants within the restored ROW.			

Photo No. 2	Date: 6-24-15	
Photo Aspect: North		
Description: Additional view of the release of <i>Galerucella</i> sp. beetles onto purple loosestrife plants within the restored ROW.		

PHOTOGRAPHIC LOG

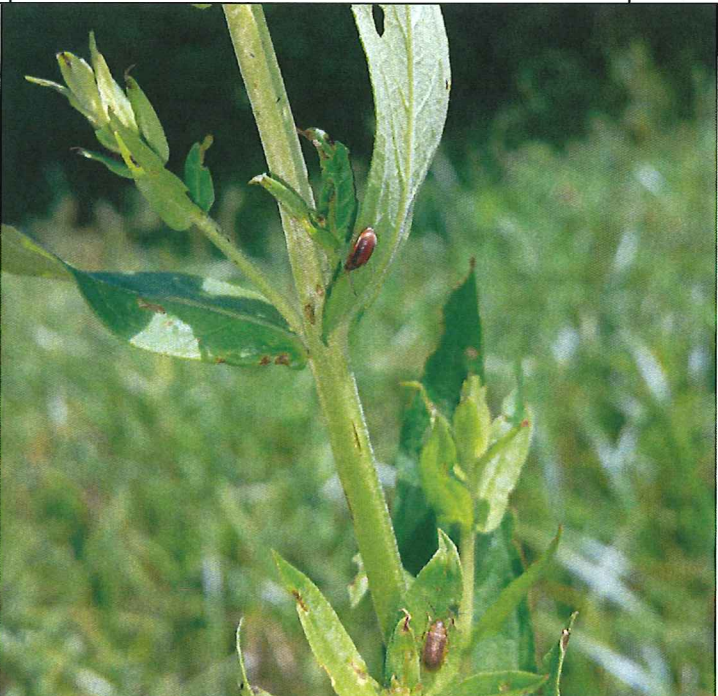
Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 3	Date: 6-24-15		
Photo Aspect: South			
Description: View of <i>Galerucella</i> sp. beetles immediately feeding on purple loosestrife plants following release within the restored ROW.			

Photo No. 4	Date: 6-24-15	
Photo Aspect: North		
Description: Additional image of <i>Galerucella</i> sp. beetles feeding on purple loosestrife plants following release within the restored ROW.		

PHOTOGRAPH LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 5	Date: 12-04-15		
Photo Aspect: East			
Description: View of installed concrete blocks, "no trespassing" signage and cattle gate to discourage unauthorized vehicle access through restored resource areas between Pleasant Street and Electric Avenue.			

Photo No. 6	Date: 11-15	
Photo Aspect: East		
Description: View of the installation of jute matting following the grading, seeding and mulching of restored locations within WL-WR-28.		

PHOTOGRAPHIC LOG

Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 7	Date: 12-04-15		
Photo Aspect: West			
Description: View of restored wetland and waterbody locations associated with WL-WR-28 and S-15 and S-16 two weeks following final restoration.			

Photo No. 8	Date:	
Photo Aspect: South		
Description: View of beaver impoundment and debris within the obstructed culvert system at waterbody S-4 prior to removal.		

PHOTOGRAPH LOG			
Client / Project: Fitchburg Expansion Project		Location: Lunenburg, Massachusetts	Project No. 60136976
Photo No. 9	Date:		
Photo Aspect: South			
Description: View following the removal of the beaver impoundment and debris within the obstructed culvert system at waterbody S-4.			