Validation of Wetland Mitigation in Abandoned Borrow Areas - Phase II

Kurt W. Johnson, Principal Investigator
Center for Applied Research and Technology Development
Natural Resources Research Institute
University of Minnesota Duluth

March 2016

Research Project
Final Report 2016-11

Minnesota Department of Transportation

RESEARCH SERVICES & LIBRARY

Office of Transportation System Management

To request this document in an alternative format call 651-366-4718 or 1-800-657-3774 (Greater Minnesota) or email your request to ADArequest.dot@state.mn.us. Please request at least one week in advance.

Technical Report Documentation Page

1. Report No.	2.	3. Recipients Accession No.
MN/RC 2016-11		

4. Title and Subtitle	5. Report Date
Validation of Wetland Mitigation in Abandoned Borrow Areas – Phase II	March 2016
	6.

7. Author(s)	8. Performing Organization Report No.
Kurt W. Johnson	

9. Performing Organization Name and Address	10. Project/Task/Work Unit No.
Center for Applied Research and Technology Development Natural Resources Research Institute University of Minnesota Duluth 5013 Miller Trunk Highway Duluth MN 55811	CTS # 2011062
	11. Contract (C) or Grant (G) No. (c) 89261 (wo) 252

12. Sponsoring Organization Name and Address	13. Type of Report and Period Covered
Minnesota Department of Transportation Research Services & Library 395 John Ireland Boulevard, MS 330 St. Paul, Minnesota 55155-1899	Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes
http://www.lrrb.org/pdf/201611.pdf

16. Abstract (Limit: 250 words)

Road construction in northeast Minnesota often causes wetland impacts that require compensatory mitigation. Borrow areas excavated for road construction material can be developed into wetland mitigation sites if hydric vegetation, hydric soils and adequate hydrology are provided. Fourteen wetland mitigation sites were constructed north of Virginia, Minnesota along the U.S. Trunk Highway 53 reconstruction project corridor. The sites were established with the goal of mitigating for project impacts to seasonally flooded basin, fresh meadow, shallow marsh, shrub swamp, wooded swamp, and bog wetlands. Monitoring results indicate that the 14 mitigation sites range in their potential to receive wetland mitigation credit. All but one of the sites consistently meet wetland hydrology criteria. The sites contain a variety of plant communities dominated by wet meadow, sedge meadow, and shallow marsh. Floristic Quality Assessment (FQA) condition categories for the sites range from “Poor” to “Exceptional.” Invasive plant species, particularly reed canary grass and narrow leaf cattail, are present on a number of sites and should be controlled. Tamarack and black spruce plantings have been successful on some of the drier areas and should be expanded to increase the quality and potential mitigation credit for other sites. These sites have shown the potential for creating mitigation wetlands in abandoned borrow pits in conjunction with highway construction. Adaptive management, particularly water level regulation, early invasive species control, tree planting, and continued long-term annual monitoring can make mitigation sites like these successful options for wetland mitigation credit. Continued site monitoring to determine potential for mitigation credit is recommended.

17. Document Analysis/Descriptors	18. Availability Statement
Wetlands, road construction, aquatic life, assessments, seeds, gravel pits, grasslands, marshes, bogs, shrubs, invasive plants	No restrictions. Document available from: National Technical Information Services, Alexandria, Virginia 22312

19. Security Class (this report)	20. Security Class (this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	297	

Validation of Wetland Mitigation in Abandoned Borrow Areas – Phase II

Final Report

Prepared by:
Kurt W. Johnson
Center for Applied Research and Technology Development
Natural Resources Research Institute
University of Minnesota Duluth

March 2016

Published by:
Minnesota Department of Transportation
Research Services & Library
395 John Ireland Boulevard, MS 330
St. Paul, Minnesota 55155-1899

Acknowledgements

I would like to thank the Minnesota Department of Transportation (MnDOT) for funding this study, especially the efforts of Sarma Staumanis, Ken Graeve, Howard Maki, and Alan Rindels in championing this project. I greatly appreciate the support given by Sarma Straumanis, the project technical liaison, and project administrative liaisons Shirlee Sherkow and Alan Rindels. Thanks to the staff at the Mn/DOT District 1 Offices in Duluth and Virginia, including Andrew Johnson, Dan Squires, Lori Ross, and Shelly Micke for providing maps and background information on the mitigation sites. Dan Shaw and Carol Strojny of the Minnesota Board of Water and Soil Resources (BWSR) gave valuable suggestions and encouragement. Thanks to my Natural Resources Research Institute (NRRI) colleague Craig Maly who conducted well monitoring and data recording throughout the project. Other NRRI staff who contributed to the project included Marsha Patelke, who assisted with data spreadsheets, Sara Post, who used GIS to create the plant community maps, and Anda Bellamy, who prepared the final report for submission. Finally, thanks to Gary Walton, the project botanist, who, with his exceptional plant species identification skills, conducted the detailed project plant surveys required to evaluate the mitigation sites.

Table of Contents

List of Tables

List of Figures

Executive Summary

Road construction in northeast Minnesota often causes wetland impacts that require compensatory mitigation. Northeast Minnesota still retains more than 80 percent of its pre-European settlement wetland acreage, thus presenting very few opportunities for traditional mitigation such as wetland restoration. Abandoned borrow areas that have been excavated for road construction materials are one of the few remaining areas that can serve as wetland mitigation sites within the affected watersheds.

Fourteen wetland mitigation sites were constructed north of Virginia, Minnesota, along the 11.2-mile segment of the U.S. Trunk Highway 53 reconstruction project corridor. The sites were established with the goal of mitigating for project impacts to 0.25 acres of seasonally flooded basin (Type 1), 1.76 acres of fresh meadow (Type 2), 0.79 acres of shallow marsh (Type 3), 28.4 acres of shrub swamp (Type 6), 28.42 acres of wooded swamp (Type7), and 24.87 acres of bog (Type 8) wetlands, for a total of 84.49 acres of wetland impacts. Wetland basins were formed by the removal of borrow material for road construction. Basins were intentionally excavated down to the water table to ensure wetland hydrology. Salvaged soils (peat and muck) from several locations within the project corridor were applied in varying amounts to the individual mitigation sites. Wetland seed mixes approved by the Minnesota Department of Transportation (MnDOT) and Minnesota Board of Water and Soil Resources (BWSR) were selectively applied to each site and covered with a MnDOT-approved straw mulch.

Mitigation Sites 4 and 5 were established in 2007 and previously monitored for the 2008 and 2009 growing seasons as part of the project “Wetland Mitigation in Abandoned Gravel Pits." Construction of the remaining 12 sites was completed in 2010. The goal of this project was to continue monitoring all 14 mitigation sites for the 2011-2014 growing seasons to evaluate their potential for wetland mitigation credit. According to state and federal regulatory agencies, the lack of long-term monitoring of mitigation sites is a primary reason for failure and non-compliance and subsequent wetland credit devaluation.

Water level wells were established at each site to monitor hydrology and determine whether wetland criteria were met with water levels measured biweekly during the frost-free growing season. For the 2011 and 2012 growing seasons, plant surveys were conducted using the relevé method to estimate percent cover by each plant species in 5m x 5m plots established in each vegetative community. Total percent cover and invasive species cover was determined for each plant community along with total species richness for each site.

A new monitoring methodology was developed and used in 2013 and 2014 to better quantify wetland plant community extent and quality over time. With this method vegetation survey transects were conducted across each plant community using the Step Point Intercept Method to determine percent cover for each plant species. The plant communities were also outlined using a GPS to allow mapping with ArcGIS® software to calculate their area. With this method the Rapid Floristic Quality Assessment (FQA) could also be used to determine plant community vegetation quality. The weighted coefficient of conservatism (wC) and Biological Condition Gradient Category are the FQA parameters most useful for purposes of this project.

Monitoring results indicate that the 14 mitigation sites within the U.S. Trunk Highway 53 corridor range in their potential to receive wetland mitigation credit. All of the sites consistently meet wetland hydrology criteria with the exception of Mit Site 11. The sites contain a variety of plant communities with FQA condition categories ranging from “Poor” to “Exceptional.” Some sites are trending toward a higher quality wetland while others are going toward poorer quality. About half of the mitigation sites are currently in relatively good condition. During a June 2015 visit to the mitigation sites, members of the Technical Advisory Panel (TAP) evaluated the potential for each site to qualify for wetland mitigation credit. Mitigation Sites 3, 4, 5, 6, 8, 9, and 10 show good to excellent potential for receiving wetland mitigation credit, although portions of Mit Sites 9 and 10 are within a power-line corridor that could result in reduced credits.

The plant communities and total areas present for all 14 mitigation sites combined as of 2014 are: 27.71 acres of wet meadow, 12.39 acres of sedge meadow, 11.8 acres of shallow marsh, 4.74 acres of reed canary grass, 2.41 acres of shrub carr, 0.86 acres of bog, and 0.65 acres of alder thicket. The sites are dominated by wet meadow, sedge meadow, and shallow marsh. In comparison, the wetlands primarily affected by the road construction were shrub swamp, wooded swamp, and bog. In an effort to more adequately replace lost wetland functions, tree planting is recommended on the drier wet meadow and sedge meadow sites to increase the woody plant component of these wetlands.

Adaptive management activities could improve site quality and increase potential for receiving wetland mitigation credit. All mitigation sites would benefit from invasive species control. Invasive species control is probably the most cost effective way to ensure and increase mitigation credits. In the future, early invasive species intervention will improve resulting site quality by increasing the likelihood of native species establishment.

Tree planting on some of the drier areas could also increase the quality and potential mitigation credit for Mitigation Sites 2, 6, 8, 9, and 11. Tamarack and black spruce have done well when planted on drier sites such as Mit Site 3. Shrubs such as willow and alder are establishing on their own on a number of sites, which is encouraging.

Reducing and stabilizing water levels to minimize standing water on certain sites may also be beneficial and promote conditions conducive to wet meadow, sedge meadow, bog, shrub carr, and forested plant communities rather than shallow marsh. Mit Site 10 would especially benefit from a reduced water table. This, however, may be difficult to control. Mitigation site inlets and outlets are not always defined, and in many cases, the only way to reduce the water table relative to the soil surface is by adding fill. This may be effective for certain smaller sites such as Mit Sites 1 and 14, but the cost may be prohibitive. As mentioned, it could be tried experimentally on Mit Site 1.

If any of the 14 mitigation sites are renovated and require reseeding, a review of the plants that established from seed mixes is recommended. This will allow seed mixes to be refined to include only species that are adapted to the area and have the best chance to survive and flourish. This information can also be useful for future mitigation site plantings in the region.

According to the U.S. Army Corps of Engineers, mitigation credit is not allowed for wetlands located within power-line corridors. As such, all or portions of Mitigation Sites 1, 7, 9, 10, 12, and 13 would be ineligible for credit.

These 14 sites have shown the potential for creating mitigation wetlands in abandoned borrow pits in conjunction with highway construction. Adaptive management, particularly water level regulation, early invasive species control, and continued long-term annual monitoring can make mitigation sites like these successful options for wetland mitigation credit. Thorough pre-construction planning should be conducted to avoid potential impediments to receiving mitigation credit, such as power-line corridors. Continued monitoring of the sites that have significant potential for mitigation credit is recommended.

Chapter 1: Introduction

Overview

Wetland impacts are often an inevitable consequence of road construction, requiring compensatory mitigation. Northeast Minnesota still retains more than 80 percent of its pre-European settlement wetland acreage, presenting very few opportunities for traditional mitigation such as wetland restoration. Abandoned borrow areas that have been excavated for road construction materials are one of the few remaining areas that can serve as wetland mitigation sites within the impacted watersheds. In a previous project, "Wetland Mitigation in Abandoned Gravel Pits," a demonstration site consisting of two mitigation sites was established in 2007 to evaluate techniques for creating fresh meadow, shrub swamp, wooded swamp, and bog wetlands in abandoned gravel pits (Johnson, 2010). Preliminary results are encouraging, but continued monitoring is needed to determine long-term success and regulatory compliance. According to state and federal regulatory agencies, the lack of long-term monitoring of mitigation sites is a primary reason for failure and non-compliance, and subsequent wetland credit devaluation. This project allowed continued monitoring of the two existing demonstration site wetlands for an additional four years. Additional vegetation monitoring was conducted on the other 11 mitigation sites within the U.S. Trunk Highway 53 reconstruction corridor for four years to evaluate their progress. The information will provide useful data on northern Minnesota wetland mitigation sites and provide insight into how salvaged soil can be utilized and restoration seed mixes should be developed for the northern portion of the state. The overall goal of the project is to develop cost-effective methods for creating functional mitigation wetlands in abandoned borrow areas that meet regulatory permit requirements. The long-term monitoring of these sites will help validate creating mitigation wetlands in abandoned borrow areas as an integral part of road construction projects.

Background

The 14 wetland mitigation sites are located north of Virginia, Minnesota along the 11.2-mile segment of the U.S. Trunk Highway 53 project corridor originating 1.2 miles south of County Road 307 and extending northward to 0.22 miles south of County Road 652 as shown in Figure 1.1. Mitigation Sites 4 and 5 were established in 2007, and construction of the remaining sites was completed in 2010. The sites were established with the goal of mitigating for project impacts to 0.25 acres of seasonally flooded basin (Type 1), 1.76 acres of fresh meadow (Type 2), 0.79 acres of shallow marsh (Type 3), 28.4 acres of shrub swamp (Type 6), 28.42 acres of wooded swamp (Type7), and 24.87 acres of bog (Type 8) wetlands, for a total of 84.49 acres of wetland impacts.

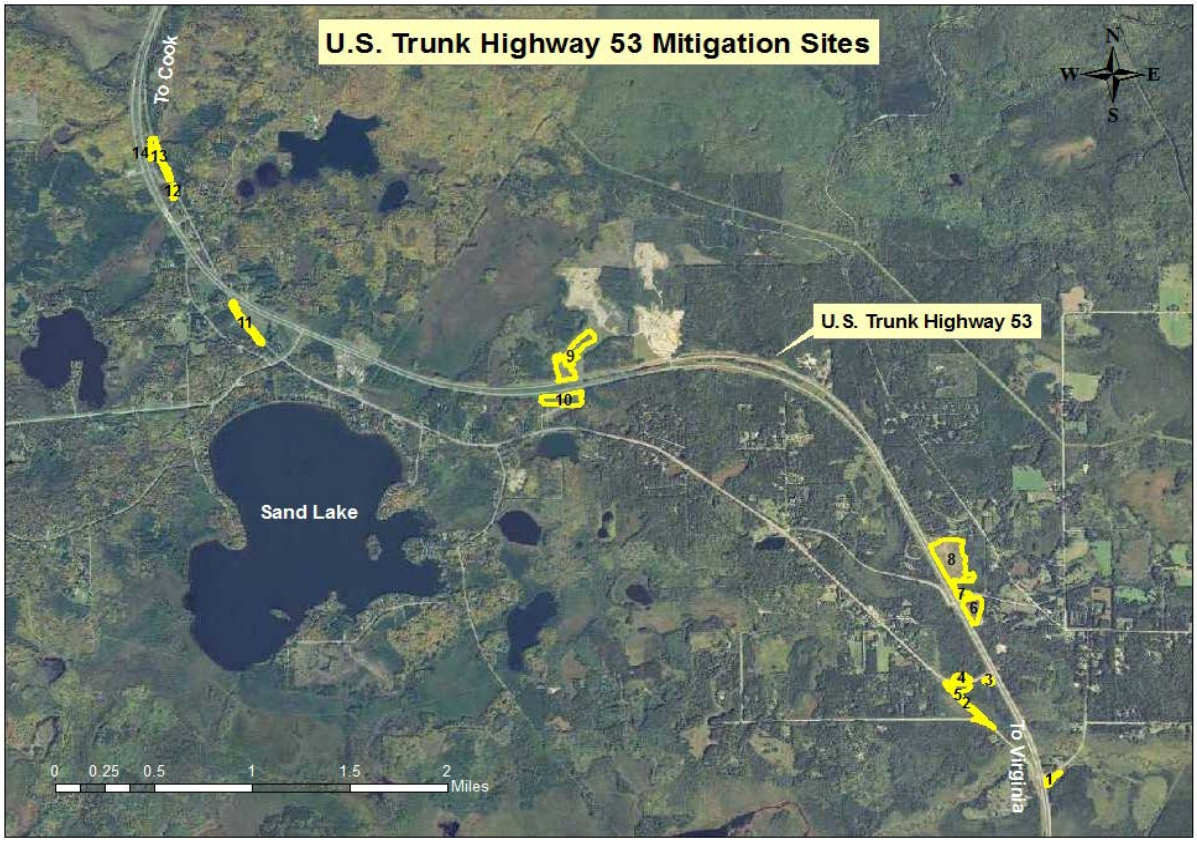


Figure 1.1. U.S. Trunk Highway 53 mitigation sites.

Wetland basins were formed by the removal of borrow material for road construction. Basins were intentionally excavated down to the water table to ensure wetland hydrology. Salvaged soils (peat and muck) from several locations within the project corridor were applied in varying amounts to the individual mitigation sites based on their proximity, ease of transport, disposal need, and potential benefit to plant growth. Wetland seed mixes approved by the Minnesota Department of Transportation (MnDOT) and Minnesota Board of Water and Soil Resources (BWSR) (Table 1.1) were selectively applied to each site and covered with a MnDOT-approved straw mulch. Mitigation Sites 4 and 5 were monitored for the 2008, 2009, 2011, 2012, 2013, and 2014 growing seasons. The remainder of the sites were monitored for the 2011, 2012, 2013, and 2014 growing seasons. The U.S. Army Corps of Engineers inspected the sites in July 2013 and provided recommendations for future monitoring and adaptive management.

Table 1.1. MnDOT/BWSR seed mixes applied to mitigation sites.

MnDOT Special (BWSR WT1) - Wetland Temporary			
Beckmannia syzigachne	Slough Grass, American	*Poa palustris*	Bluegrass, Fowl
Lolium multiflorum	Rye Grass, Annual		
MnDOT Special 1 (BWSR W1) - Native Emergent/Wetland Fringe			
Acorus calamus	Sweet flag	*Eleocharis acicularis*	Spike-rush, creeping
Alisma plantago-aquatica	Water Plantain	*Eleocharis palustris*	Spike-rush, great
Alisma triviale	Plantain, large flowered-water	*Eupatorium maculatum*	Joe-pye weed
Asclepias incarnata	Milkweed, marsh	*Glyceria Canadensis*	Manna grass, rattlesnake
Beckmannia syzigachne	Slough Grass, American	*Glyceria grandis*	Manna grass, reed
Calamagrostis canadensis	Blue-joint grass	*Juncus effusus*	Rush, common
Carex comosa	Sedge, bottlebrush	*Leersia oryzoides*	Cut-grass, rice
Carex hystericina	Sedge, porcupine	*Scirpus acutus*	Bulrush, hard-stem
Carex lacustris	Sedge, lake	*Scirpus validus*	Bulrush, soft-stem
Carex stricta	Sedge, tussock	*Scripus fluvitialis*	Bulrush, river
Carex vulpinoidea	Sedge, fox	*Sparganium eurycarpum*	Bur-reed, giant
MnDOT Special 2 (BWSR W2) - Native Sedge/Wet Meadow			
Anemone canadensis	Anemone, Canada	*Helianthus grosserratus*	Sunflower Sawtooth
Asclepias incarnata	Milkweed, marsh	*Iris versicolor*	Iris, blue-flag
Aster puniceus	Aster, swamp	*Juncus effusus*	Slender rush
Aster umbellatus	Aster, flat-topped	*Liatris* sp.	Blazing Star Meadow
Beckmannia syzigachne	Slough Grass, American	*Lobelia siphilatica*	Great Blue Bobelia
Bromus ciliatus	Brome, fringed	*Mimulus ringens*	Monkey Flower
Calamagrostis canadensis	Blue-joint grass	*Poa palustris*	Bluegrass, fowl
Carex comosa	Sedge, bottlebrush	*Pycanthemum flexuosum*	Mint Mountain
Carex stricta	Sedge, tussock	*Scirpus atrotinctus*	Bulrush, green
Carex vulpinoidea	Sedge, fox	*Scirpus cyperinus*	Woolgrass
Elymus virginicus	Wild-rye, virginia	*Scirpus validus*	Bulrush, soft-stem
Eupatorium maculatum	Joe-Pye Weed	*Scripus fluvitialis*	Bulrush, river
Eupatorium perfoliatum	Boneset	*Solidago gigantea*	Goldenrod, giant
Euthamia graminifolia	Goldenrod, grass-leaved	*Verbena hastata*	Vervain, blue
Glyceria Canadensis	Manna grass, rattlesnake	*Veronia fasiculata*	Ironweed
Glyceria grandis	Manna grass, reed	*Veronocrastum virginica*	Culvers Root
Helenium autumnale	Sneezeweed		

Report Organization

The original project proposal specified three additional years of monitoring for all 14 mitigation sites within the U.S. Trunk Highway 53 corridor. Due to a renewed focus on regulatory approval of wetland mitigation credits after a site visit by the Army Corps of Engineers in July 2013, a new monitoring methodology was developed to better quantify wetland plant community extent and quality. The new monitoring procedure was first implemented in October 2013 with good results. The project had been granted a no-cost extension in August 2012 allowing monitoring to continue into 2014 for a total of four years. The final report is organized as follows: Chapter 2 details the original monitoring methods used in 2011 and 2012 and the new monitoring methods used in 2013 and 2014. In Chapter 3, the monitoring results are presented and summarized for each individual mitigation site for each year. Overall conclusions and recommendations are presented in Chapter 4, along with specific recommendations for future adaptive management for individual sites. Additional data including water-level graphs and plant lists are contained within the Annual Reports in the Appendix.

For purposes of this report, “Mitigation Site” will be abbreviated to “Mit” (“Mitigation Site 1” will be “Mit 1”).

Chapter 2: Mitigation Site Monitoring Methods

Monitoring Methods and Success Criteria 2011 and 2012

The goal in monitoring these 14 wetland mitigation sites is twofold. The first is to determine if the sites meet the regulatory requirements for compensatory mitigation such as wetland hydrology, wetland plant species cover, and limited invasive species. The second is more research oriented with the goal of determining if certain factors such as water table levels and seed mixes applied can successfully create a wetland of the desired quality and type.

In order for the wetlands constructed in association with the U.S. Trunk Highway 53 reconstruction to meet regulatory requirements for wetland mitigation they must meet a wetland hydrology standard. According to the U.S. Army Corps of Engineers (USACE) technical standard (2005), wetland hydrology is present when:

> "The site is inundated (flooded or ponded) or the water table is ≤12 inches below the soil surface for ≥14 consecutive days during the growing season at a minimum frequency of 5 years in 10 (≥50% probability). Any combination of inundation or shallow water table is acceptable in meeting the 14-day minimum requirement. Short-term monitoring data may be used to address the frequency requirement if the normality of rainfall occurring prior to and during the monitoring period each year is considered."

Water table monitoring wells were constructed of two-inch-diameter slotted PVC pipe covered with a fabric filter screen with a solid PVC standpipe and cap (USACE, 2005). Wells were installed to a minimum depth of 15 inches or to the depth of the impermeable layer. Three wells were installed on each site (with the exception of Mit 9 that had two wells installed). Water table levels were recorded biweekly throughout the frost-free period. Water table data was graphed and is included in the Annual Reports in the Appendix.

Along with wetland hydrology, the criteria for successful wetland creation are wetland plant cover and absence of invasive species. Plant surveys were conducted using the relevé method (Minnesota Depatment of Natural Resources, 2007) to estimate percent cover by each plant species in 5m x 5m plots established in each vegetative community. All data collected was sorted in order to categorize plant species as native, foreign (introduced), invasive, or originating from the WT1, W2, or other seed mixes. Total percent cover and invasive species cover was determined for each plant community along with total species richness for each site. This information is presented for each plant survey conducted in 2011 and 2012 in Table 3.1, Table 3.2, and Table 3.3. Other more detailed plant survey information is included in the Annual Reports in the Appendix.

Monitoring Methods and Success Criteria 2013 and 2014

A new vegetation survey method was adopted in October 2013 to get a better idea of overall site conditions, better quantify plant communities and invasive species infestations, evaluate the

quality of each plant community, and get a clearer picture of year to year vegetation changes. The new method includes the following procedures:

1) Outline entire mitigation wetland basin and each distinct plant community according to *Wetland Plants and Plant Communities of Minnesota and Wisconsin* (Eggers and Reed, 1997) within the basin using a GPS. Although "Reed Canary Stands" are not designated plant communities, they were outlined as such because they are one of the most predominant invasive species on the mitigation sites and require control.
2) Outline any invasive species infestations.
3) Conduct vegetation survey transects across each plant community using the Step Point Intercept Method (Evans and Love, 1957) to determine percent cover for each plant species.
4) Record all plants observed on the site to create an entire species inventory.
5) Download GPS data onto computer and use ArcGIS® software to create maps for each mitigation site delineating plant communities and calculating their area.
6) Calculate Floristic Quality Assessment (FQA) parameters (Minnesota Pollution Control Agency, 2014) for each plant community within each mitigation site. The weighted coefficient of conservatism (wC) and Biological Condition Gradient Category are the most useful for purposes of this project.
7) Evaluate the potential for each individual mitigation site to qualify for wetland mitigation credit.
8) Determine areas requiring adaptive management.

Using this method, maps were produced using ArcGIS® software showing transect locations and plant communities for each mitigation site. These maps are included with this report. Maps for complex Mitigation Sites 9 and 10 were not completed for the 2013 growing season. Maps for all mitigation sites were completed in 2014 and are included in this final report.

Rapid Floristic Quality Assessment (FQA)

Another relatively new method for assessing wetland quality is Floristic Quality Assessment (FQA). The FQA is based on the Coefficient of Conservatism (C-value) which is a numerical rating of an individual plant species' conservatism and fidelity to natural habitats (Milburn et al., 2007). Species that have little tolerance to disturbance and very specific habitat requirements have higher C-values. The Rapid FQA (Minnesota Pollution Control Agency, 2014) is a simplified wetland quality assessment developed for natural resource professionals that is suitable for restoration monitoring and determining compliance with mitigation performance standards. The primary asssessment metric for the Rapid FQA is the weighted Coefficient of Conservatism (wC). The wC is the preferred metric because it takes into consideration the proportional abundance of plant species on a site and is not affected by sampling effort, as are species richness metrics. An Excel spreadsheet calculator has been developed (Minnesota Pollution Control Agency, 2014) where plant survey data can be entered to determine the wC for specific plant communities. The calculator also determines the wC for the entire wetland site or "Assessment Area" based on the proportional abundance of each plant community present on the site. The Rapid FQA calculator uses the wetland plant community classifications according to

Wetland Plants and Plant Communities of Minnesota & Wisconsin (Eggers and Reed, 1997) with the exception that Sedge Meadow and Fresh (Wet) Meadow community classifications are combined into the single Fresh Meadow community classification. The spreadsheet calculator uses the wC values to determine the Biological Condition Gradient, Condition Category (Table 2.1) which can be used to evaluate site quality.

Table 2.1. The general wetland vegetation Biological Condition Gradient (adapted from MPCA, 2014).

Condition Category	Description
Exceptional (1)*	Community composition and structure as they exist (or likely existed) in the absence of measurable effects of anthropogenic stressors representing pre-European settlement conditions. Non-native taxa may be present at very low abundance and not causing displacement of native taxa.
Good (2)	Community structure similar to natural community. Some additional taxa present and/or there are minor changes in the abundance distribution from the expected natural range. Extent of expected native composition for the community type remains largely intact.
Fair (3)	Moderate changes in community structure. Sensitive taxa are replaced as the abundance distribution shifts towards more tolerant taxa. Extent of expected native composition for the community type diminished.
Poor (4)	Large to extreme changes in community structure resulting from large abundance distribution shifts towards more tolerant taxa. Extent of expected native composition for the community type reduced to isolated pockets and/or wholesale changes in composition.

*Total introduced species cover must be <1% for a site to be considered Exceptional.

The sampling method described and used for this project, although not commonly used for the Rapid FQA, meets the requirements for alternative sampling methods (Minnesota Pollution Control Agency, 2014). These criteria include: 1) sampling is done by community types, 2) sampling intensity is adequate to produce a representative sample, 3) species are identified at least to the level of the Rapid Species List, and 4) areal cover estimates are made.

The wC values and wetland Condition Category rankings are included in the vegetation tables for each Mitigation Site.

Site Evaluations

For the 2013 and 2014 growing seasons, each Mitigation Site was evaluated based on compliance with wetland hydrology criteria, dominant species percent cover, invasive species percent cover, wC, and Condition Category. Total acres for each site and for each plant community within the site were determined and are also outlined on maps included for each

Mitigation Site. A general narrative description and evaluation of each site and its potential for wetland mitigation credit is also included.

Seed Mix Evaluations

The seed mixes originally applied to the U.S. Trunk Highway 53 mitigation sites have since been superseded by mixes more specifically suited to northeast Minnesota (MnDOT, 2014). To help guide in the future development and refinement of effective seed mixes for application to wetland mitigation sites in northeast Minnesota, plant species that had successfully established on the 14 mitigation sites as of the 2014 plant survey were compared to the seed mixes applied. Plant species presumed to originate from planted seed were divided into “dominant” (greater than one percent cover) and “present” (less than one percent cover**).**

Chapter 3: Mitigation Site Monitoring Results

Monitoring Results 2011 and 2012

Plant communities with percent cover and invasive species are presented in Table 3.1, Table 3.2, and Table 3.3 for the 2011 and 2012 growing seasons. More detailed vegetation survey results are included in the Annual Reports in the Appendix. Pertinent information from these tables will be included in the detailed discussion for each mitigation site in the following section "Monitoring Results 2013 and 2014."

Table 3.1. U.S. Trunk Highway 53 Mitigation Site Characteristics – 2011.

Site	Size (acres)	Wetland Plant Community Type*	Species Richness	Mean Total Percent Cover	Invasive Species Percent Cover
Mit 1	1.10	Shallow Marsh	19	109	70 (*Typha angustifolia*)
Mit 2	2.31	Fresh (Wet) Meadow	31	126.2	10 (*Phalaris arundinacea*)
Mit 3	0.78	Sedge Meadow	62	108	4.9 (*Phalaris arundinacea*) 2 (*Typha angustifolia)*
Mit 4	2.06	Sedge Meadow	85	138	1.9 (*Lythrum salicaria*) 1.4 (*Phalaris arundinacea*) 6.9 (*Typha angustifolia*)
Mit 5	3.22	Sedge Meadow	55	121	2.25 (*Phalaris arundinacea*) 1 (*Typha angustifolia*)
Mit 6	5.93	Shallow Marsh Sedge Meadow	19	137.5 86	30 (*Typha angustifolia*) 0
Mit 7	1.45	Shallow Marsh	24	190	80 (*Typha angustifolia*)
Mit 8	20.20	Sedge Meadow Fresh (Wet) Meadow	29	106.1 108.3	0.1 (*Cirsium arvense)* 1 (*Cirsium arvense)*
Mit 9	11.43	Shallow Marsh Fresh (Wet) Meadow	51	163.3 132	80 (*Typha angustifolia*) 10 (*Cirsium arvense)*
Mit 10	7.75	Fresh (Wet) Meadow & Shrub Carr Open Bog	62	179 194.6	1 (*Tanacetum vulgare*) 1 (*Tanacetum vulgare*)
Mit 11	3.02	Fresh (Wet) Meadow	30	137	30 (*Phalaris arundinacea*)
Mit 12	1.02	Shallow Marsh	30	136.1	2 (*Lythrum salicaria*)
Mit 13	3.40	Sedge Meadow	52	136.7	5 (*Lythrum salicaria*) 0.1 (*Cirsium arvense*)
Mit 14	0.64	Shallow Marsh	17	91	20 (*Typha angustifolia*)

* Wetland plant community type according to *Wetland Plants and Plant Communities of Minnesota & Wisconsin* by Eggers and Reed, 1997.

Table 3.2. U.S. Trunk Highway 53 Mitigation Site Characteristics – July 2012.

Site	Size (acres)	Wetland Plant Community Type*	Species Richness	Mean Total Percent Cover	Invasive Species Percent Cover
Mit 1	1.10	Shallow Marsh	9	146	100 (*Typha angustifolia, T. latifolia, & hybrids*)
Mit 2	2.31	Fresh (Wet) Meadow	10	105.1	15 (*Phalaris arundinacea*)
Mit 3	0.78	Sedge Meadow	66	93.1	3.6 (*Phalaris arundinacea*) 4.8 (*Typha angustifolia)*
Mit 4	2.06	Sedge Meadow	89	140.8	2.3 (*Lythrum salicaria*) 1 (*Phalaris arundinacea*) 6.3 (*Typha angustifolia*)
Mit 5	3.22	Sedge Meadow	64	122	1.3 (*Phalaris arundinacea*) 1.5 (*Typha angustifolia*)
Mit 6	5.93	Shallow Marsh Sedge Meadow	14 13	162.6 144.1	85 (*Typha angustifolia, T. latifolia, & hybrids*) 0.1 (*Phalaris arundinacea*)
Mit 7	1.45	Shallow Marsh	9	234	95 (*Typha angustifolia*) 2 (*Phalaris arundinacea*)
Mit 8	20.20	Sedge Meadow Fresh (Wet) Meadow	17 13	150 150	1.7 (*Phalaris arundinacea*) 16.7 (*Typha angustifolia, T. latifolia, & hybrids*) 1 (*Cirsium arvense)*
Mit 9	11.43	Shallow Marsh Fresh (Wet) Meadow	16 16	209.3 165.1	60 (*Typha angustifolia*) 5 (*Cirsium arvense)*
Mit 10	7.75	Fresh (Wet) Meadow & Shrub Carr Open Bog	12 15	99 250.6	0 0
Mit 11	3.02	Fresh (Wet) Meadow	18	133.2	46 (*Phalaris arundinacea*) 0.5 (*Cirsium vulgare)*
Mit 12	1.02	Shallow Marsh	16	191.2	20 (*Typha angustifolia*) 5 (*Lythrum salicaria*)
Mit 13	3.40	Sedge Meadow	25	176.6	2 (*Lythrum salicaria*)
Mit 14	0.64	Shallow Marsh	9	142.4	90 (*Typha angustifolia*)

* Wetland plant community type according to *Wetland Plants and Plant Communities of Minnesota & Wisconsin* by Eggers and Reed, 1997.

Table 3.3. U.S. Trunk Highway 53 Mitigation Site Characteristics – September 2012.

Site	Size (acres)	Wetland Plant Community Type*	Species Richness	Mean Total Percent Cover	Invasive Species Percent Cover
Mit 1	1.10	Shallow Marsh	12	161.3	100 (*Typha angustifolia, T. latifolia,& hybrids*)
Mit 2	2.31	Fresh (Wet) Meadow	13	148.1	15 (*Phalaris arundinacea*) 2 (*Typha angustifolia)*
Mit 3	0.78	Sedge Meadow	68	120.3	9.8 (*Phalaris arundinacea*) 6.5 (*Typha angustifolia)* 2 (*Cirsium arvense*)
Mit 4	2.06	Sedge Meadow	89	140.8	6.3 (*Typha angustifolia*) 2.3 (*Lythrum salicaria*) 1 (*Phalaris arundinacea*)
Mit 5	3.22	Sedge Meadow	65	140.2	2.3 (*Phalaris arundinacea*) 1.5 (*Typha angustifolia*)
Mit 6	5.93	Shallow Marsh Sedge Meadow	17 23	147.6 160.4	95 (*Typha angustifolia, T. latifolia,& hybrids*) 2 (*Cirsium arvense)* 0.1 (*Cirsium vulgare)*
Mit 7	1.45	Shallow Marsh	12	218	80 (*Typha angustifolia*) 1 (*Phalaris arundinacea*)
Mit 8	20.20	Sedge Meadow Fresh (Wet) Meadow	28 13	170 159	21.25 (*Typha angustifolia*) 10 (*Typha angustifolia, T. latifolia, & hybrids*) 2.5 (*Phalaris arundinacea*) 0.25 (*Cirsium arvense)* 0.25 (*Tanacetum vulgare)* 10 (*Phalaris arundinacea*) 2 (*Cirsium arvense)*
Mit 9	11.43	Shallow Marsh Fresh (Wet) Meadow	13 12	312 182	60 (*Typha angustifolia*) 0
Mit 10	7.75	Fresh (Wet) Meadow & Shrub Carr Open Bog	14 19	186.2 270.15	0 0
Mit 11	3.02	Fresh (Wet) Meadow	20	160.6	41 (*Phalaris arundinacea*) 1 (*Cirsium vulgare)*
Mit 12	1.02	Shallow Marsh	8	167	10 (*Typha angustifolia*) 5 (*Lythrum salicaria*)
Mit 13	3.40	Sedge Meadow	18	157	17.5 (*Lythrum salicaria*) 2.5 (*Typha angustifolia, T. latifolia, & hybrids*)
Mit 14	0.64	Shallow Marsh	5	127	90 (*Typha angustifolia*)

* Wetland plant community type according to *Wetland Plants and Plant Communities of Minnesota & Wisconsin, Second Edition* (Eggers and Reed, 1997).

Monitoring Results 2013 and 2014

A summary of water table and vegetation monitoring results for the 2013 and 2014 growing seasons is presented for each individual mitigation site in the following sections. Dominant

species are those present at >10% cover. Also included are plant community maps for each mitigation site for both 2013 and 2014. Note that maps for Mitigation Sites 9 and 10 were not completed for the 2013 growing season. More detailed data and graphs for each site are presented in the Annual Reports in the Appendix. A detailed wetland delineation was completed for each of the 14 mitigation sites in September 2014 (Short Elliot Hendrickson, Inc., 2014); therefore, differences in total mitigation site area may be noted betweeen 2013 and 2014. The 2014 area data is the final and most accurate determination.

Mitigation Site 1

Mit 1 is a 0.83 acre site that is predominantly a shallow marsh with some wet meadow present. The water table levels (Figure 3.1) meet the wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface. Standing water covers the site for most of the year. The shallow marsh is dominated by the invasive *Typha angustifolia* that significantly increased its dominance from 2013 to 2014 to over 90 percent cover (Table 3.4 and Table 3.5). The wet meadow is dominated by *Agrostis gigantea* with a total invasive cover of 10 percent as of 2014. The total site FQA condition rating decreased from "fair" in 2013 to "poor" in 2014. The cover maps (Figure 3.2 and Figure 3.3) show a slight increase in the shallow marsh from 2013 to 2014.

Without extensive remedial work, the site has very limited potential as a mitigation site. There is some potential to change the plant community by mowing and spraying the cattails with herbicide then filling the site with approximately one foot of salvaged peat and reseeding with native species. There are power-lines adjacent to the site that will need to be taken into consideration. According to the USACE, power-lines are not permitted on wetland mitigation sites.

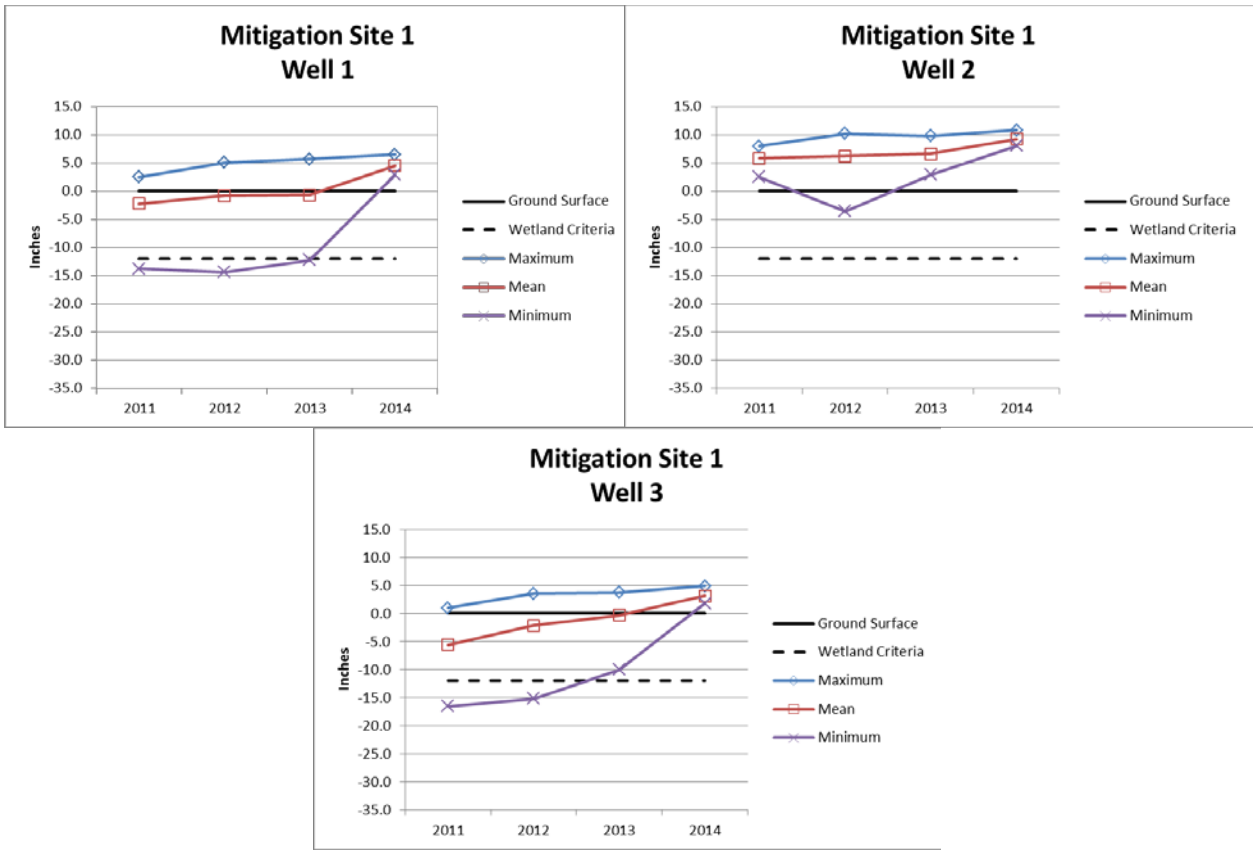


Figure 3.1. Mitigation Site 1 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.4. Mitigation Site 1 plant community vegetation characteristics 2013.

Mit 1 - 2013	Shallow Marsh		Wet Meadow	
Area (acres) 0.78	0.65		0.13	
Dominant Species	*Typha angustifolia* *Scirpus cyperinus* *Agrostis gigantea*	54% 14% 11%	*Agrostis gigantea* *Phleum pratense* *Elymus repens*	48% 11% 7%
Invasive Species	*Typha angustifolia*	54%		< 1%
wC	0.7		1.4	
Condition Category	Poor		Fair	
Total Site Condition Category	Fair			

Table 3.5. Mitigation Site 1 plant community vegetation characteristics 2014.

Mit 1 - 2014	Shallow Marsh		Wet Meadow	
Area (acres) 0.83	0.73		0.10	
Dominant Species	*Typha angustifolia* *Scirpus cyperinus* *Scirpus microcarpus*	93% 4% 4%	*Agrostis gigantea* *Carex tenera* *Juncus effusus*	48% 7% 7%
Invasive Species	*Typha angustifolia*	93%	*Typha angustifolia* *Phalaris arundinacea*	7% 3%
wC	0.6		0.9	
Condition Category	Poor		Poor	
Total Site Condition Category	Poor			

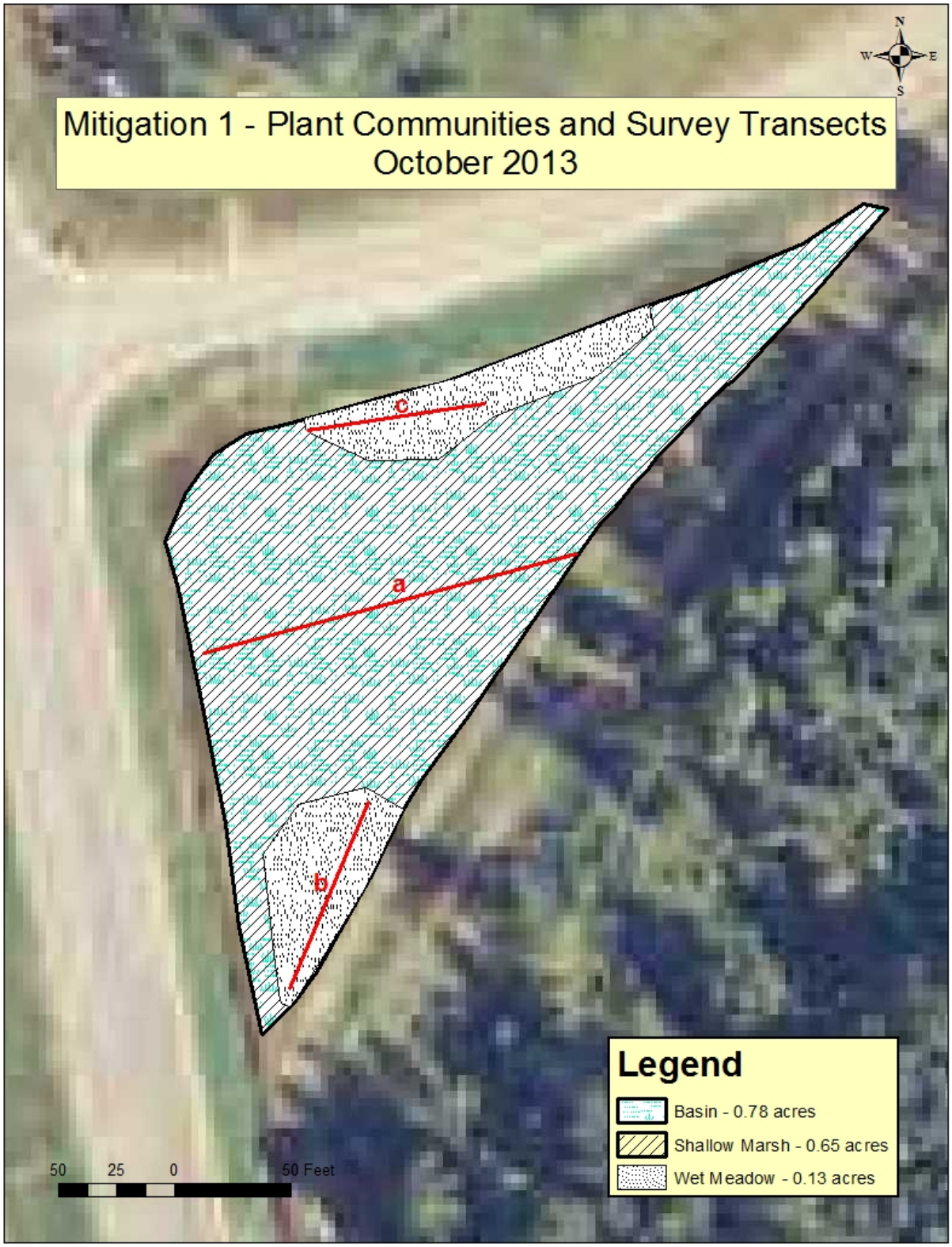


Figure 3.2. Mitigation Site 1 plant community areas 2013.

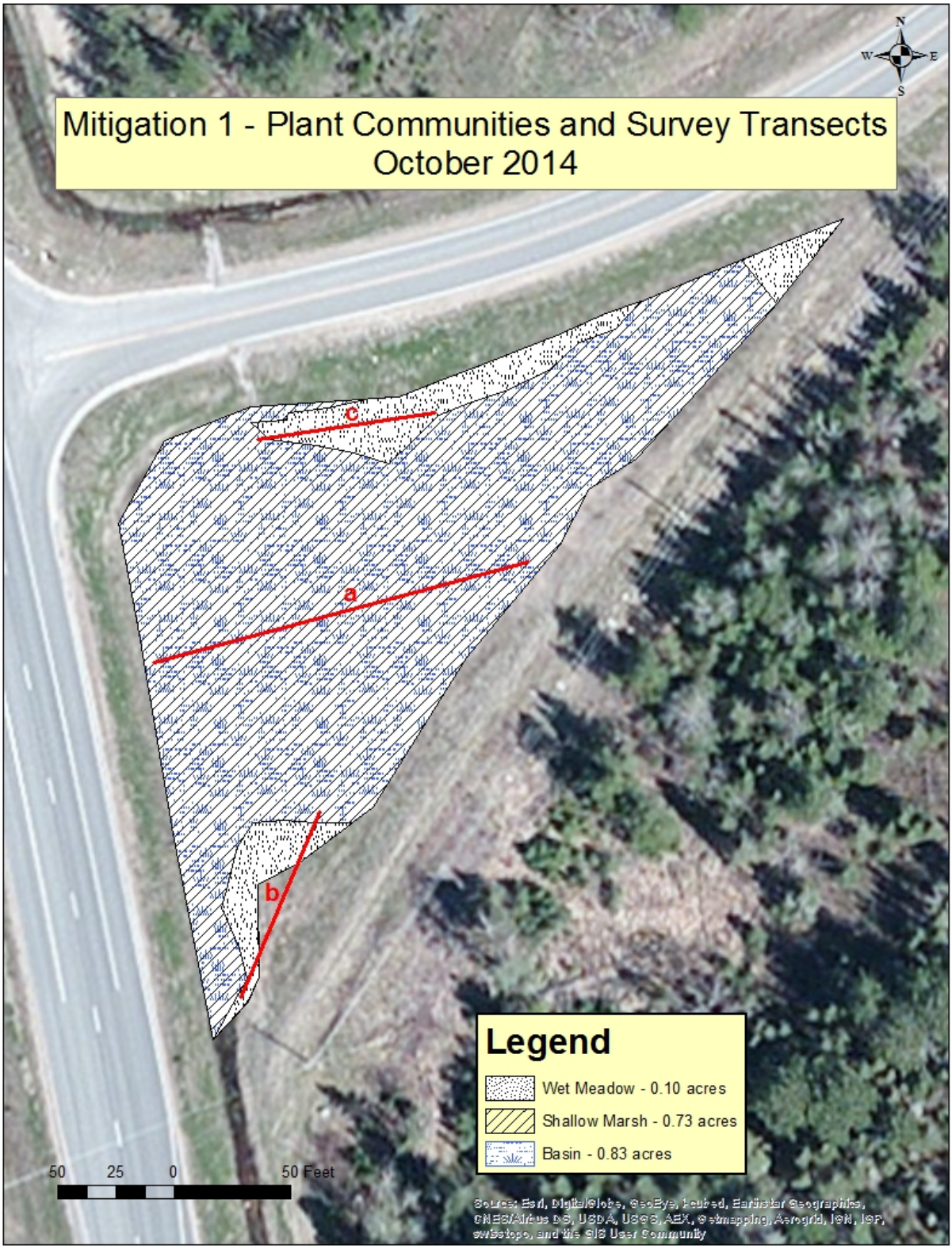


Figure 3.3. Mitigation Site 1 plant community areas 2014.

Mitigation Site 2

Mit 2 is a 3.32 acre site that is predominantly a wet meadow with scattered areas of alder thicket and a large 2.04 acre stand of reed canary grass. The site is relatively dry but still meets wetland hydrology criteria (Figure 3.4). The wet meadow plant community is dominated by *Phalaris arundinacea* and *Scirpus* species (Table 3.6 and Table 3.7). The alder thicket plant community is dominated by *Carex lacustris*, *Calamagrostis canadensis*, *Scirpus cyperinus*, and *Alnus rugosa*. All plant communties on the site have some degree of reed canary grass infestation that should be controlled. The FQA condition rating is "fair" for both the wet meadow and the alder thicket. The reed canary stand increased in size from 2013 to 2014 (Figure 3.5 and Figure 3.6).

The drier conditions on the site make it a good candidate for tamarack and black spruce tree planting after controlling the reed canary grass. Weed control mats may help with tree establishment. Overall, it has fair potential as a mitigation site with some invasive species control.

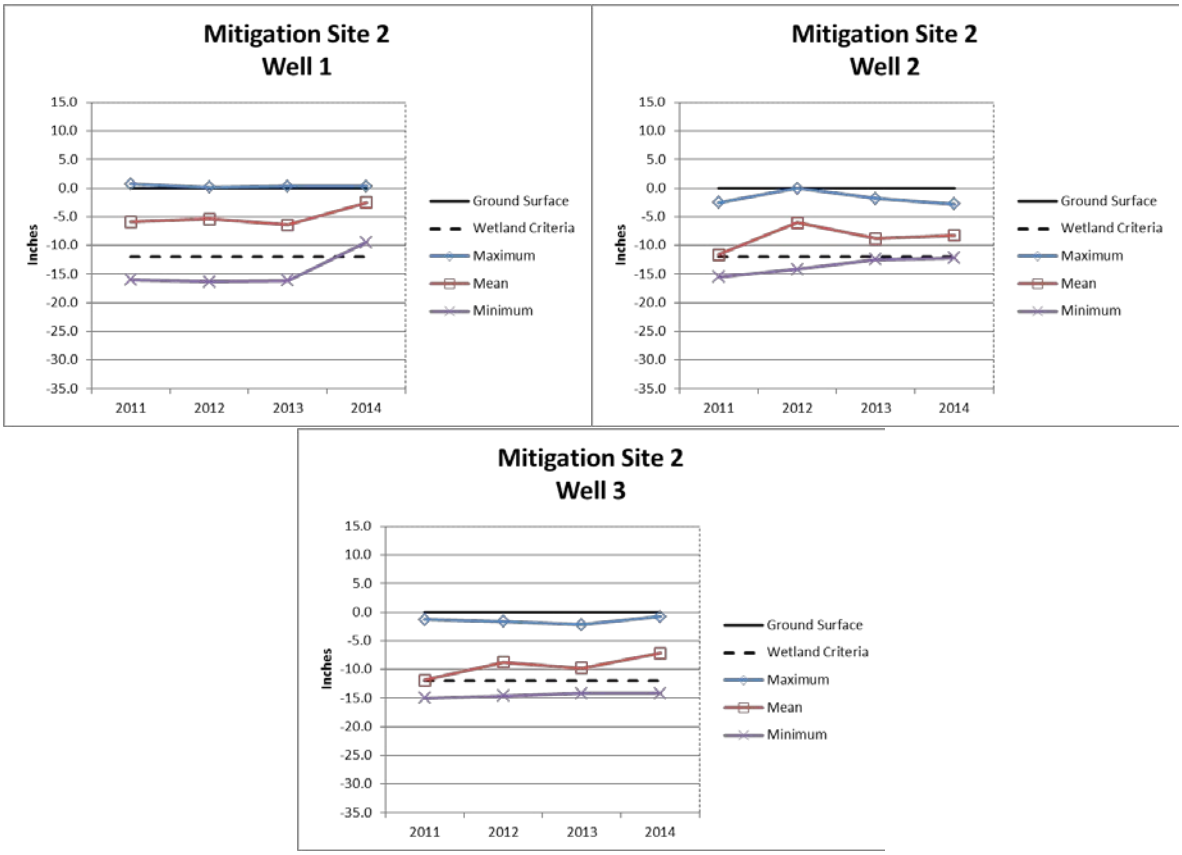


Figure 3.4. Mitigation Site 2 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.6. Mitigation Site 2 plant community vegetation characteristics 2013.

Mit 2 - 2013	Wet Meadow		Alder Thicket		Reed Canary Stand	
Area (acres) 3.53	2.08		0.14		1.31	
Dominant Species	*Phalaris arundinacea* *Scirpus cyperinus* *Calamagrostis canadensis* *Scirpus microcarpus* *Juncus effusus*	27% 20% 11% 11% 10%	*Phalaris arundinacea* *Scirpus cyperinus* *Alnus rugosa* *Carex lacustris*	25% 25% 14% 14%	*Phalaris arundinacea*	100%
Invasive Species	*Phalaris arundinacea* *Typha angustifolia* *Cirsium arvense*	27% 3% 1%	Phalaris arundinacea Cirsium arvense	25% 7%	*Phalaris arundinacea*	100%
wC	1.7		2.6		0.0	
Condition Category	Fair		Fair		Poor	
Total Site Condition Category	Fair					

Table 3.7. Mitigation Site 2 plant community vegetation characteristics 2014.

Mit 2 - 2014	Wet Meadow		Alder Thicket		Reed Canary Stand	
Area (acres) 3.32	1.15		0.13		2.04	
Dominant Species	*Phalaris arundinacea* *Scirpus microcarpus* *Carex lacustris* *Juncus effusus*	34% 16% 10% 10%	*Carex lacustris* *Calamagrostis canadensis* *Scirpus cyperinus* *Phalaris arundinacea*	33% 22% 22% 17%	*Phalaris arundinacea*	100%
Invasive Species	*Phalaris arundinacea* *Cirsium arvense* *Typha angustifolia*	34% 3% 1%	Phalaris arundinacea	17%	*Phalaris arundinacea*	100%
wC	2.2		3.5		0.0	
Condition Category	Fair		Fair		Poor	
Total Site Condition Category	Fair					

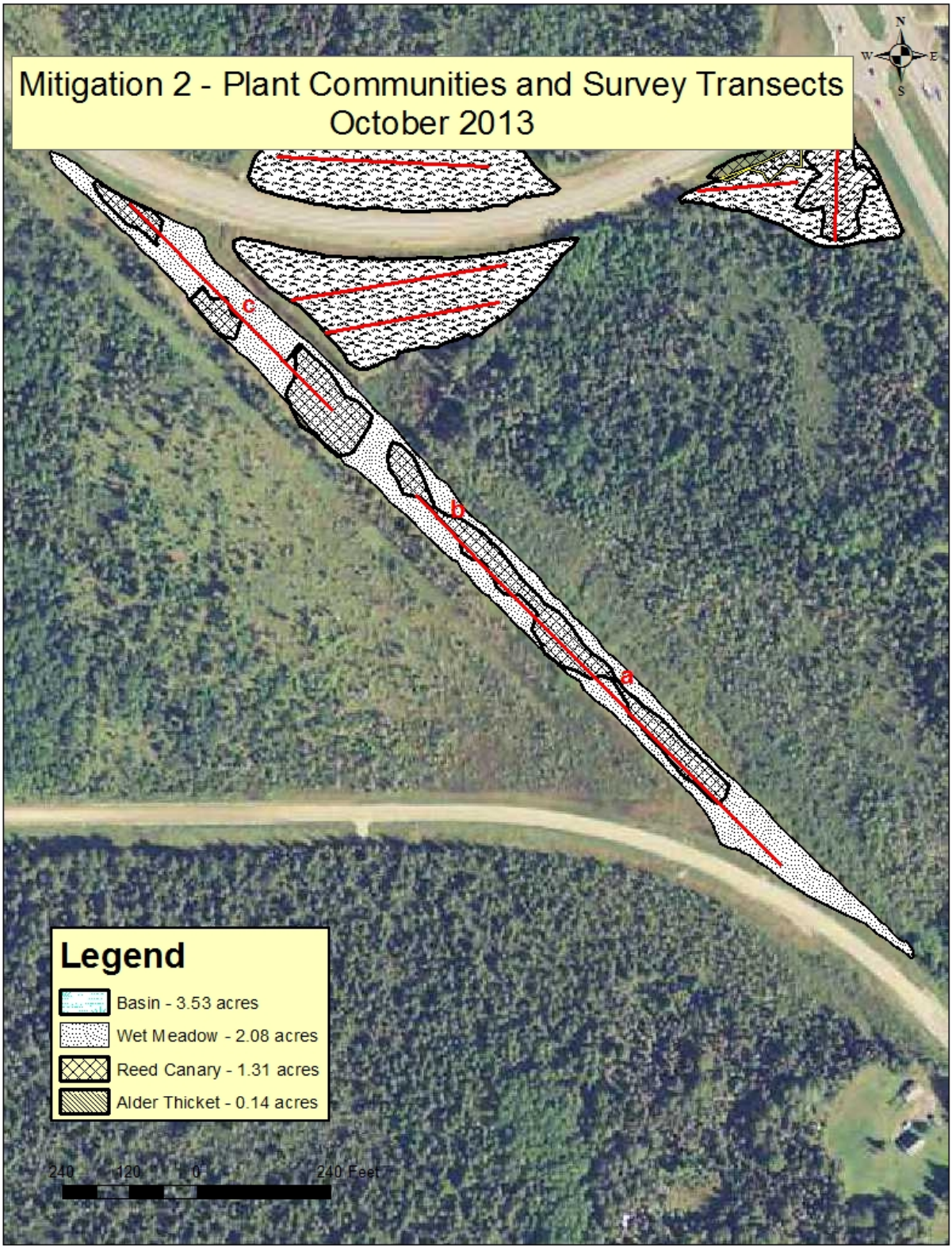


Figure 3.5. Mitigation Site 2 plant community areas 2013.

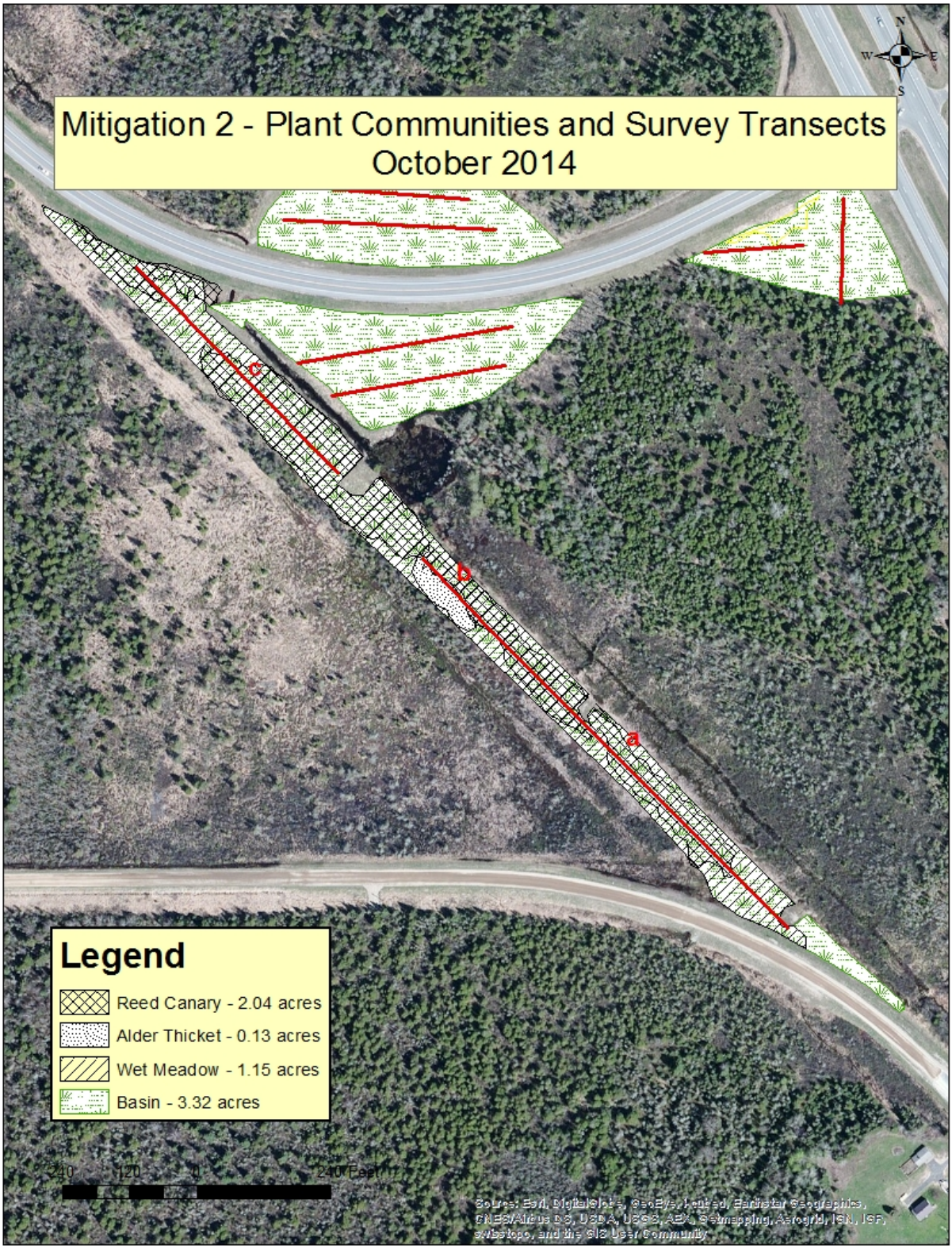


Figure 3.6. Mitigation Site 2 plant community areas 2014.

Mitigation Site 3

Mit 3 is a 1.04 acre site that is a mix of wet meadow and shallow marsh communities with a small stand of reed canary grass. The site meets wetland hydrology criteria, with the area surrounding well number 3 being considerably wetter with standing water present (Figure 3.7). The sedge meadow portion of the site is dominated by native species with limited reed canary grass and has a "fair" FQA condition rating (Table 3.8 and Table 3.9). The shallow marsh is dominated by *Typha latifolia* with other native species and receives a "good" FQA condition rating. Plant community areas remained about the same from 2013 to 2014 (Figure 3.8 and Figure 3.9).

Planted tamarack and black spruce seedlings are surviving and growing well on the drier areas of the site. Survival of tamarack and black spuce trees planted on mounds created by hand in the wetter areas is limited. The entire site would benefit from reed canary grass control and make the site a good candidate for wetland mitigation credit.

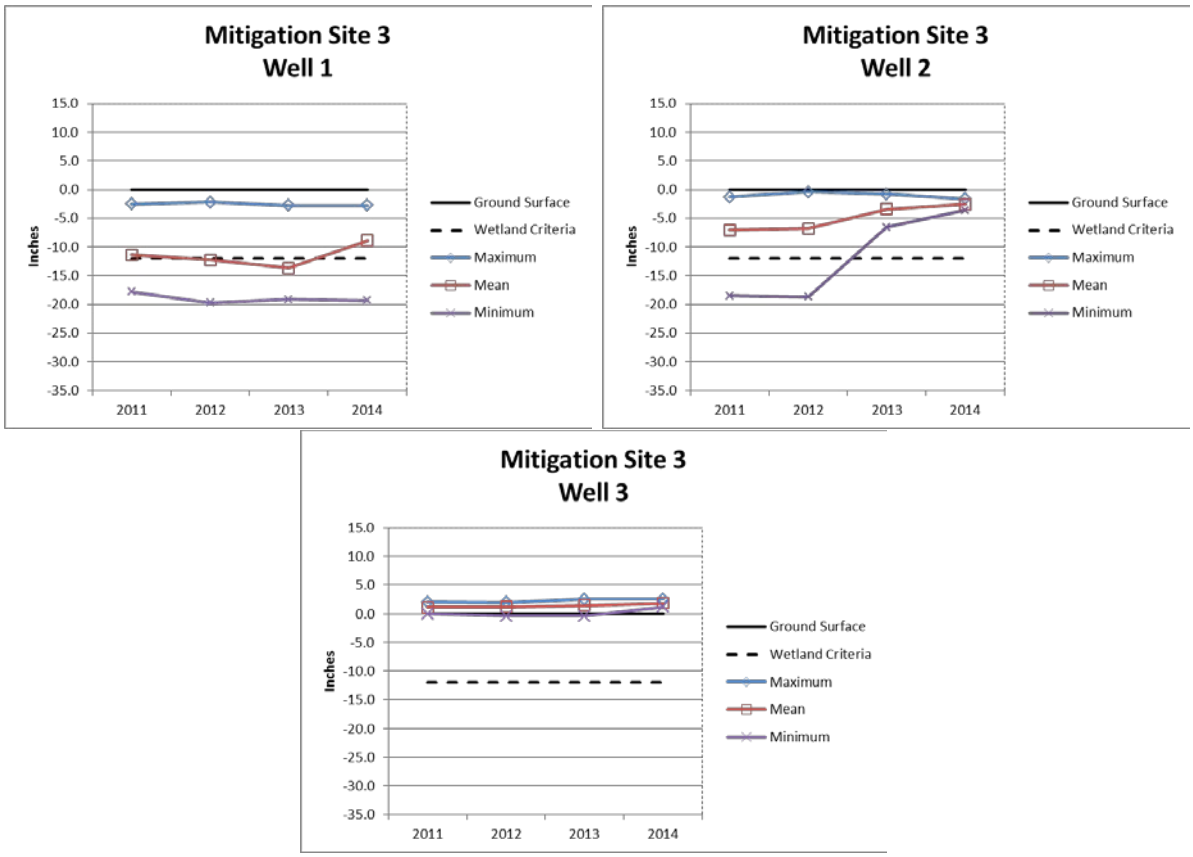


Figure 3.7. Mitigation Site 3 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.8. Mitigation Site 3 plant community vegetation characteristics 2013.

Mit 3 - 2013	Sedge Meadow		Shallow Marsh		Reed Canary Stand	
Area (acres) 1.04	0.59		0.38		0.17	
Dominant Species	*Calamagrostis canadensis* *Scirpus cyperinus* *Carex utriculata*	35% 35% 15%	*Typha latifolia* *Scirpus microcarpus* *Calamagrostis canadensis* *Scirpus cyperinus* *Typha angustifolia*	42% 19% 10% 10% 10%	*Phalaris arundinacea*	100%
Invasive Species	*Phalaris arundinacea*	4%	Typha angustifolia	10%	*Phalaris arundinacea*	100%
wC	4.0		2.9		0.0	
Condition Category	Fair		Fair		Poor	
Total Site Condition Category	Fair					

Table 3.9. Mitigation Site 3 plant community vegetation characteristics 2014.

Mit 3 - 2014	Sedge Meadow		Shallow Marsh		Reed Canary Stand	
Area (acres) 1.04	0.59		0.39		0.16	
Dominant Species	*Scirpus cyperinus* *Calamagrostis canadensis*	53% 30%	*Carex utriculata* *Typha latifolia* *Scirpus cyperinus* *Typha angustifolia* *Glyceria canadensis*	30% 23% 13% 13% 10%	*Phalaris arundinacea*	100%
Invasive Species	*Phalaris arundinacea*	7%	*Phalaris arundinacea*	13%	*Phalaris arundinacea*	100%
wC	3.0		4.4		0.0	
Condition Category	Fair		Good		Poor	
Total Site Condition Category	Fair					

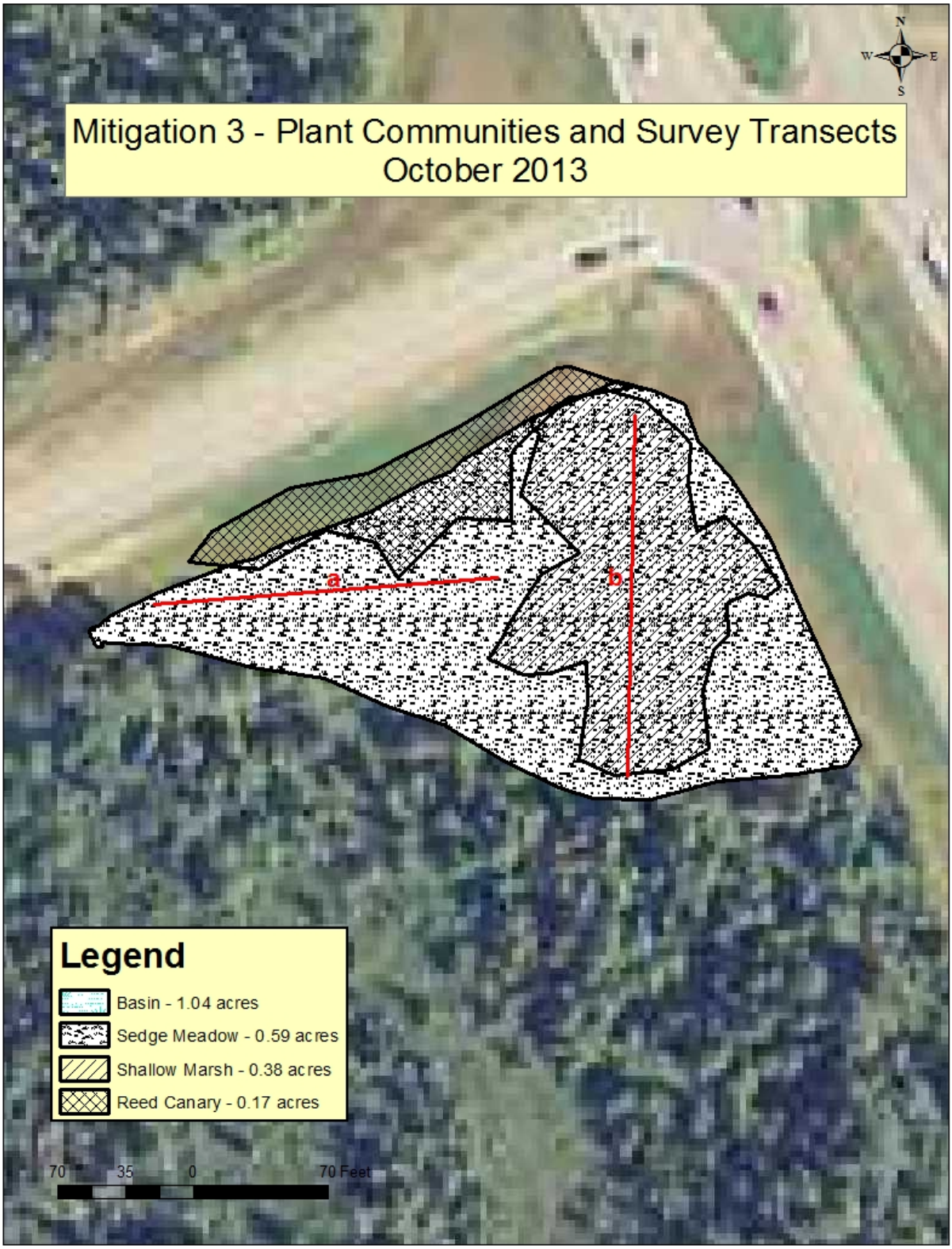


Figure 3.8. Mitigation Site 3 plant community areas 2013.

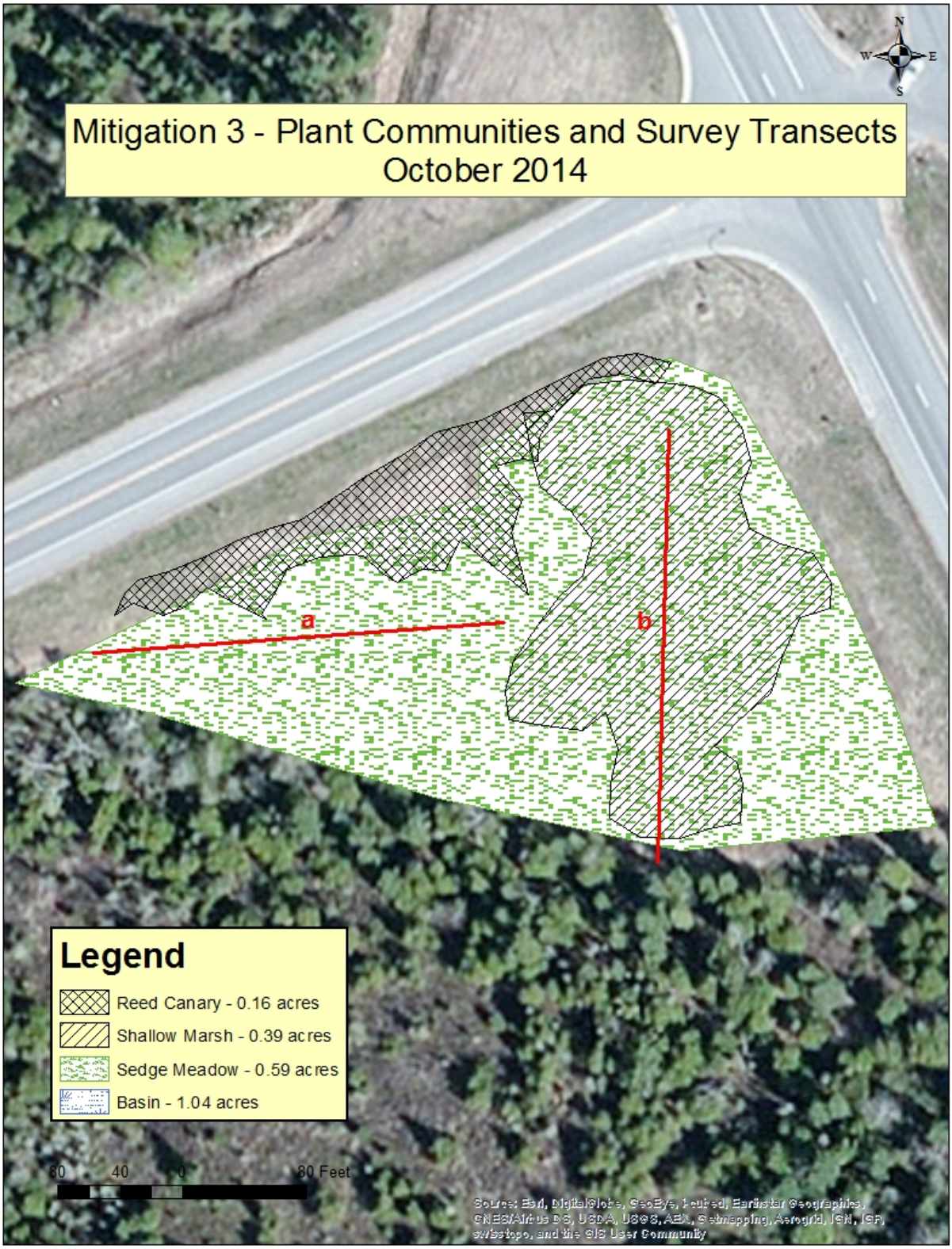


Figure 3.9. Mitigation Site 3 plant community areas 2014.

Mitigation Site 4

Mit 4 is a 1.86 acre site that is a sedge meadow in its entirety. Mit 4 was one of the sites that was more intensively managed in Phase I of this project with peat donor soil and a number of seed mixes applied in 2007. It has coalesced into a realitively homogenous sedge meadow. Water table levels have met wetland criteria for the years monitored and is a mix of standing water and saturated soils throughout the site (Figure 3.10). The site has become dominated by *Carex utriculata*, *Carex lacustris*, and *Scirpus* species (Table 3.10 and Table 3.11). Invasive species cover by *Typha angustifolia*, *Lythrum salicaria*, and *Phalaris arundinacea* reached a combined total of about 10 percent in 2011 and 2012. In the 2013 and 2014 surveys invasive species are present, but no single species appears at greater than 1% cover. This could be the result of more intensive sampling done in the earlier surveys or an actual reduction in invasive cover. A more rigorous survey of invasive plants should be conducted in the future to make an accurate determination. FQA calculations resulted in an "exceptional" condition rating for the site; however, due to the uncertainty regarding invasive species cover, the site should realistically be given a more conservative "good" condition rating.

It is interesting to note that *Sphagnum* moss is growing quite well on some of the drier portions of the site where *Sphagnum* donor material was applied as part of the project's Phase I. Overall, the site remains one of the best of the 14 mitigation sites created and has excellent potential for receiving mitigation credit.

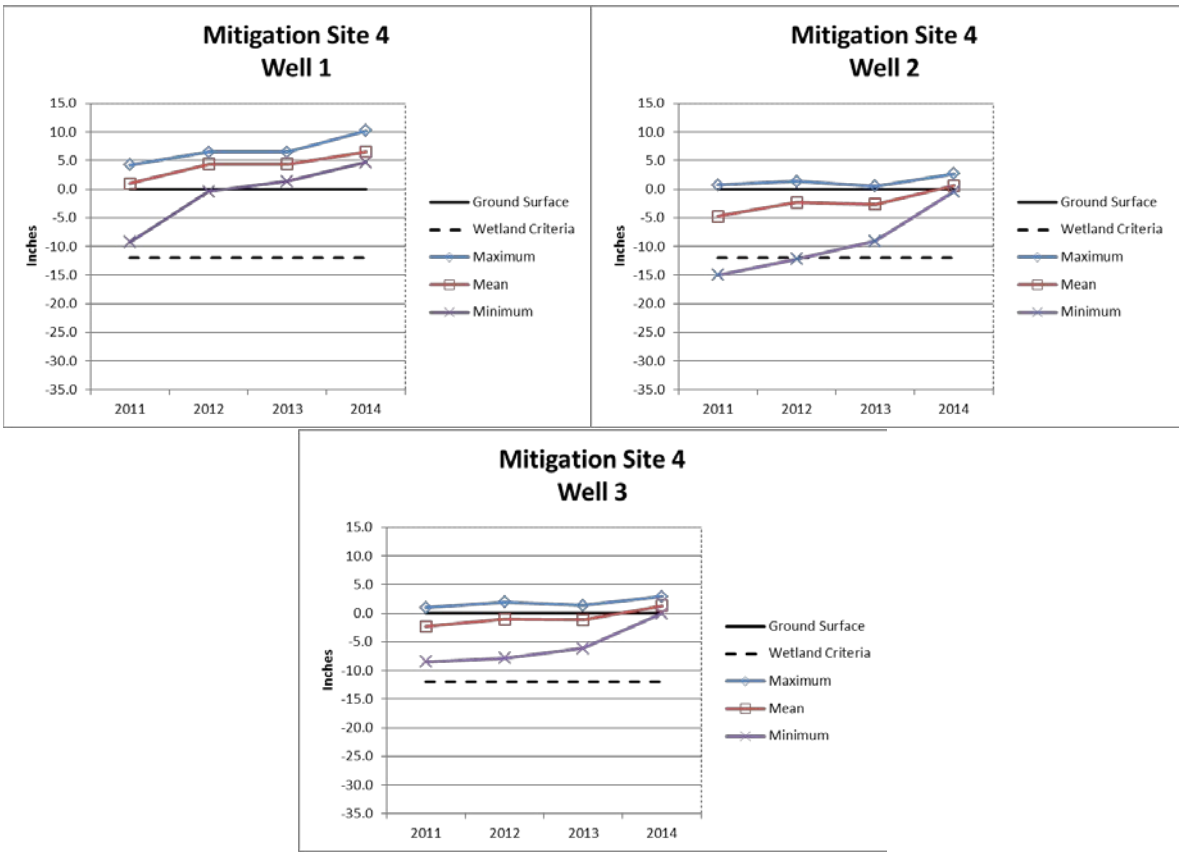


Figure 3.10. Mitigation Site 4 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.10. Mitigation Site 4 plant community vegetation characteristics 2013.

Mit 4 - 2013	Sedge Meadow	
Area (acres) 1.86	1.86	
Dominant Species	*Carex utriculata* *Scirpus cyperinus* *Calamagrostis canadensis*	35% 30% 16%
Invasive Species		<1%
wC	4.8	
Condition Category	Exceptional	
Total Site Condition Category	Exceptional	

Table 3.11. Mitigation Site 4 plant community vegetation characteristics 2014.

Mit 4 - 2014	Sedge Meadow	
Area (acres) 1.86	1.86	
Dominant Species	*Carex utriculata* *Carex lacustris* *Scirpus microcarpus*	53.4% 13.8% 13.8%
Invasive Species		<1%
wC	5.3	
Condition Category	Exceptional	
Total Site Condition Category	Exceptional	

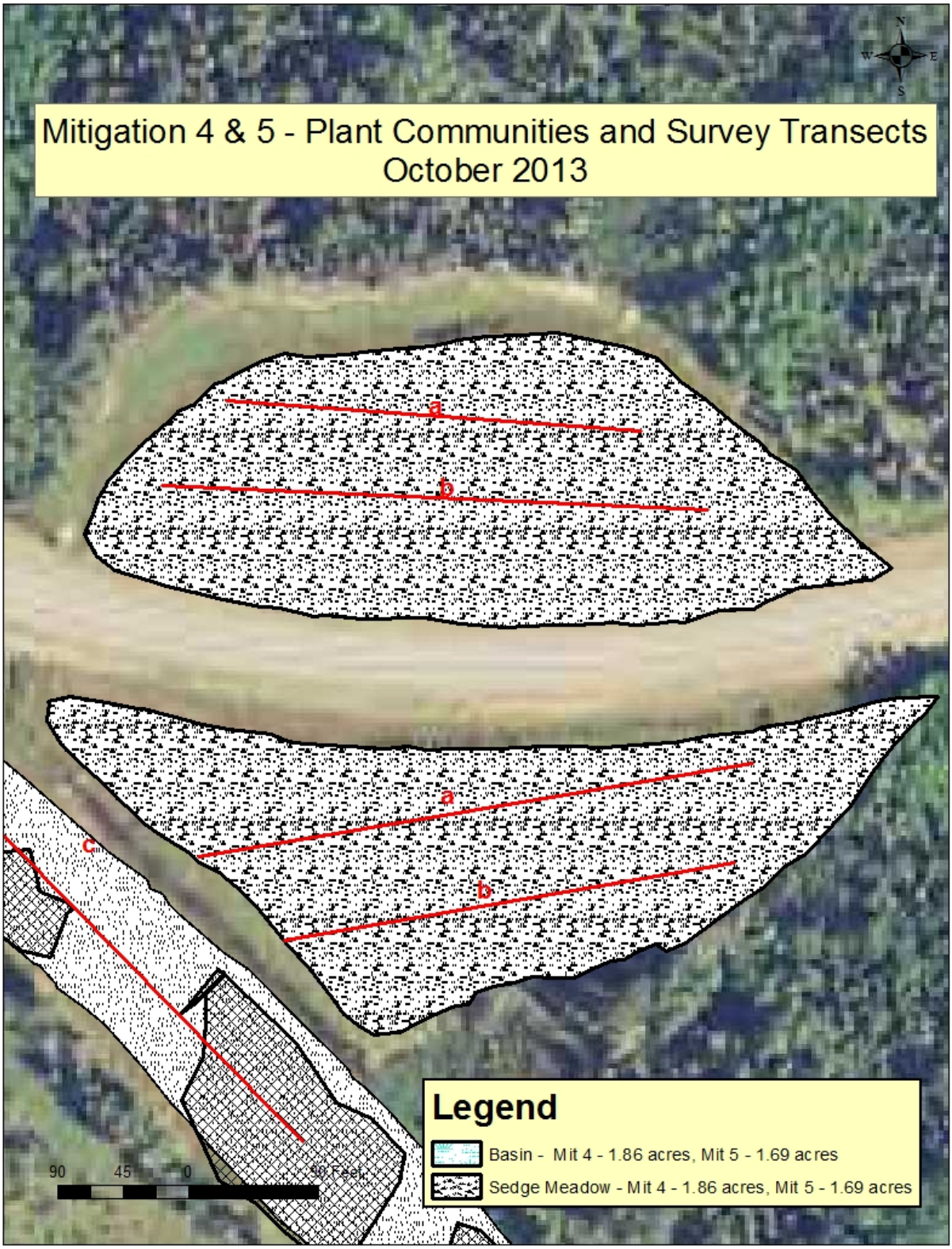


Figure 3.11. Mitigation Sites 4 and 5 plant community areas 2013.

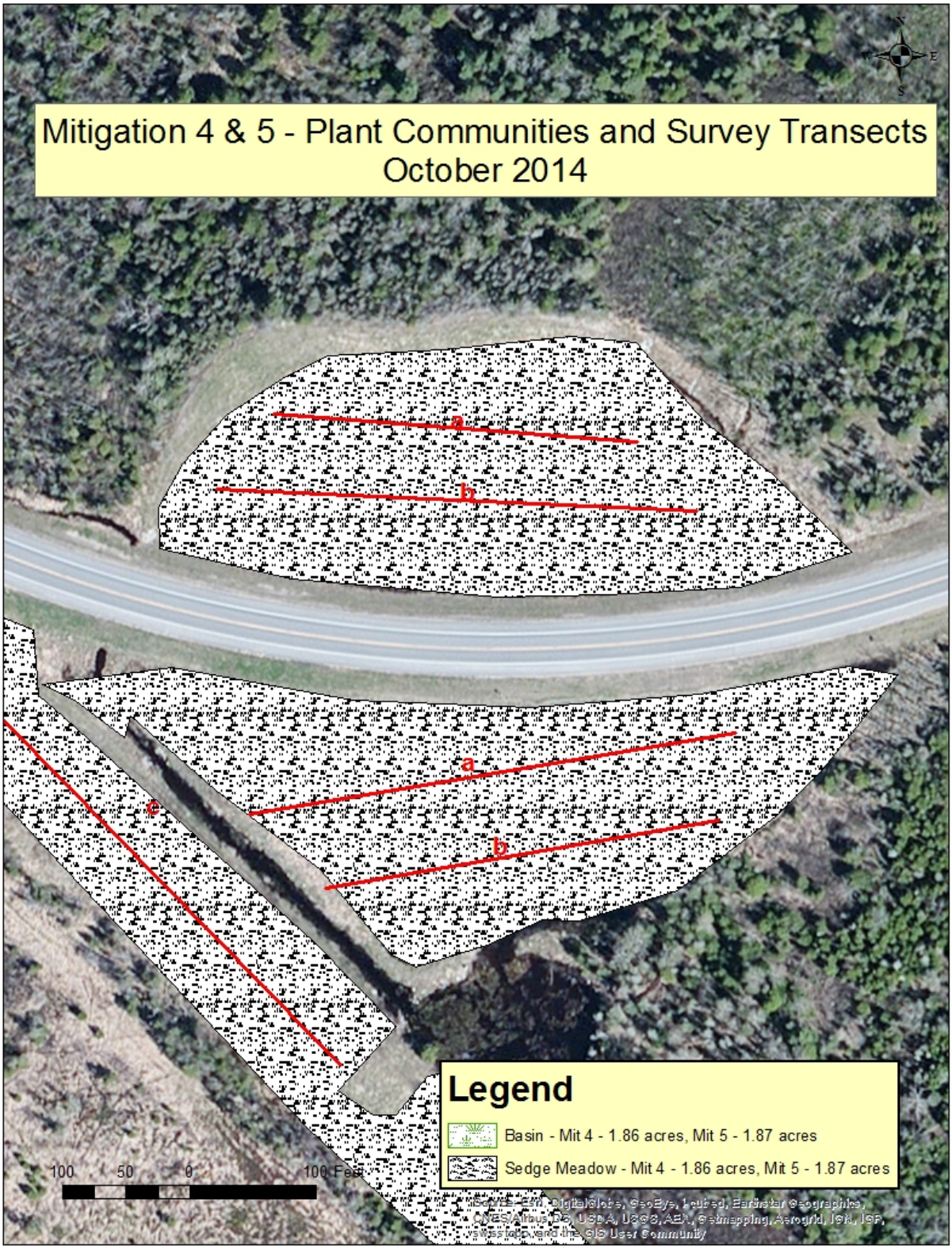


Figure 3.12. Mitigation Sites 4 and 5 plant community areas 2014.

Mitigation Site 5

Mit 5 is a 1.87 acre site that is also a sedge meadow in its entirety. Like Mit 4, this site was also more intensively managed in Phase I of the project. The site meets wetland hydrology criteria with standing water present on most of the site (Figure 3.13). Some of the high water events can be attributed to beavers blocking the outlet. Mit 5 is also dominated by *Carex utriculata*, *Carex lacustris*, and *Scirpus* species (Table 3.12 and Table 3.13). Invasive species are generally less than 5 percent and include *Typha angustifolia* and *Phalaris arundinacea*. The FQA condition rating for the site is "good" to "exceptional." Again, the presence of invasive species at >1% cover would place this site conservatively at a "good" condition rating.

Continued control of beaver activity is recommended to prevent flooding. This is another one of the top mitigation sites with excellent potential for receiving mitigation credit with control of the limited invasive species present on the site.

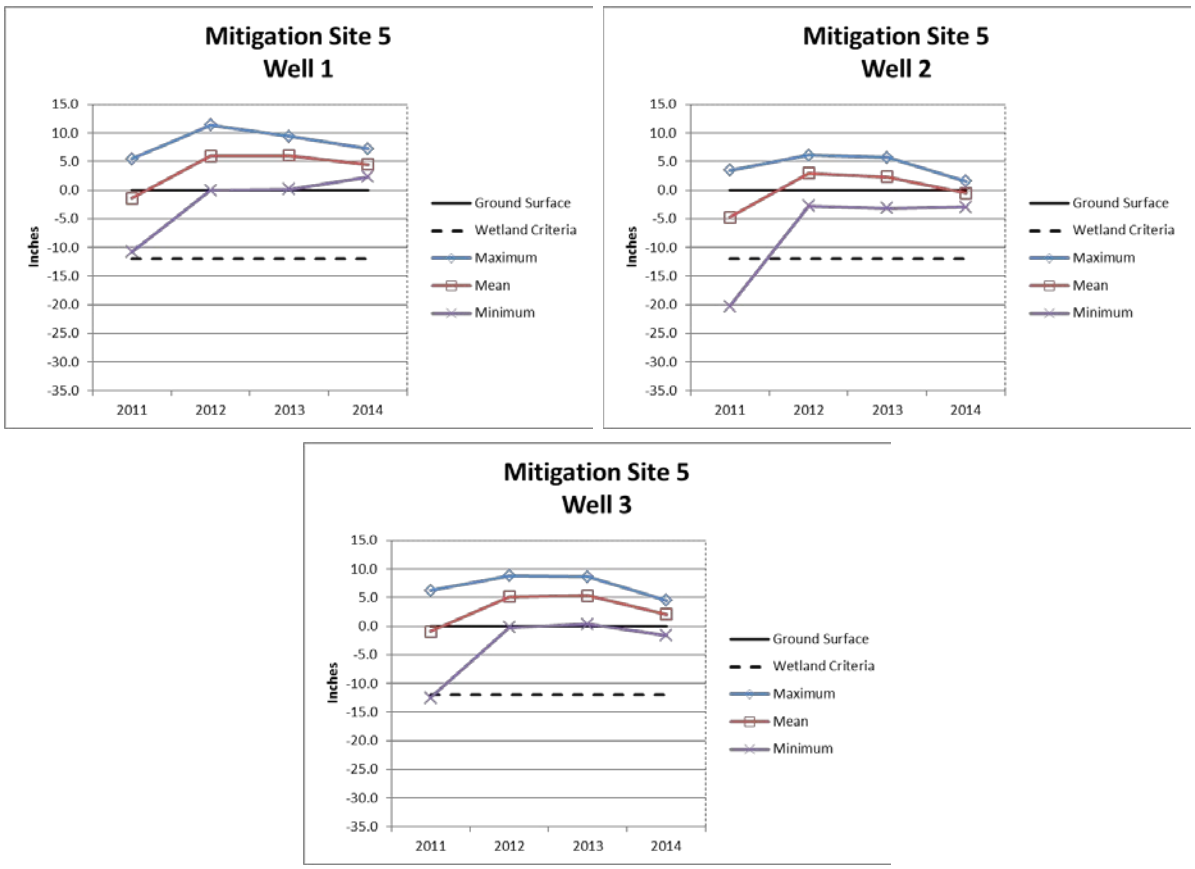


Figure 3.13. Mitigation Site 5 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.12. Mitigation Site 5 plant community vegetation characteristics 2013.

Mit 5 - 2013	Sedge Meadow	
Area (acres) 1.69	1.69	
Dominant Species	*Carex utriculata* *Scirpus cyperinus* *Carex lacustris*	32% 29% 17%
Invasive Species	*Phalaris arundinacea* *Typha angustifolia*	2% 2%
wC	5.0	
Condition Category	Good	
Total Site Condition Category	Good	

Table 3.13. Mitigation Site 5 plant community vegetation characteristics 2014.

Mit 5 - 2014	Sedge Meadow	
Area (acres) 1.87	1.87	
Dominant Species	*Carex utriculata* *Scirpus cyperinus* *Carex lacustris* *Calamagrostis canadensis*	38% 23% 15% 13%
Invasive Species		<1%
wC	5.1	
Condition Category	Exceptional	
Total Site Condition Category	Exceptional	

Mitigation Site 6

Mit 6 is a 6.07 acre site consisting of sedge meadow and shallow marsh plant communities. Water table levels meet wetland criteria with a mix of standing water and saturated soils throughout the site (Figure 3.14). The shallow marsh community is dominated by invasive *Typha* species interspersed with *Carex lacustris* and *Carex utriculata* (Table 3.14 and Table 3.15). The sedge meadow community is dominated by *Carex lacustris*, *Carex utriculata*, and *Scirpus* species with approximately 10 percent invasive species cover by *Cirisium arvense*, *Phalaris arundinacea*, and *Typha angustifolia*. The shallow marsh plant communty has a FQA condition rating of "fair" and the sedge meadow plant community has a condition rating of "good."

The sedge meadow community appears to be outcompeting shallow marsh in drier areas with the encroachment of native sedges. This is shown by a significant increase in sedge meadow area from 2013 to 2014 (Figure 3.15 and Figure 3.16). This site shows good potential for mitigation credit with control of invasive species potentially improving the quality and encouraging the spread of the sedge meadow plant community.

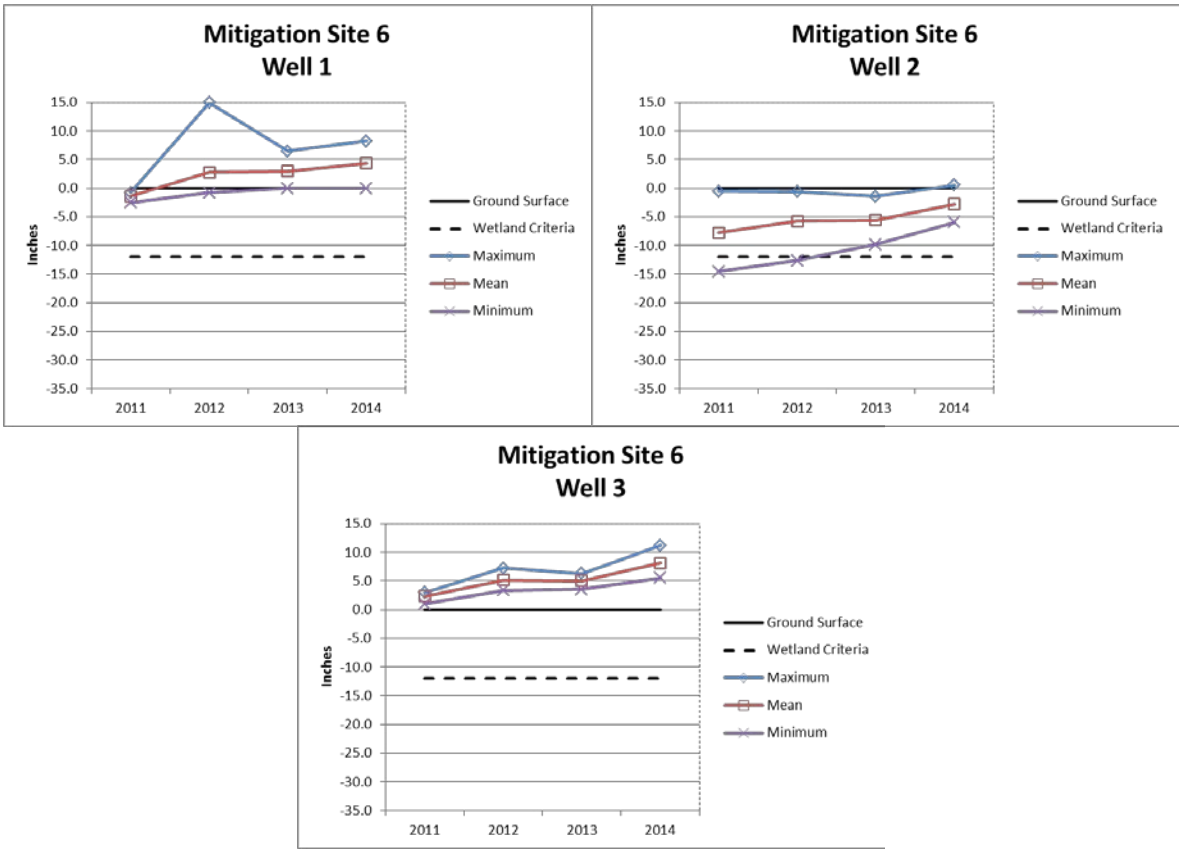


Figure 3.14. Mitigation Site 6 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.14. Mitigation Site 6 plant community vegetation characteristics 2013.

Mit 6 - 2013	Shallow Marsh		Sedge Meadow		Wet Meadow
Area (acres) 5.77	3.64		2.05		0.08
Dominant Species	*Carex lacustris* *Typha X glauca* *Typha angustifolia*	24% 24% 19%	*Carex utriculata* *Carex lacustris* *Scirpus cyperinus*	44% 33% 11%	No data
Invasive Species	*Typha angustifolia*	19%	*Phalaris arundinacea*	3%	
wC	2.9		5.3		
Condition Category	Fair		Good		
Total Site Condition Category	Good				

Table 3.15. Mitigation Site 6 plant community vegetation characteristics 2014.

Mit 6 - 2014	Shallow Marsh		Sedge Meadow		Wet Meadow
Area (acres) 6.07	3.10		2.87		0.10
Dominant Species	*Typha angustifolia* *Carex lacustris* *Carex utriculata* *Typha x glauca*	34% 18% 16% 11%	*Carex utriculata* *Carex lacustris* *Calamagrostis canadensis* *Scirpus microcarpus*	38% 16% 11% 11%	No data
Invasive Species	*Typha x glauca* *Phalaris arundinacea*	11% 2%	Cirsium arvense Phalaris arundinacea Typha angustifolia	3% 3% 3%	
wC	2.3		4.7		
Condition Category	Fair		Good		
Total Site Condition Category	Good				

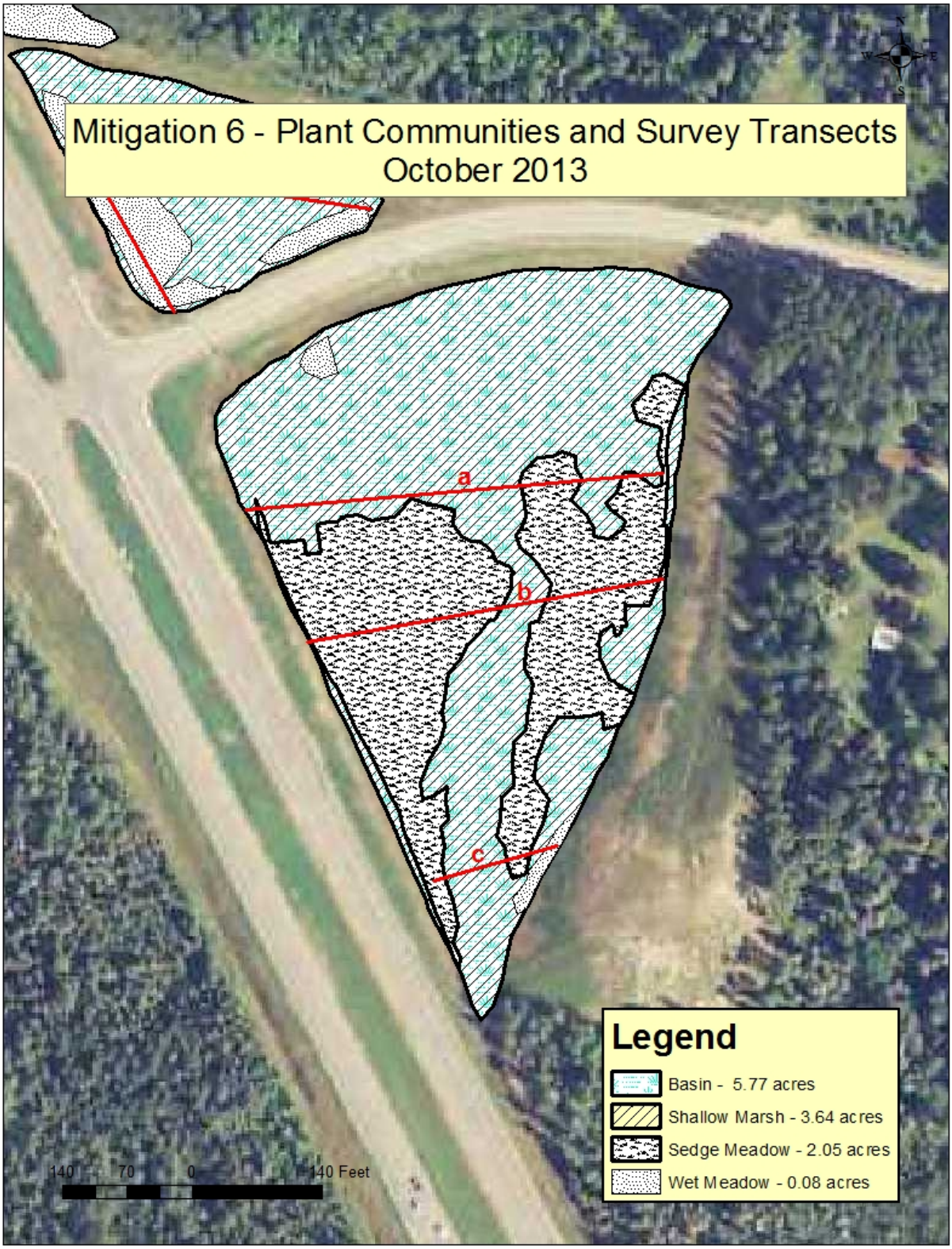


Figure 3.15. Mitigation Site 6 plant community areas 2013.

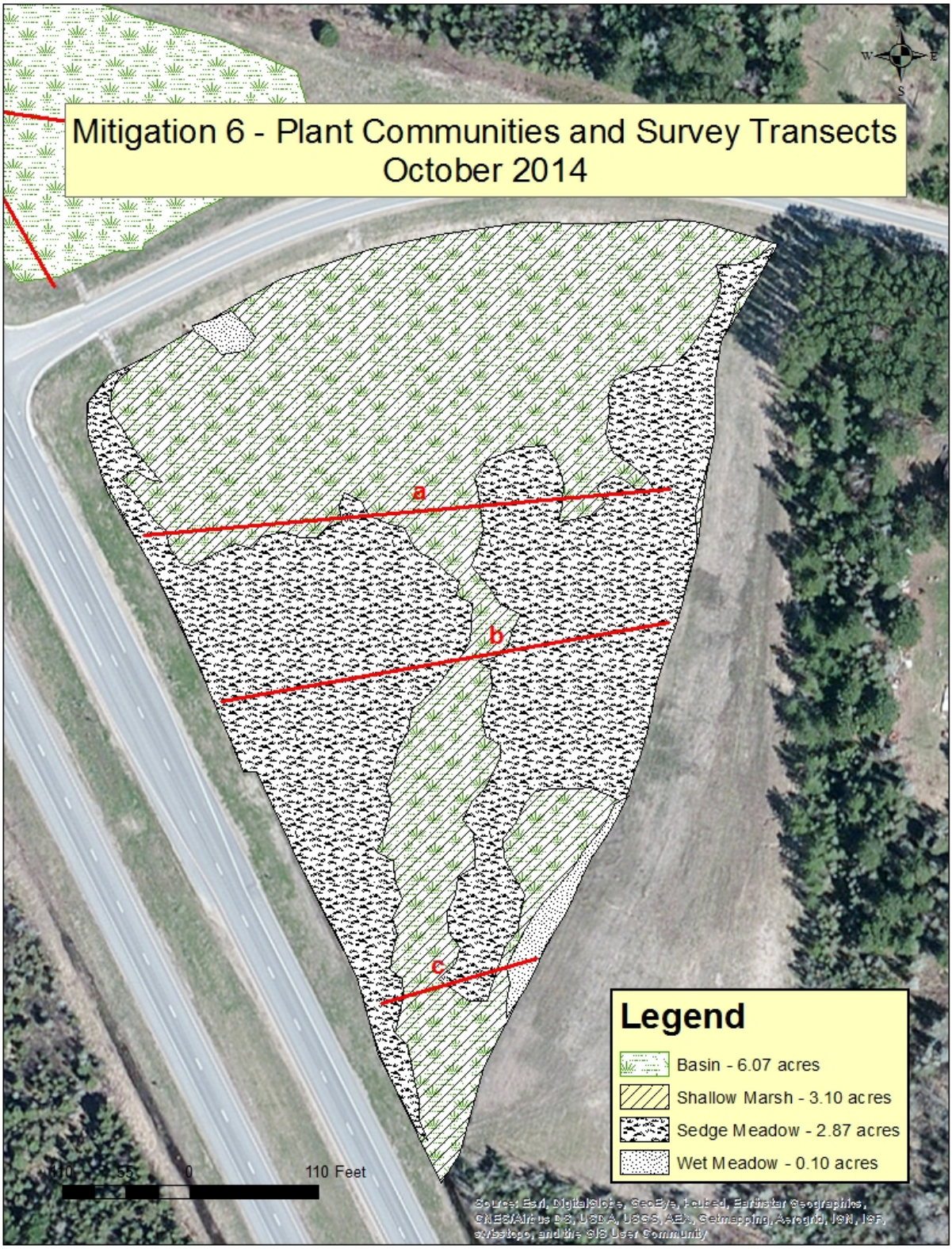


Figure 3.16. Mitigation Site 6 plant community areas 2014.

Mitigation Site 7

Mit 7 is a 1.50 acre site consisting of shallow marsh and wet meadow plant communities. Water table levels meet wetland criteria with a mix of standing water and saturated soils (Figure 3.17). The shallow marsh plant community is dominated by invasive *Typha* species interspersed with *Scirpus* species (Table 3.16 and Table 3.17). The wet meadow plant community is dominated by *Scirpus* species, *Juncus effusus* and *Calamagrostis canadensis* with some invasive *Phalaris arundinacea* present at less than 10 percent cover. Both plant communities have a FQA condition rating of "fair."

As seen on the aerial cover maps (Figure 3.18 and Figure 3.19) and in changes to the shallow marsh community species composition (Table 3.16 and Table 3.17), the site appears to be trending more towards a wet meadow. This site has some potential for mitigation credit with control of invasive species. Power-lines are located near the site and will have to be considered.

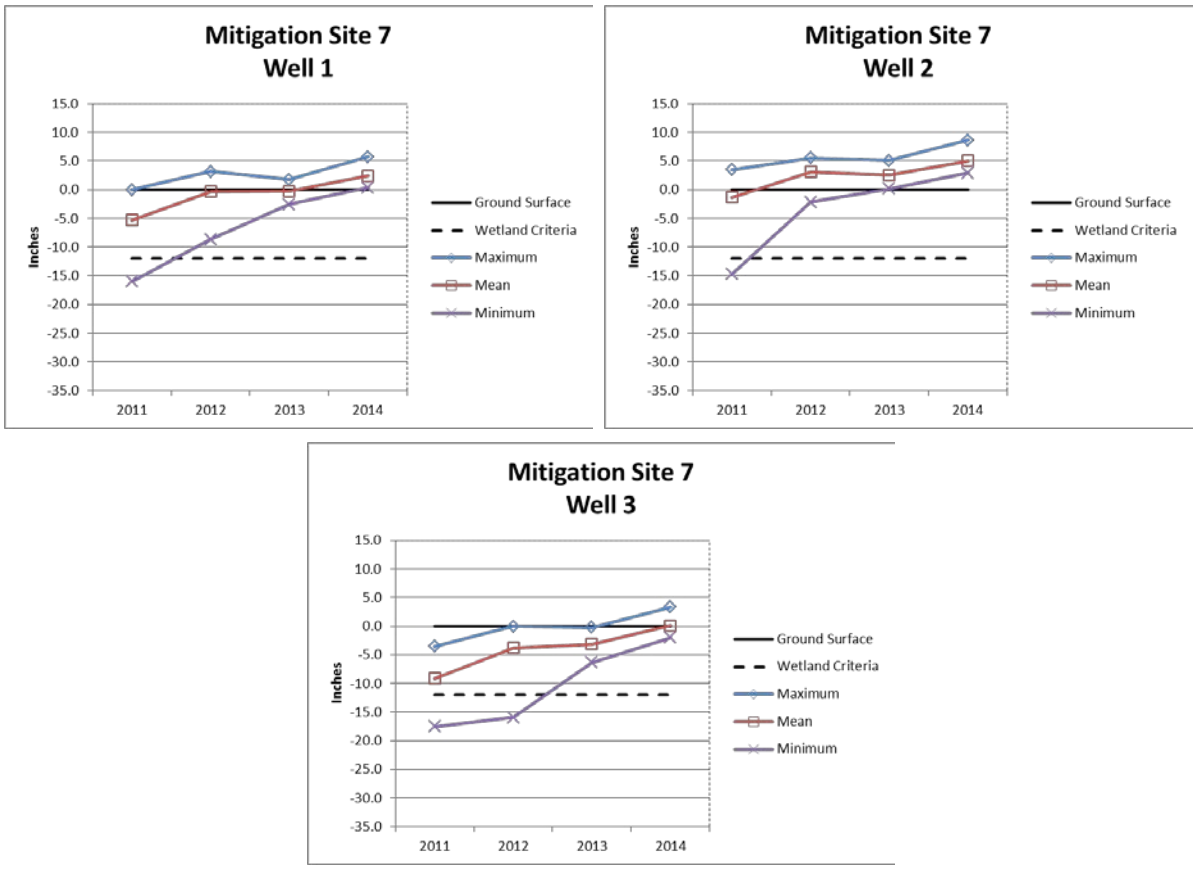


Figure 3.17. Mitigation Site 7 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.16. Mitigation Site 7 plant community vegetation characteristics 2013.

Mit 7 - 2013	Shallow Marsh		Wet Meadow	
Area (acres) 1.44	1.09		0.35	
Dominant Species	*Typha angustifolia* *Scirpus cyperinus* *Typha X glauca*	45% 28% 10%	*Carex tenera* *Juncus effusus* *Agrostis gigantea* *Calamagrostis canadensis* *Scirpus cyperinus*	21% 21% 14% 14% 14%
Invasive Species	*Typha angustifolia* *Typha X glauca* *Phalaris arundinacea*	45% 10% 3%	*Phalaris arundinacea*	7%
wC	1.4		2.0	
Condition Category	Poor		Fair	
Total Site Condition Category	Fair			

Table 3.17. Mitigation Site 7 plant community vegetation characteristics 2014.

Mit 7 - 2014	Shallow Marsh		Wet Meadow	
Area (acres) 1.5	1.1		0.4	
Dominant Species	*Scirpus cyperinus* *Typha angustifolia* *Scirpus microcarpus*	52% 20% 16%	*Scirpus cyperinus* *Calamagrostis canadensis* *Juncus effusus* *Scirpus microcarpus*	26% 19% 11% 11%
Invasive Species	*Typha angustifolia* *Typha x glauca*	20% 4%	Phalaris arundinacea	7%
wC	2.5		3.0	
Condition Category	Fair		Fair	
Total Site Condition Category	Fair			

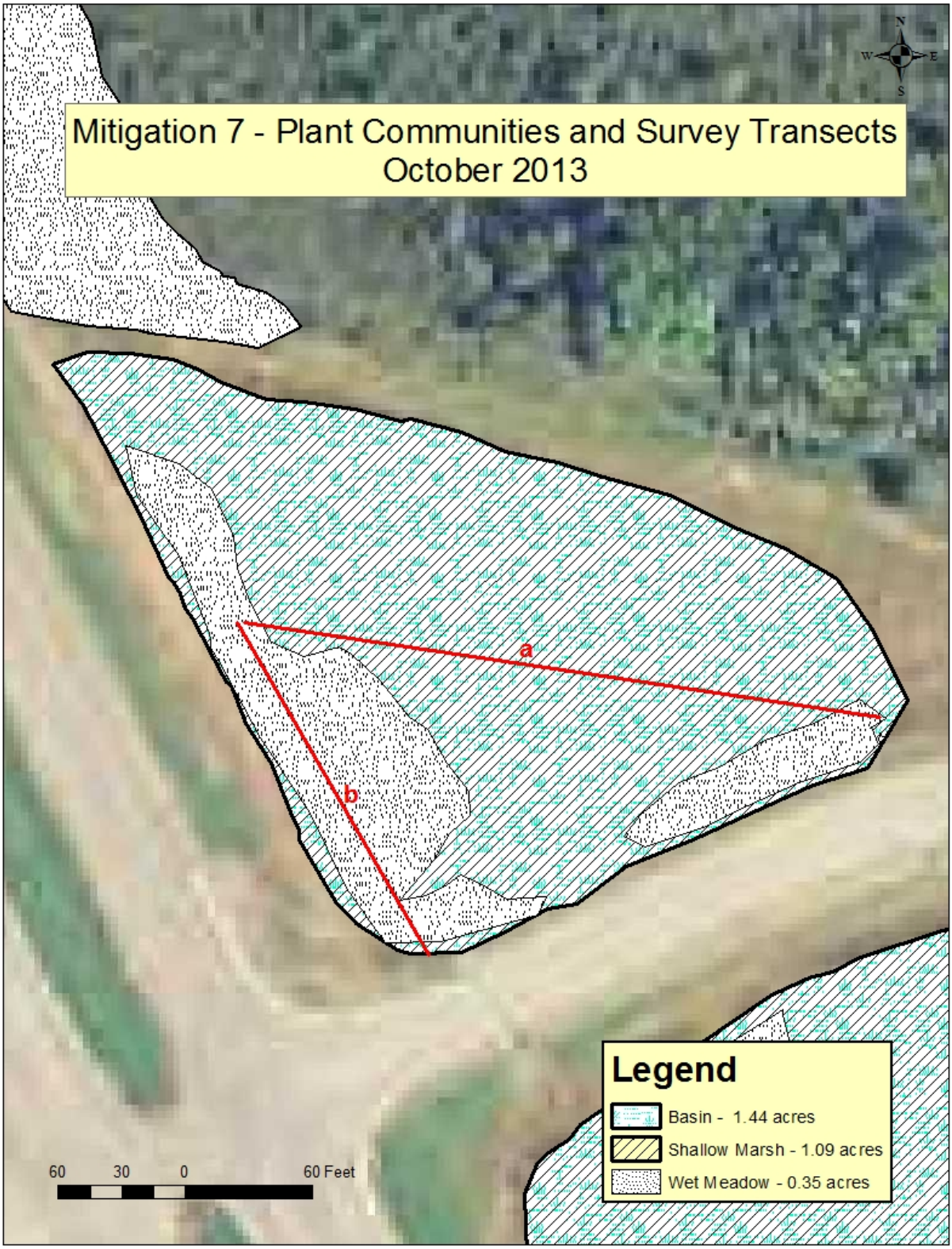


Figure 3.18. Mitigation Site 7 plant community areas 2013.

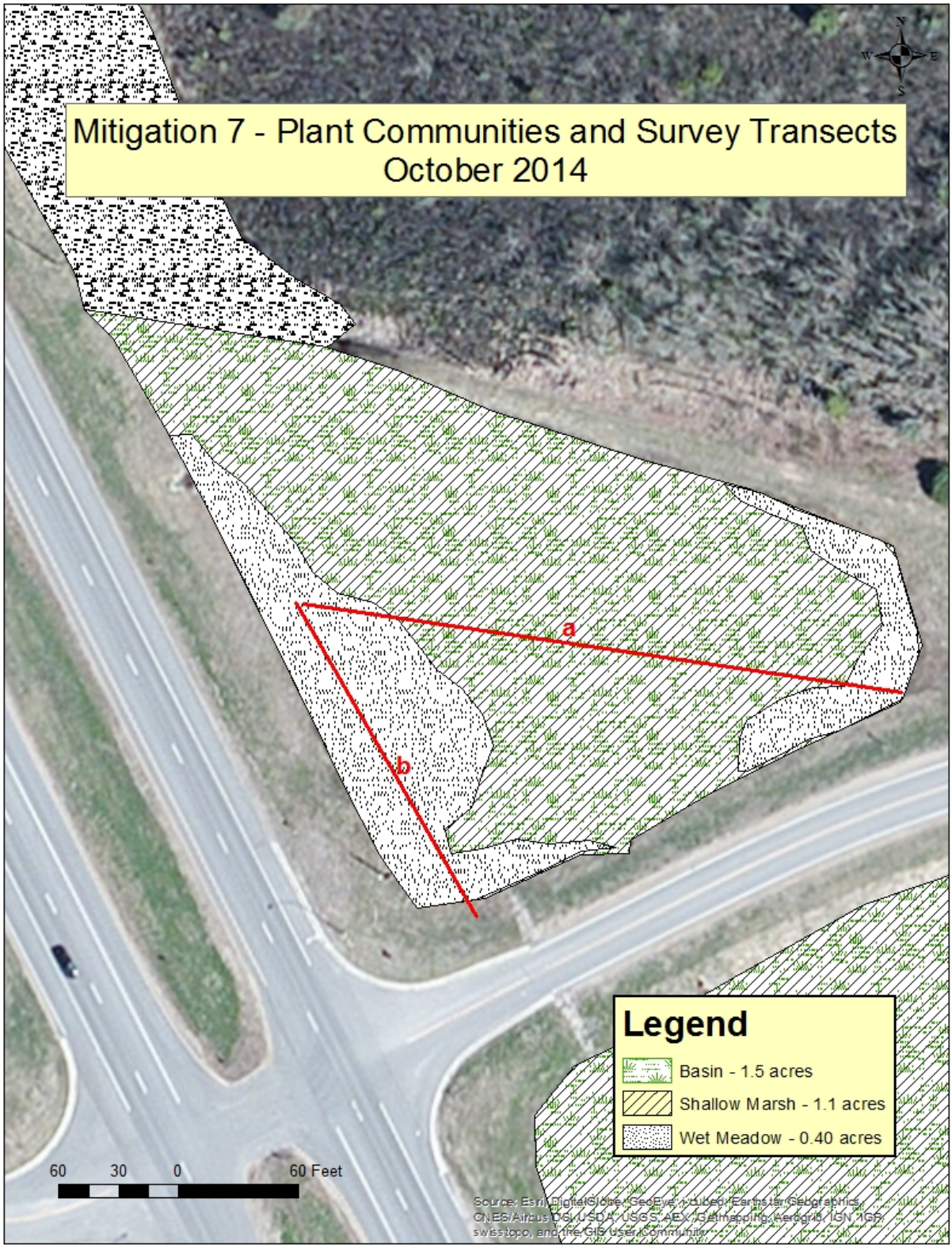


Figure 3.19. Mitigation Site 7 plant community areas 2014.

Mitigation Site 8

Mit 8 is a large 19.83-acre site that is predominantly a wet meadow plant community with minor components of shallow marsh, sedge meadow, shrub carr, and reed canary grass. The site is relatively dry, but water table levels meet wetland criteria (Figure 3.20). The wet meadow is dominated by *Calamagrostis canadensis*, *Scirpus cyperinus*, and *Carex lacustris* with invasive *Cirisium arvense* and *Phalaris arundinacea* present at less than 10 percent combined cover, with a FQA condition rating of "fair" (Table 3.18and Table 3.19). The shallow marsh areas are dominated by *Carex lacustris* with invasive *Typha species* and *Phalaris arundinacea* present at from 15 to 25 percent cover, with a FQA condition rating of "fair." The sedge meadow communities are dominated by *Carex utriculata* and *Carex lacustris* with less than one percent invasive species cover, and a FQA condition rating of "exceptional." The shrub carr communities are dominated by *Carex lacustis* and *Salix* species with less than one percent invasive species cover, and a FQA condition rating of "fair."

As seen on the aerial cover maps (Figure 3.21and Figure 3.22) and in changes to the shallow marsh community species composition (Table 3.18and Table 3.19) it appears that *Carex lacustris* and *Scirpus* species are overtaking the scattered *Typha* dominated shallow marsh areas. There is a concentrated area of reed canary grass on the site that has increased slightly from 2013 to 2014. There is also some ATV damage to a small portion of the site. This site has good potential for mitigation credit with control of the invasive species. The relatively dry condition of the site makes it particularly well suited to tamarack and black spruce tree planting as well. Overall, this site has excellent potential for receiving mitigation credit on a relatively large scale.

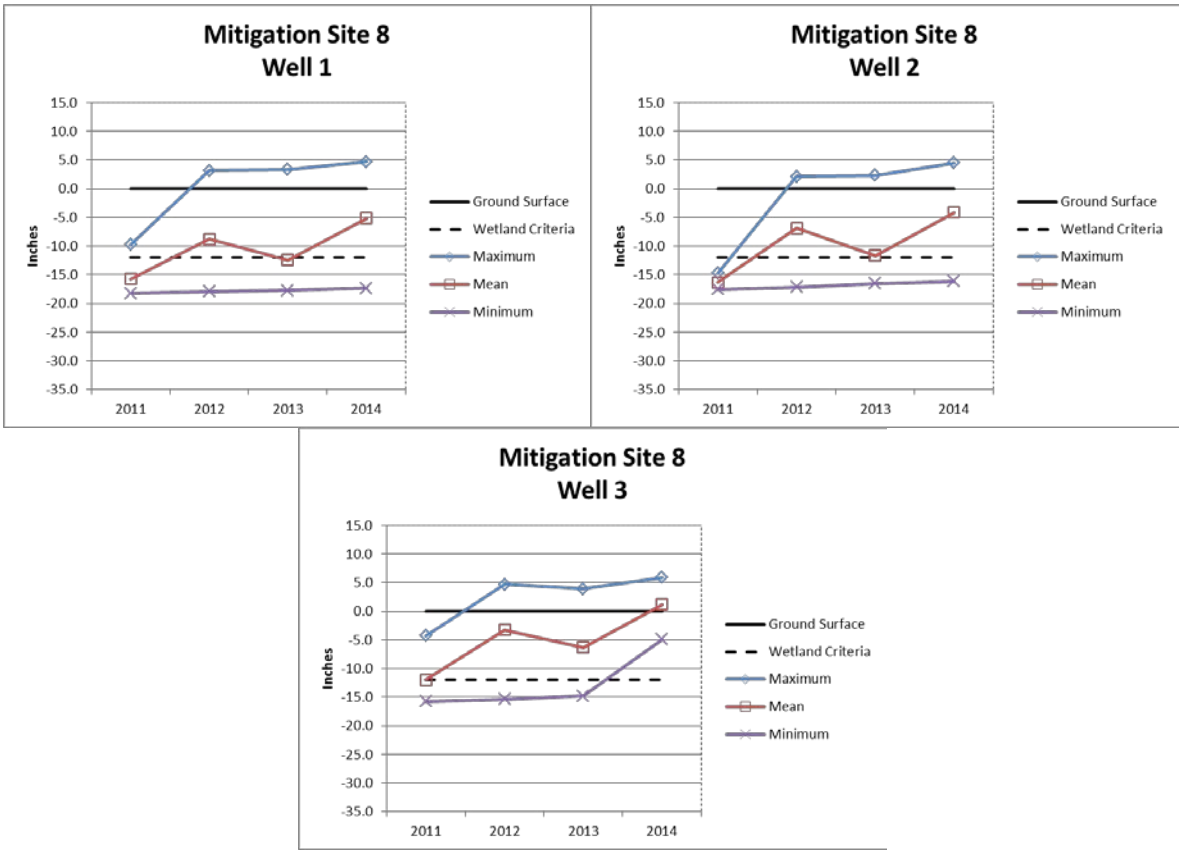


Figure 3.20. Mitigation Site 8 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.18. Mitigation Site 8 plant community vegetation characteristics 2013.

Mit 8 - 2013	Wet Meadow		Shallow Marsh		Sedge Meadow		Shrub Carr	
Area (acres) 19.68	18.23		0.37		0.66		0.42	
Dominant Species	*Scirpus cyperinus* *Calamagrostis canadensis* *Carex lacustris*	28% 27% 19%	*Carex lacustris* *Scirpus cyperinus* *Scirpus microcarpus* *Typha angustifolia*	40% 13% 13% 13%	*Carex utriculata* *Carex lacustris*	77% 10%	*Carex lacustris* *Salix petiolaris* *Populus balsamifera* *Salix bebbiana*	43% 29% 14% 14%
Invasive Species	*Phalaris arundinacea*	1%	*Typha angustifolia* *Phalaris arundinacea* *Typha X glauca*	13% 7% 7%		<1%		<1%
wC	3.7		2.3		6.6		5.0	
Condition Category	Fair		Fair		Exceptional		Exceptional	
Total Site Condition Category	Good							

Table 3.19. Mitigation Site 8 plant community vegetation characteristics 2014.

Mit 8 - 2014	Wet Meadow		Shallow Marsh		Sedge Meadow		Shrub Carr		Reed Canary Stand	
Area (acres) 19.83	14.35		1.54		1.6		1.49		0.64	
Dominant Species	*Calamagrostis canadensis* *Scirpus cyperinus* *Carex lacustris*	32% 25% 16%	*Carex lacustris* *Scirpus cyperinus* *Scirpus microcarpus* Bare soil, ATV damage *Calamagrostis canadensis* *Typha latifolia*	23% 19% 15% 12% 12% 12%	*Carex utriculata* *Carex lacustris* *Scirpus cyperinus*	48% 17% 13%	*Carex lacustris* *Salix discolor*	67% 33%	*Phalaris arundinacea*	100%
Invasive Species	*Cirsium arvense* *Phalaris arundinacea*	4% 4%	*Typha angustifolia* Bare soil, ATV damage	4% 12%		<1%		<1%	*Phalaris arundinacea*	100%
wC	3.5		3.4		5.3		4.3		0.0	
Condition Category	Fair		Fair		Exceptional		Fair		Poor	
Total Site Condition Category	Fair									

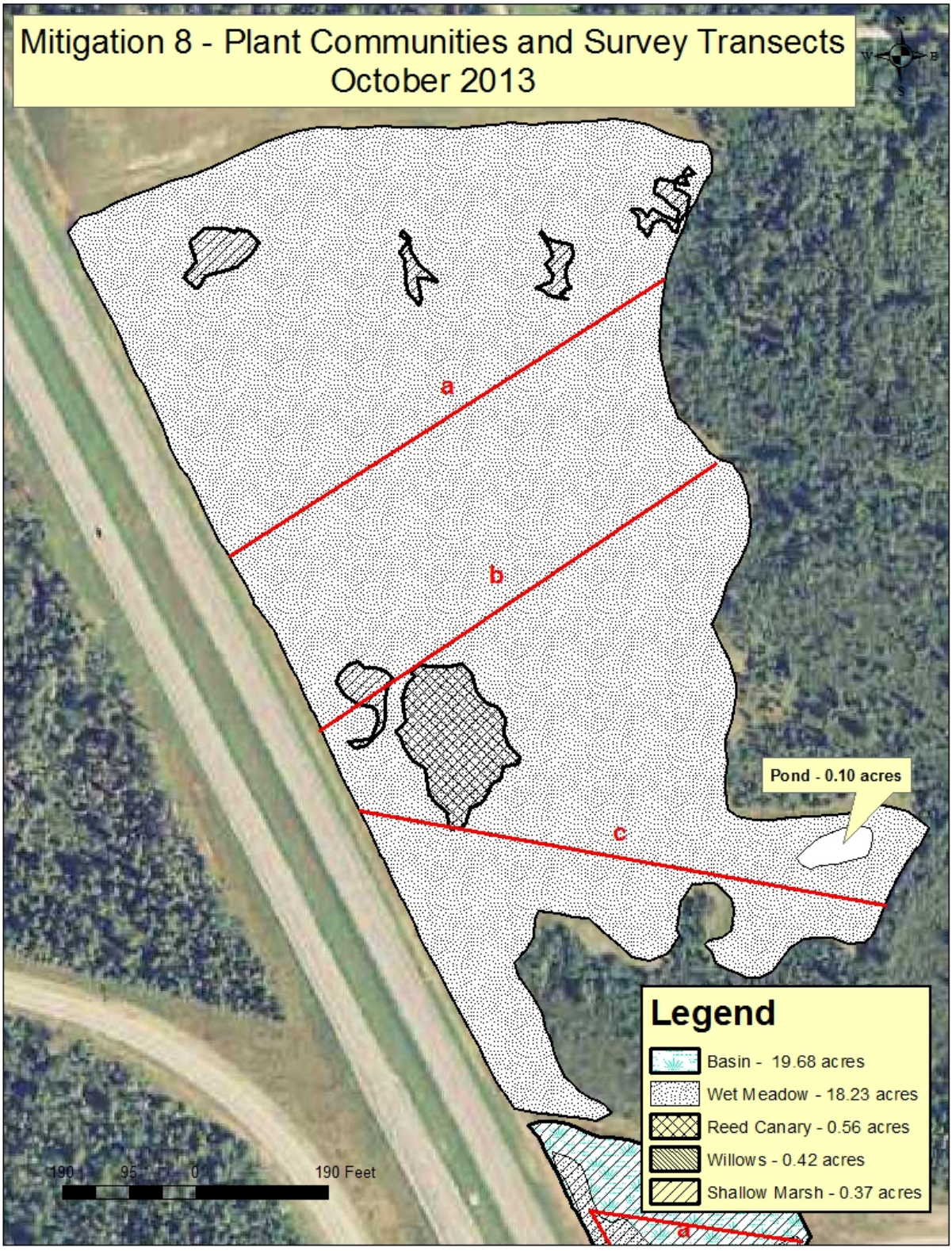


Figure 3.21. Mitigation Site 8 plant community areas 2013.

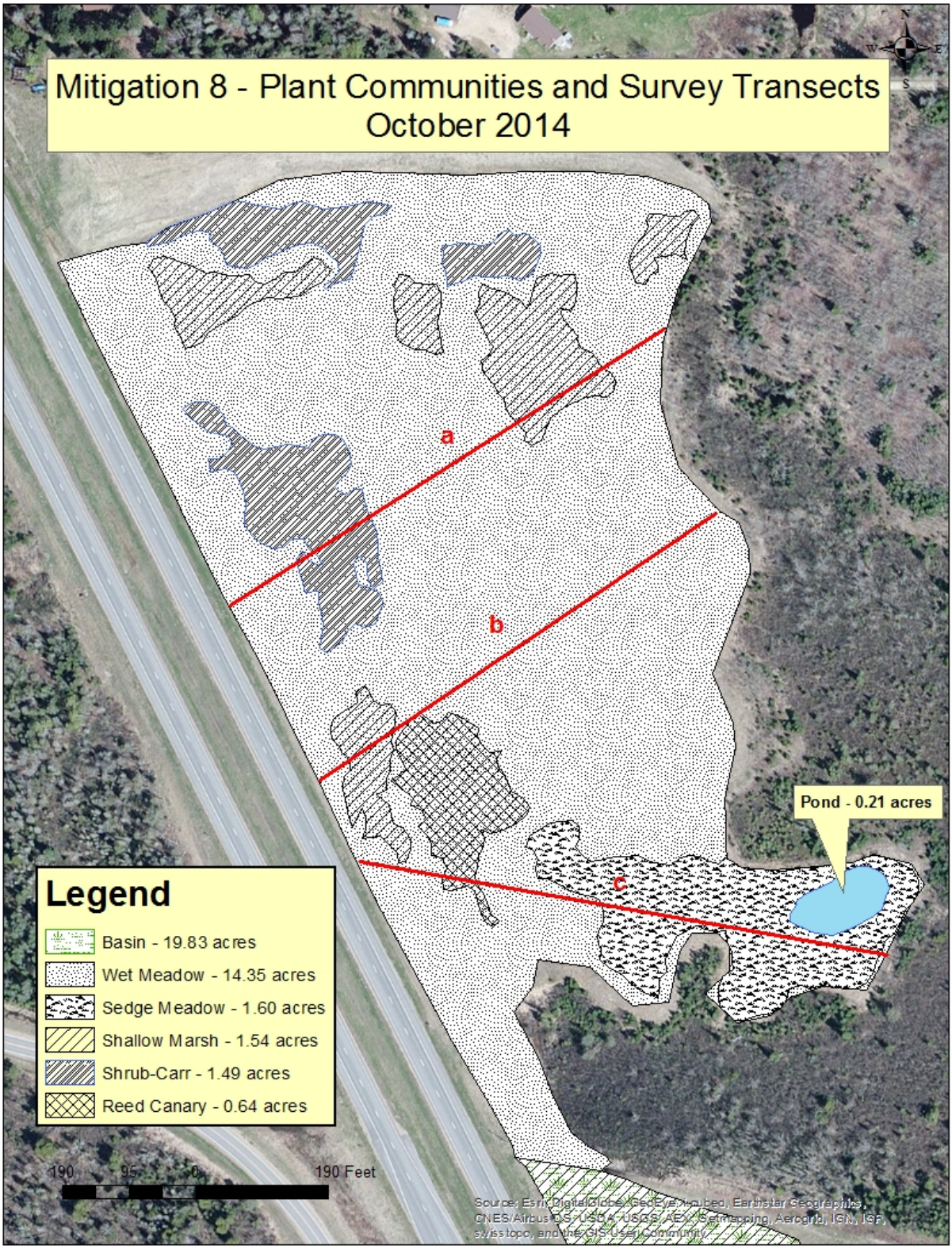


Figure 3.22. Mitigation Site 8 plant community areas 2014.

Mitigation Site 9

Mit 9 is a 9.24 acre site that is predominantly a wet meadow plant community with some shallow marsh. Water table levels meet wetland criteria with the area around well number 2 being considerably drier (Figure 3.23). The wet meadow is dominated by *Calamagrostis canadensis*, *Scirpus cyperinus* and *Glyceria canadensis*, and invasive *Tanacetum vulgare* present at less that 5 percent cover, with a FQA condition rating of "good" (Table 3.20 and Table 3.21). The shallow marsh plant community is dominated by *Scirpus cyperinus*, *Glyceria canadensis* and the invasive *Typha angustifolia*, with a FQA condition rating of "fair."

The entire site is actually a mixture of uplands, ponds, wet meadow and shallow marsh. Note that the wetland delineation conducted in 2014 reduced the wetland acreage of this site considerably. The wet meadow areas of the site, once sorted out and delineated have some good potential for mitigation credit with control of invasive species (Figure 3.24). Drier areas of the site may be suited to tamarack and black spruce tree planting. Power-lines run across a section of the site that prohibit those areas from receiving mitigation credit per Army Corps rules.

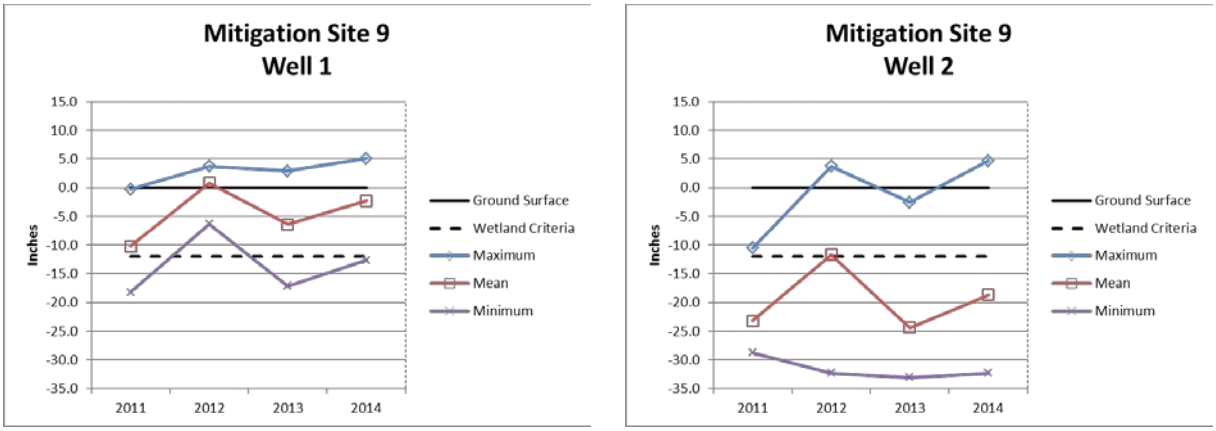


Figure 3.23. Mitigation Site 9 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.20. Mitigation Site 9 plant community vegetation characteristics 2013.

Mit 9 - 2013	Shallow Marsh		Wet Meadow	
Area (acres) 17.12	1.14		15.85	
Dominant Species	*Scirpus cyperinus* *Glyceria canadensis* *Typha latifolia* *Calamagrostis canadensis* *Typha angustifolia*	25% 24% 17% 11% 11%	*Glyceria canadensis* *Calamagrostis canadensis* *Euthamia graminifolia*	40% 12% 12%
Invasive Species	*Typha angustifolia* *Phalaris arundinacea*	11% 1%	*Tanacetum vulgare*	4%
wC	3.2		5.7	
Condition Category	Fair		Exceptional	
Total Site Condition Category	Exceptional			

Table 3.21. Mitigation Site 9 plant community vegetation characteristics 2014.

Mit 9 - 2014	Wet Meadow		Shallow Marsh		Sedge Meadow		Bog	
Area (acres) 9.24	5.74		2.01		1.21		0.12	
Dominant Species	*Scirpus cyperinus* *Calamagrostis canadensis* *Glyceria canadensis*	36% 30% 14%	*Typha angustifolia* *Scirpus cyperinus* *Typha latifolia*	30% 23% 10%	*Scirpus cyperinus* *Glyceria canadensis*	45% 41%	*Glyceria canadensis* *Scirpus cyperinus*	67% 33%
Invasive Species	*Phalaris arundinacea*	2%	*Typha angustifolia*	30%		<1%		<1%
wC	3.9		2.9		4.9		5.5	
Condition Category	Fair		Fair		Exceptional		Fair	
Total Site Condition Category	Good							

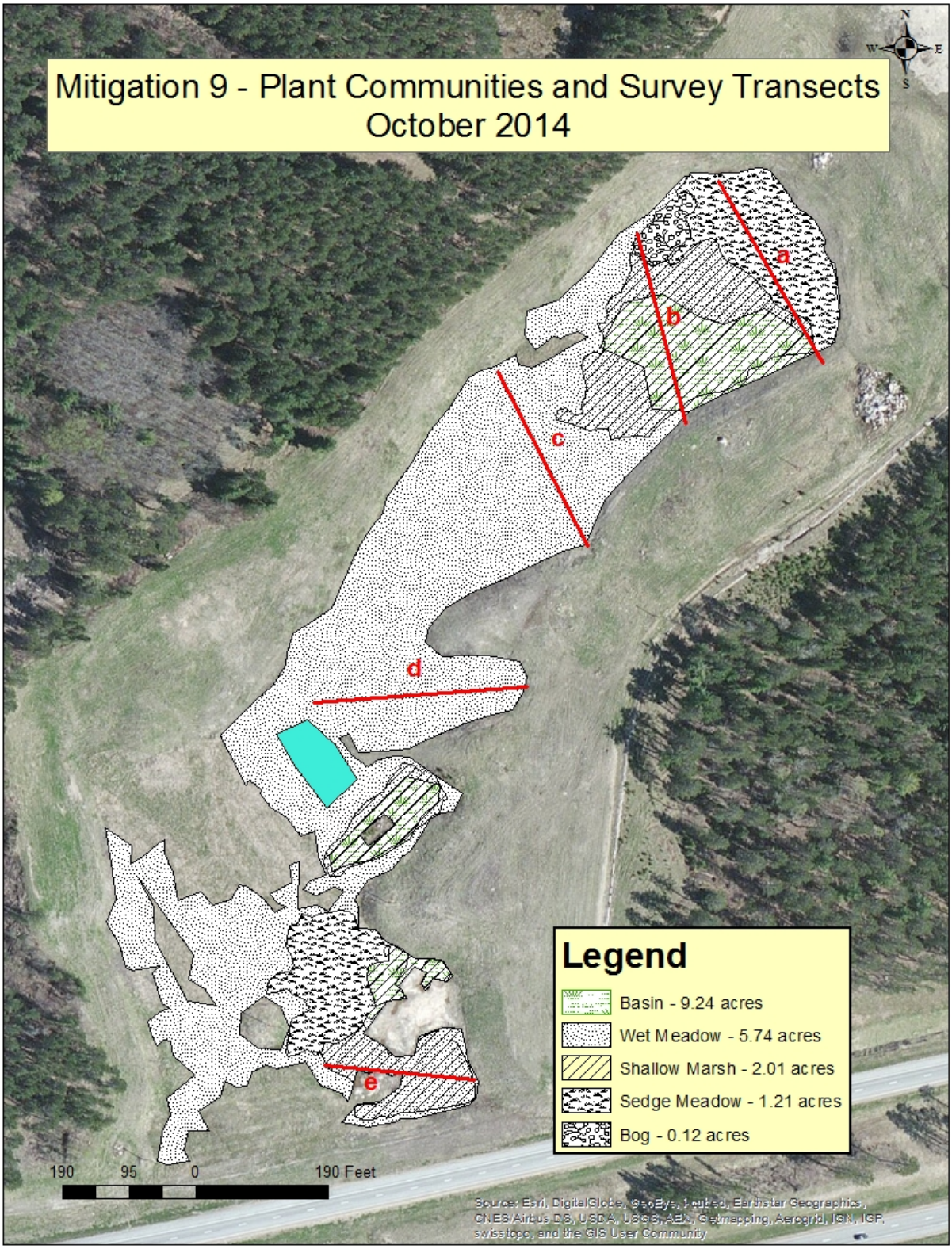


Figure 3.24. Mitigation Site 9 plant community areas 2014.

Mitigation Site 10

Mit 10 is a 7.48 acre site that consists primarily of wet meadow with shrub carr, bog, and shallow marsh plant communities spread throughout. The water table levels meet wetland hydrology criteria (Figure 3.25). The wet meadow plant community is dominated by Carex utriculata with a FQA condition rating of "good" (Table 3.22 and Table 3.23). The shrub carr plant community was dominated by *Scirpus cyperinus* and *Salix* species and less than one percent invasive species cover, with a FQA condition rating of "fair." The bog plant community was dominated by *Scirpus cyperinus*, *Chamaedaphne calyculata*, *Carex utriculata,* and *Carex oligosperma*, and invasives present at less than one percent cover, with a FQA condition rating of "fair." The shallow marsh plant community was dominated by *Scirpus cyperinus*, *Typha latifolia*, and *Carex lacustris*, and invasive Typha species present at less than 10 percent, with a FQA condition rating of "fair."

It is interesting to note that early in the study, in 2011 and 2012, there was significant cover (up to 100 percent) of *Sphagnum* moss in the bog community areas. However, after significantly higher water tables occurred in 2012 and 2014, the *Sphagnum* moss was drowned out by extended periods of standing water and has not yet recovered. There was no identifiable cause for the high water levels but it should be investigated in the future. Although the site is a mosaic of plant communities (Figure 3.26), it has good potential for mitigation credit with proper water level management and control of invasive species. Power-lines cross a portion of the site that prohibit those areas from receiving mitigation credit per Army Corps rules.

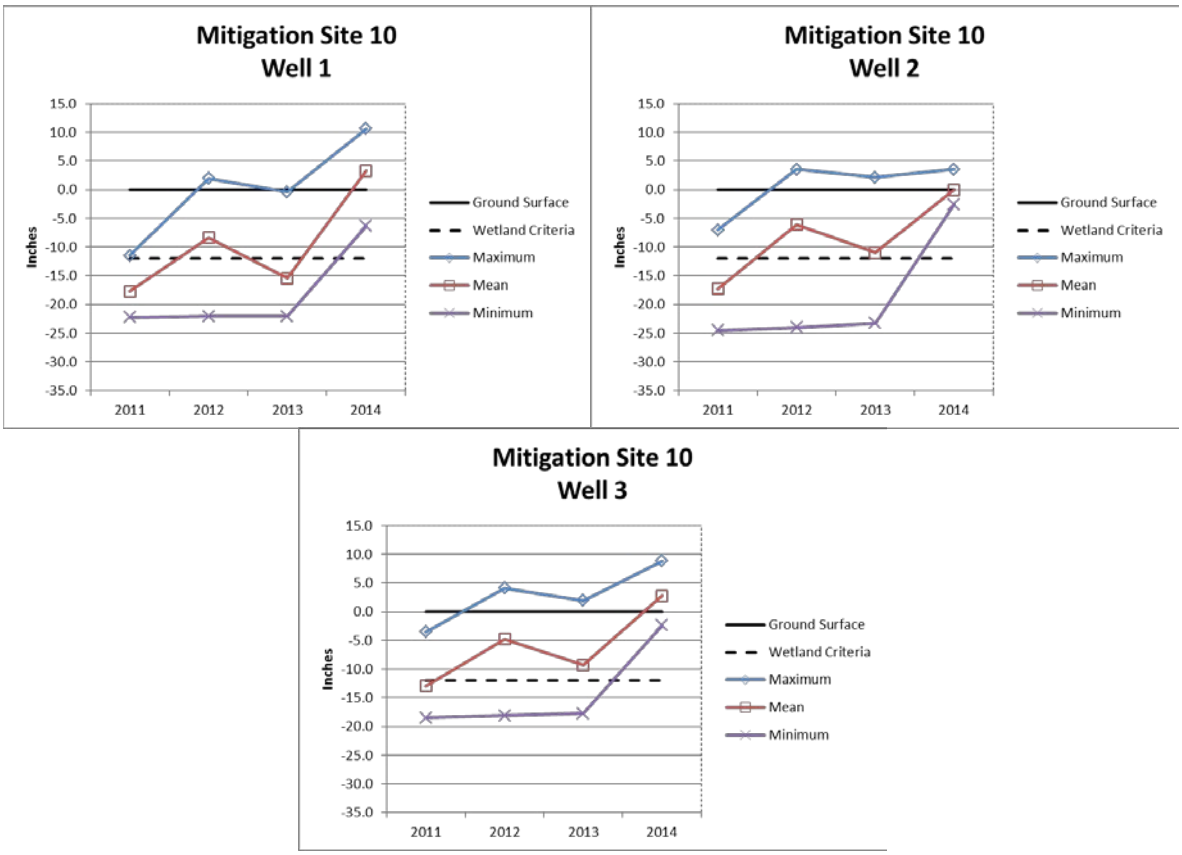


Figure 3.25. Mitigation Site 10 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.22. Mitigation Site 10 plant community vegetation characteristics 2013.

Mit 10 - 2013	Wet Meadow/Shrub Carr		Bog		Shallow Marsh	
Area (acres) 7.16	4.41		1.93		0.76	
Dominant Species	*Scirpus cyperinus* *Calamagrostis canadensis* *Salix petiolaris*	53% 13% 13%	*Chamaedaphne calyculata* *Scirpus cyperinus* *Carex utriculata*	27% 24% 14%	*Scirpus cyperinus* *Typha latifolia*	46% 26%
Invasive Species		<1%	Tanacetum vulgare	2%	*Typha angustifolia*	6%
wC	4.0		6.3		2.6	
Condition Category	Fair		Fair		Fair	
Total Site Condition Category	Fair					

Table 3.23. Mitigation Site 10 plant community vegetation characteristics 2014.

Mit 10 - 2014	Shrub Carr		Bog		Shallow Marsh		Wet Meadow	
Area (acres) 7.48	0.92		0.74		1.15		4.59	
Dominant Species	*Scirpus cyperinus* *Salix bebbiana*	50% 14%	*Scirpus cyperinus* *Chamaedaphne calyculata* *Carex utriculata* *Carex oligosperma*	31% 20% 17% 11%	*Scirpus cyperinus* *Typha latifolia* *Carex lacustris*	35% 29% 12%	*Carex utriculata*	41%
Invasive Species		<1%		<1%	*Typha x glauca*	6%	*Typha x glauca* *Typha angustifolia*	9% 5%
wC	3.5		5.5		3.9		5.3	
Condition Category	Fair		Fair		Fair		Good	
Total Site Condition Category	Good							

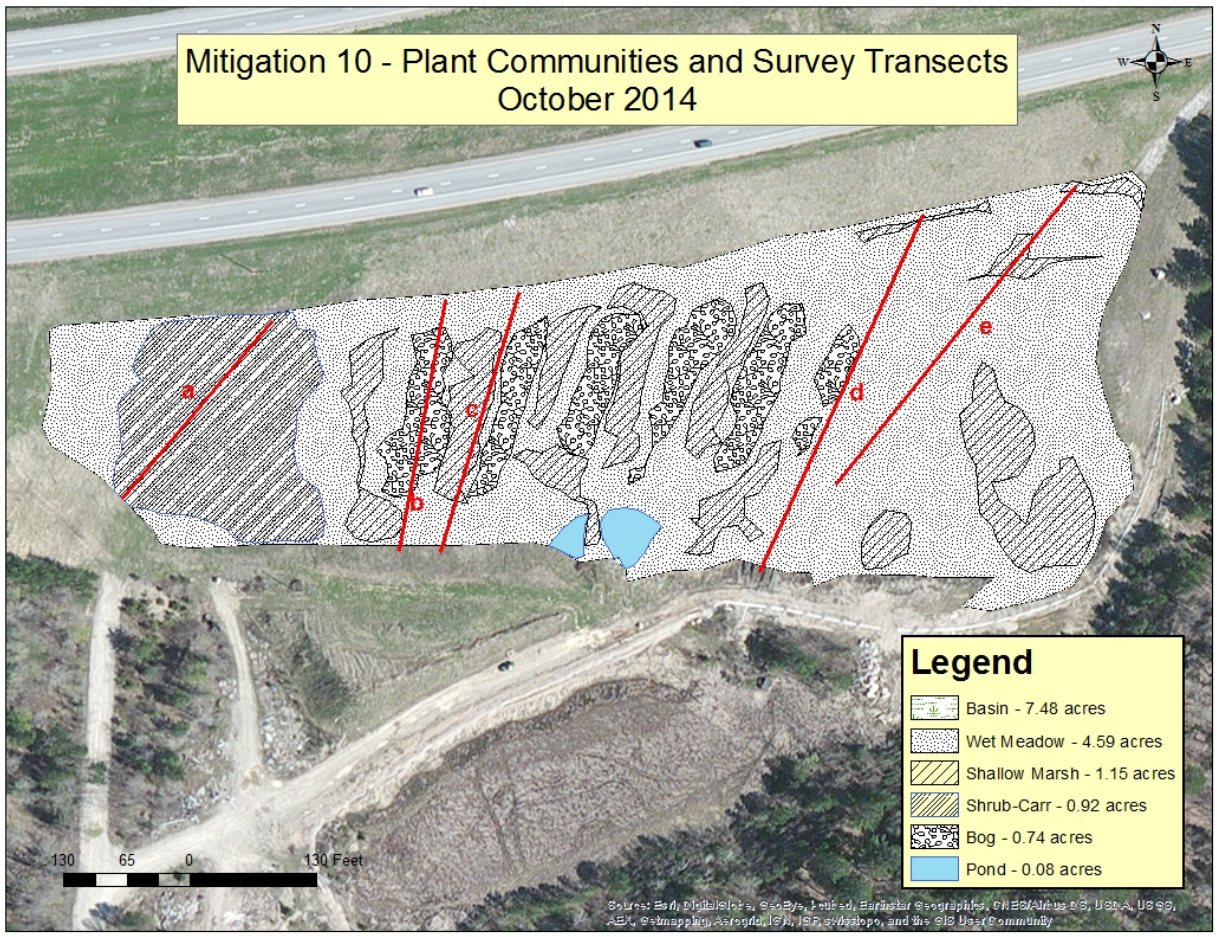


Figure 3.26. Mitigation Site 10 plant community areas 2014.

Mitigation Site 11

Mit 11 is a 3.02 acre site that consists of a wet meadow, alder thicket and a stand of reed canary grass. The site is quite dry and only just meets wetland hydrology criteria and only in some years (Figure 3.27). The wet meadow plant community is dominated by *Scirpus cyperinus*, *Carex lacustris*, *Alnus rugosa*, *Agrostis gigantea*, and the invasive species *Phalaris arundinacea*, with a FQA condition rating of "fair" (Table 3.24 and Table 3.25). The reed canary stand is dominated by invasive *Phalaris arundinacea* and some *Calamagrostis canadensis*, with a FQA condition rating of "poor."

The site has poor potential for mitigation credit due to its low water table and extensive reed canary grass infestations that according to the aerial cover maps dominate over half the site and have increased from 2013 to 2014 (Figure 3.28 and Figure 3.29). Because of the low water table, planting tamarack and black spruce trees might be a good option on the site, but not without first controlling the invasive reed canary grass. Weed control mats may help with tree establishment.

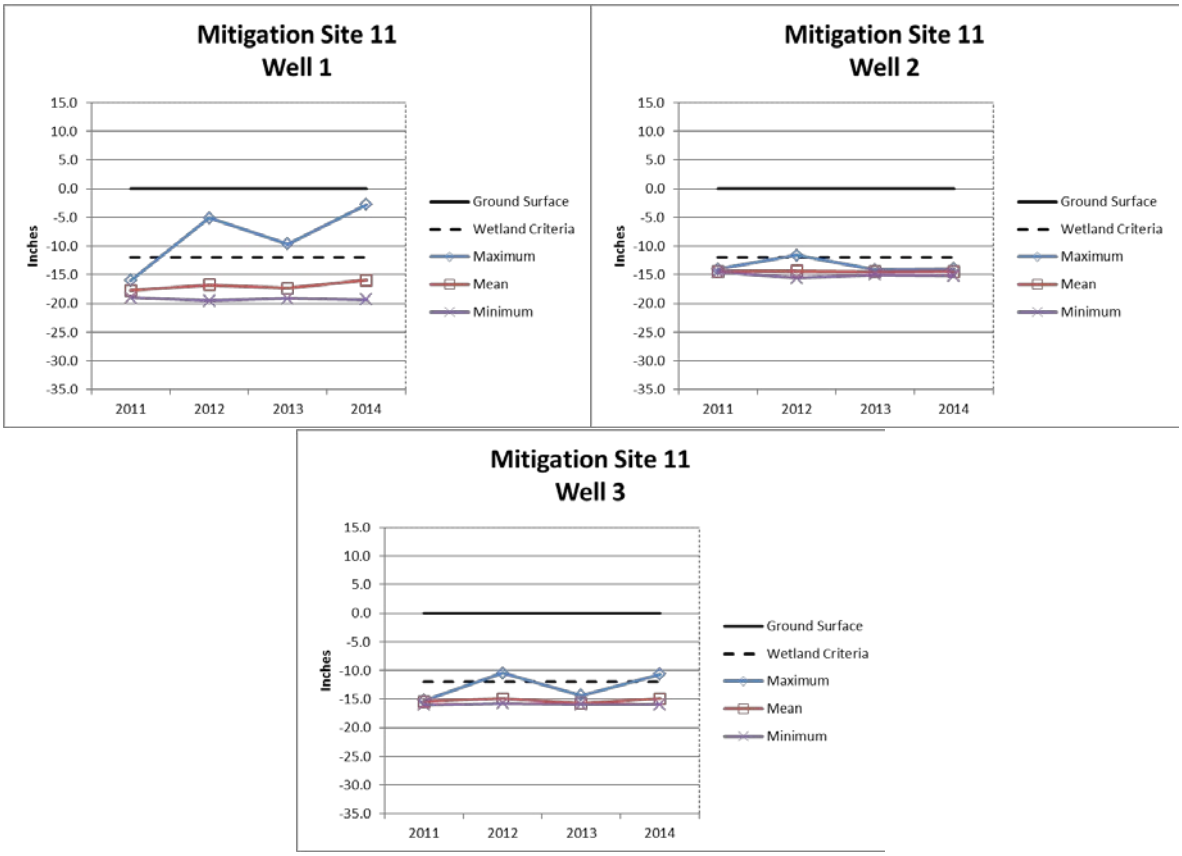


Figure 3.27. Mitigation Site 11 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.24. Mitigation Site 11 plant community vegetation characteristics 2013.

Mit 11 - 2013	Wet Meadow		Reed Canary Stand	
Area (acres) 2.84	1.17		1.67	
Dominant Species	*Scirpus cyperinus* *Alnus rugosa* *Phalaris arundinacea* *Agrostis gigantea*	39% 15% 15% 12%	*Phalaris arundinacea*	59%
Invasive Species	*Phalaris arundinacea*	15%	*Phalaris arundinacea*	59%
wC	2.1		1.2	
Condition Category	Fair		Poor	
Total Site Condition Category	Fair			

Table 3.25. Mitigation Site 11 plant community vegetation characteristics 2014.

Mit 11 - 2014	Wet Meadow		Reed Canary Stand		Alder Thicket
Area (acres) 3.02	1.23		1.9		0.20
Dominant Species	*Scirpus cyperinus* *Carex lacustris* *Phalaris arundinacea*	44% 14% 14%	*Phalaris arundinacea* *Calamagrostis canadensis*	78% 12%	No data
Invasive Species	*Phalaris arundinacea*	14%	*Phalaris arundinacea*	78%	
wC	3.1		0.7		
Condition Category	Fair		Poor		
Total Site Condition Category	Fair				

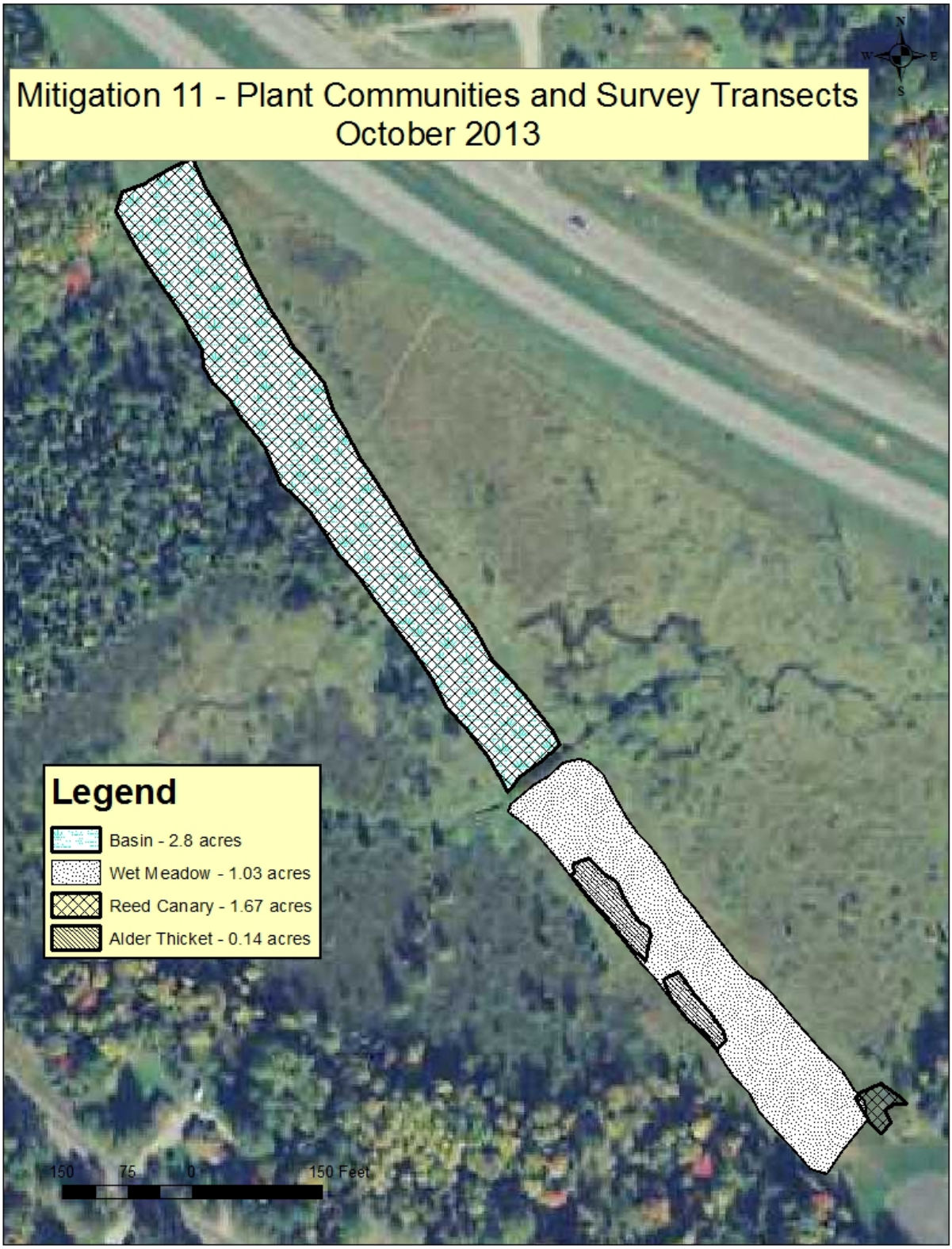


Figure 3.28. Mitigation Site 11 plant community areas 2013.

Figure 3.29. Mitigation Site 11 plant community areas 2014.

Mitigation Site 12

Mit 12 is a 0.62 acre site that is predominantly a shallow marsh. The water table levels meet wetland hydrology criteria (Figure 3.30). The shallow marsh plant community is dominated by invasive *Typha* species and *Scirpus cyperinus* (Table 3.26 and Table 3.27). Invasive *Lythrum salicaria* is present at less than 10 percent cover and the FQA condition rating is "fair."

There was little to no change in the site from 2013 to 2014 (Figure 3.30, Figure 3.31, and Figure 3.32). Although this site may benefit from invasive species control, it has poor potential for mitigation credit because a power-line runs directly over it.

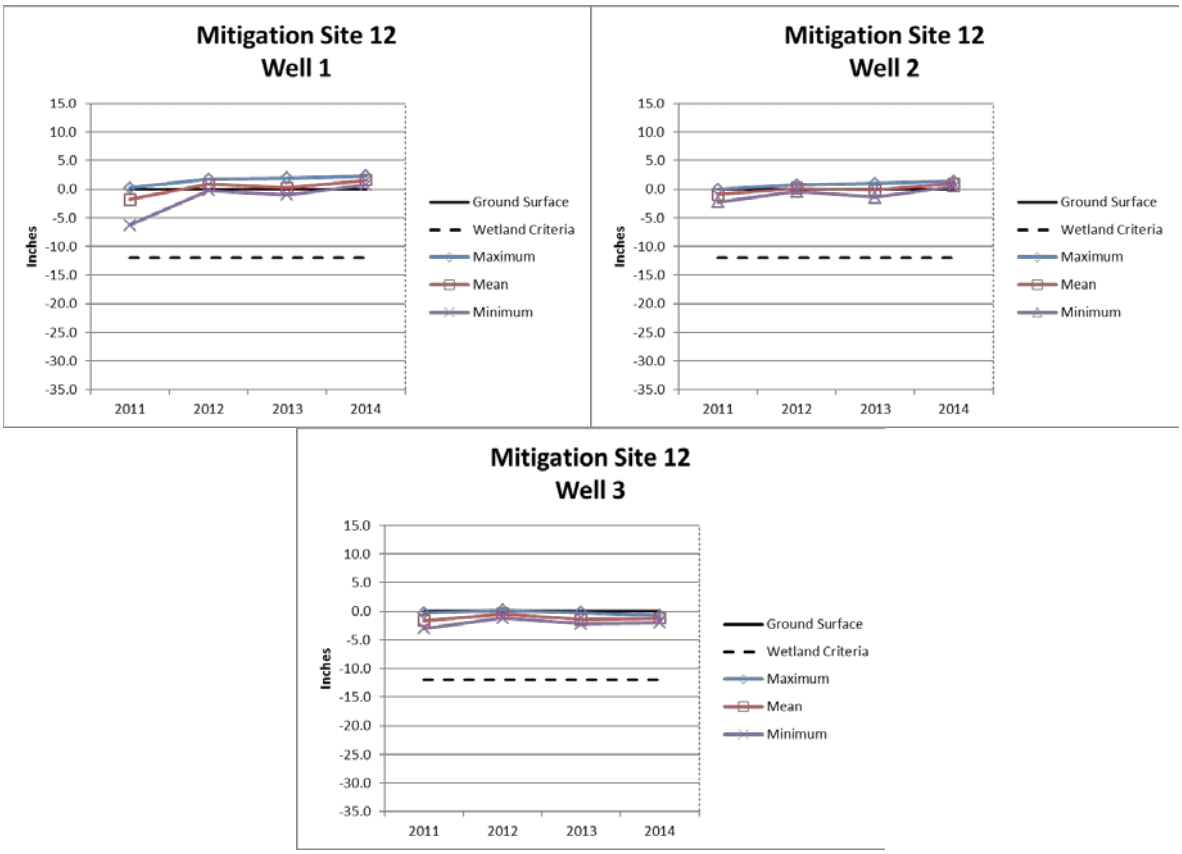


Figure 3.30. Mitigation Site 12 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.26. Mitigation Site 12 plant community vegetation characteristics 2013.

Mit 12 - 2013	Shallow Marsh	
Area (acres) 0.66	0.66	
Dominant Species	*Typha X glauca* *Typha angustifolia* *Juncus effusus* *Carex utriculata*	24% 22% 17% 10%
Invasive Species	*Typha X glauca* *Typha angustifolia* *Lythrum salicaria*	24% 22% 7%
wC	2.0	
Condition Category	Fair	
Total Site Condition Category	Fair	

Table 3.27. Mitigation Site 12 plant community vegetation characteristics 2014.

Mit 12 - 2014	Shallow Marsh	
Area (acres) 0.62	0.62	
Dominant Species	*Typha angustifolia* *Scirpus cyperinus*	44% 19%
Invasive Species	*Typha angustifolia*	44%
wC	2.2	
Condition Category	Fair	
Total Site Condition Category	Fair	

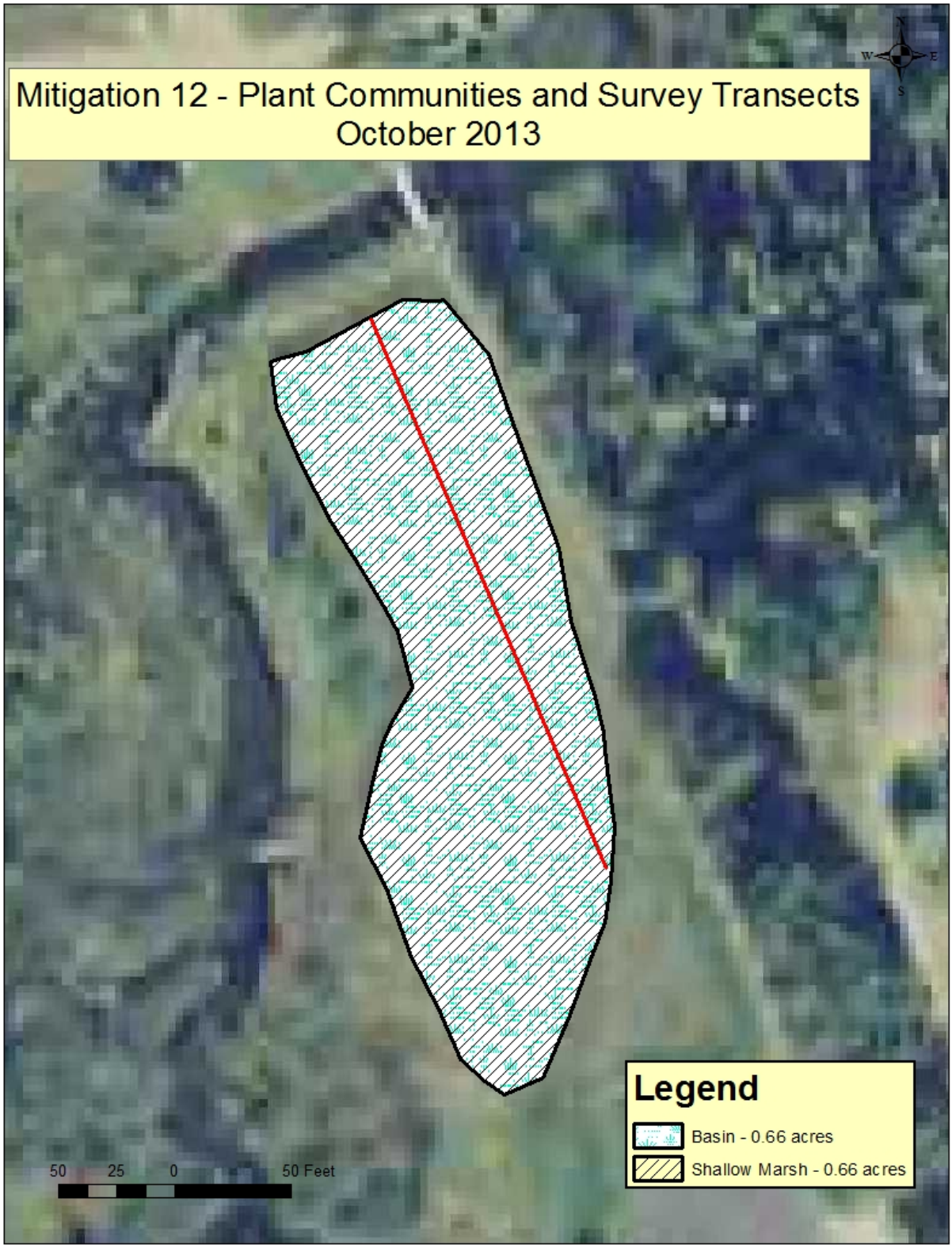


Figure 3.31. Mitigation Site 12 plant community areas 2013.

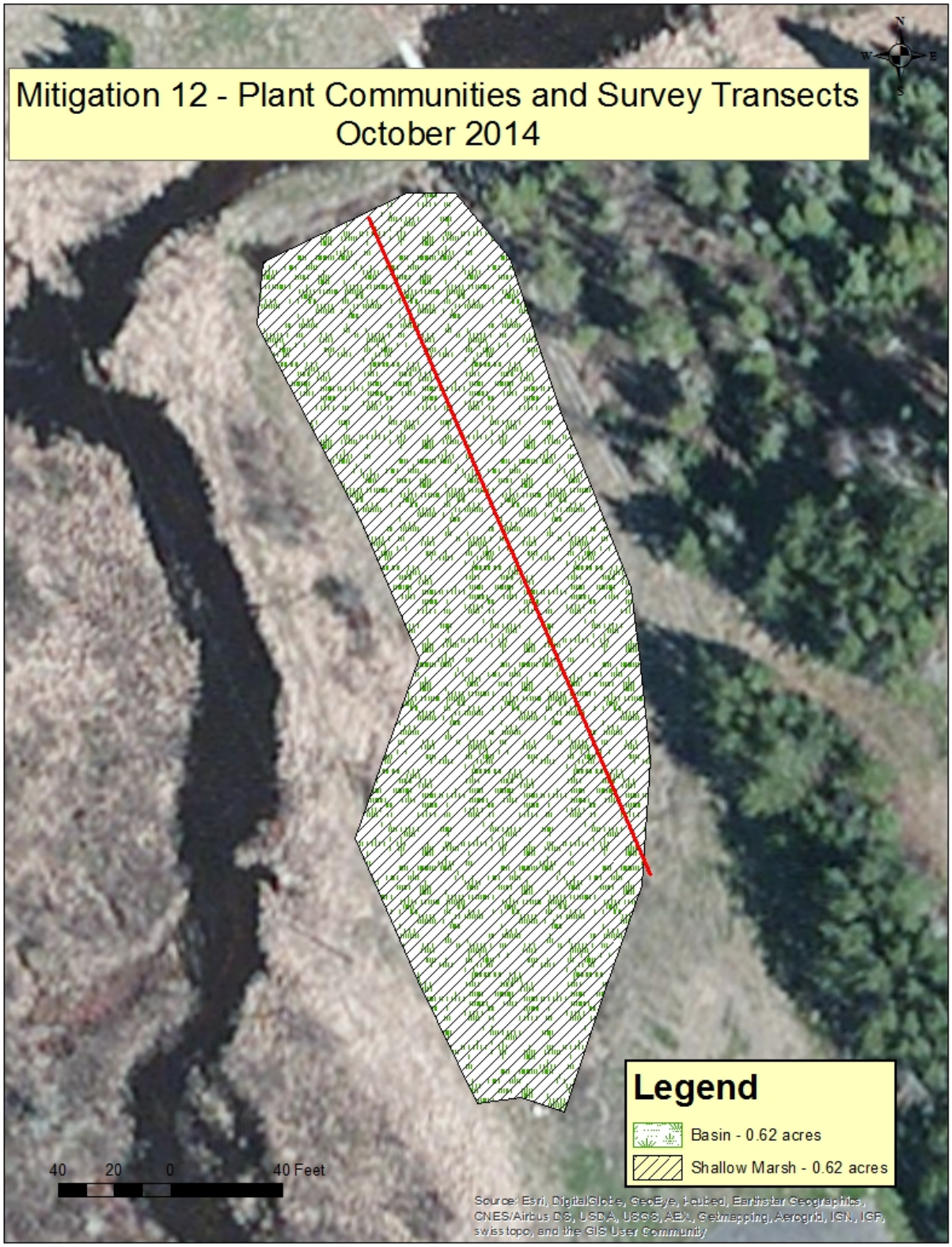


Figure 3.32. Mitigation Site 12 plant community areas 2014.

Mitigation Site 13

Mit 13 is a 3.15 acre site that consists of sedge meadow and shallow marsh. The water table levels meet wetland hydrology criteria (Figure 3.33). The sedge meadow community is dominated by *Calamagrostis canadensis* and *Scirpus cyperinus* (Table 3.28 and Table 3.29). Invasive species *Phalaris arundinacea*, *Typha angustifolia*, and *Lythrum salicaria* are present at less than 5 percent cover and FQA condition rating is "fair." The site was upgraded from a wet meadow in 2013 to a sedge meadow in 2014 due to the increase in *Carex* cover. The shallow marsh community is dominated by native and invasive *Typha* species. Invasive *Lythrum salicaria* is also present at less than 5 percent, and the FQA condition rating is "fair." A considerable alder thicket has also established on the sit. (Figure 3.34 and Figure 3.35).

This site may benefit from invasive species control, but like the adjacent Mit 12 site, a power-line runs directly over the full length of the wetland, precluding it from receiving mitigation credit.

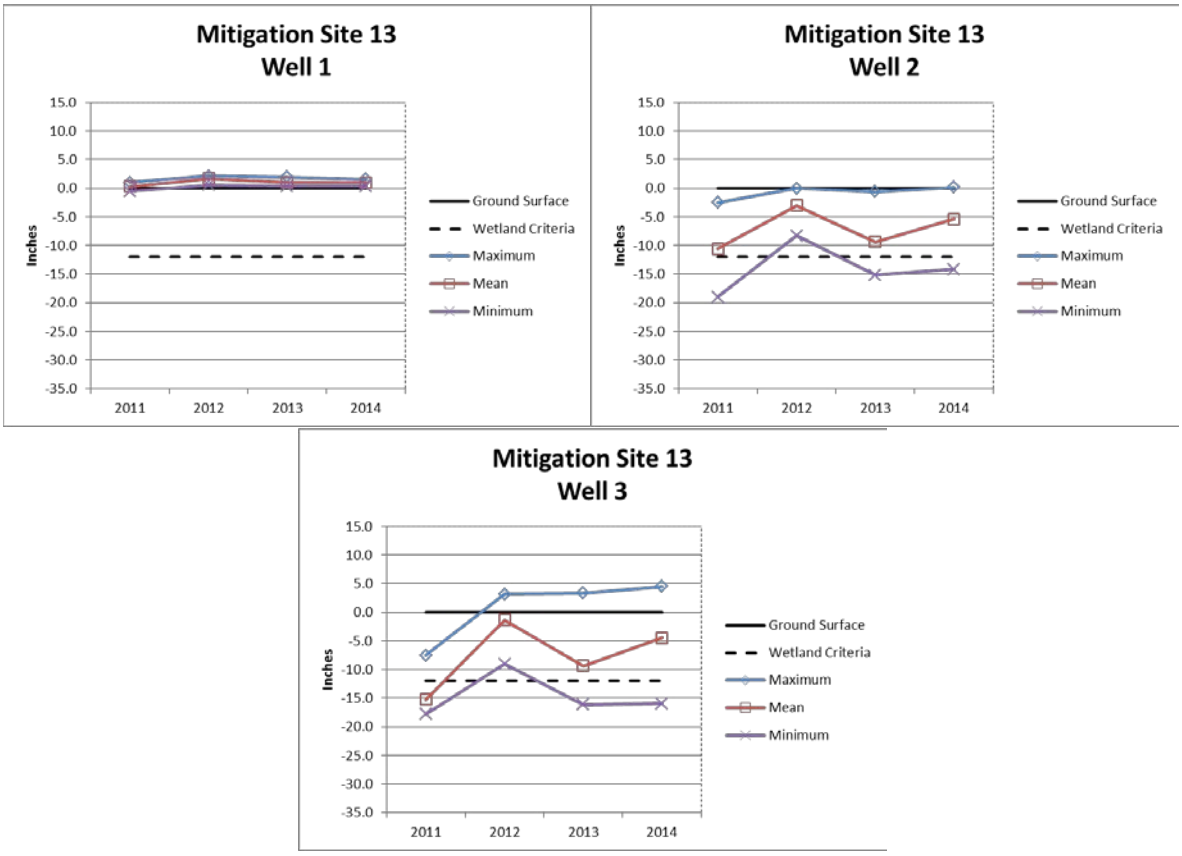


Figure 3.33. Mitigation Site 13 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.28. Mitigation Site 13 plant community vegetation characteristics 2013.

Mit 13 - 2013	Shallow Marsh		Wet Meadow	
Area (acres) 3.2	0.39		2.76	
Dominant Species	*Typha angustifolia* *Scirpus cyperinus* *Typha latifolia* *Typha X glauca*	28% 16% 16% 12%	*Calamagrostis canadensis* *Scirpus cyperinus*	31% 19%
Invasive Species	*Typha angustifolia* *Typha X glauca* *Lythrum salicaria*	28% 12% 4%	*Phalaris arundinacea* *Typha angustifolia* *Lythrum salicaria*	5% 2% 1%
wC	0.9		2.8	
Condition Category	Poor		Fair	
Total Site Condition Category	Fair			

Table 3.29. Mitigation Site 13 plant community vegetation characteristics 2014.

Mit 13 - 2014	Shallow Marsh		Sedge Meadow		Alder Thicket
Area (acres) 3.15	0.44		2.39		0.32
Dominant Species	*Typha angustifolia* *Typha X glauca* *Typha latifolia*	26% 26% 15%	*Calamagrostis canadensis* *Scirpus cyperinus*	32% 22%	No data
Invasive Species	*Typha angustifolia* *Typha X glauca*	26% 26%	*Lythrum salicaria* *Typha angustifolia*	2% 2%	
wC	1.7		4.0		
Condition Category	Fair		Fair		
Total Site Condition Category	Fair				

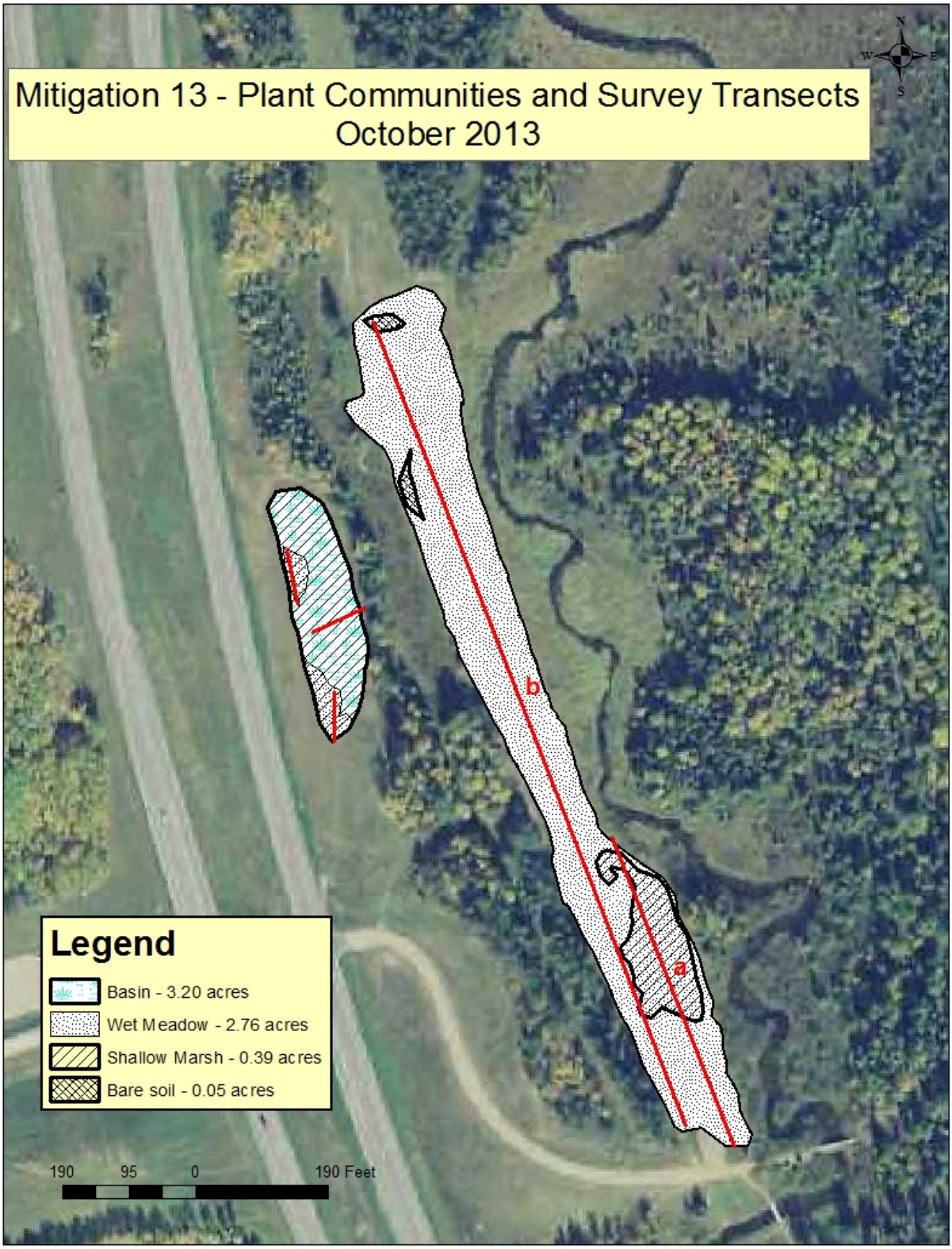


Figure 3.34. Mitigation Site 13 plant community areas 2013.

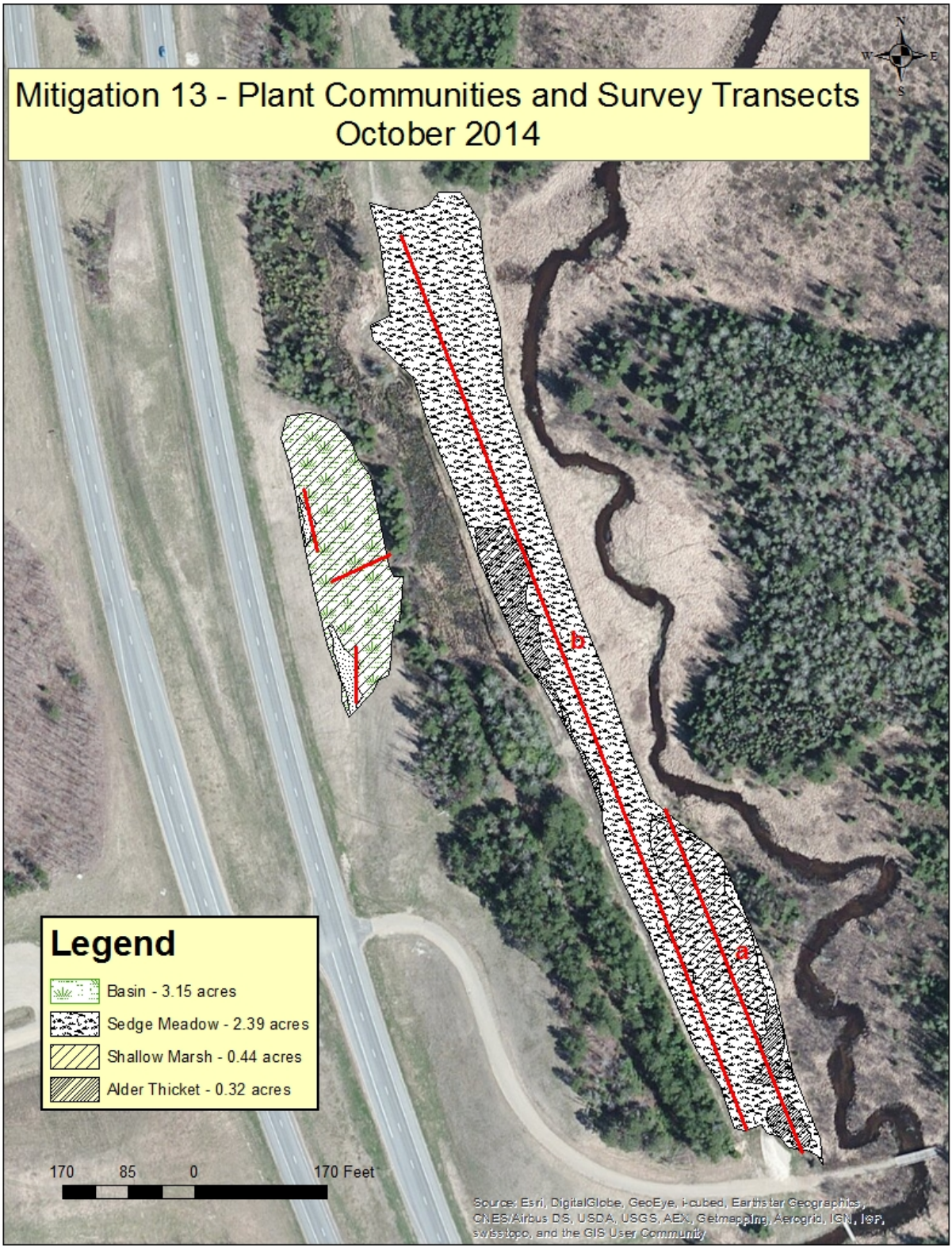


Figure 3.35. Mitigation Site 13 plant community areas 2014.

Mitigation Site 14

Mit 14 is a 0.77 acre site that consists of shallow marsh and wet meadow. The water table levels meet wetland hydrology criteria with standing water covering the site for most of the year (Figure 3.36). The shallow marsh community is dominated by invasive *Typha* species and *Scirpus cyperinus* (Table 3.30 and Table 3.31) with invasive cover of greater than 50 percent and a FQA condition rating of "fair." The wet meadow community is dominated by *Scirpus cyperinus, Typha angustifolia* and *Juncus effusus* with invasive cover of 30 percent and a FQA condition rating of "fair." The wet meadow plant community decreased in size from 2013 to 2014 (Figure 3.37 and Figure 3.38).

The site has poor potential for mitigation credit without extensive remediation. As with Mit 1, there is some potential to change the plant community by mowing and spraying the cattails with herbicide, then filling the site with approximately one foot of salvaged peat and reseeding. However, access to the site is more limited than to Mit 1, and the adjacent Mit 12 and Mit 13 sites have considerable invasive cover that could spread to Mit 14.

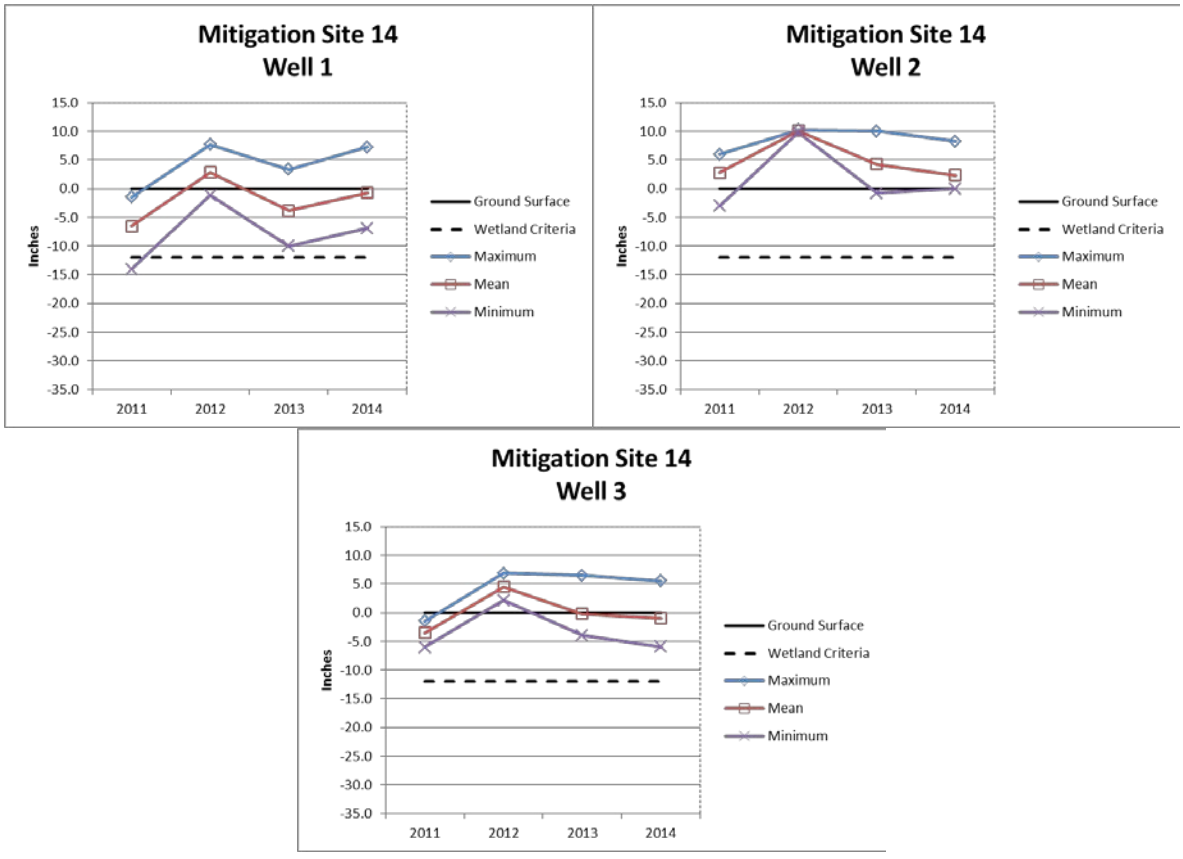


Figure 3.36. Mitigation Site 14 mean, maximum, and minimum water table levels for 2011-2014.

Table 3.30. Mitigation Site 14 plant community vegetation characteristics 2013.

Mit 14 - 2013	Wet Meadow		Shallow Marsh	
Area (acres) 0.66	0.12		0.54	
Dominant Species	*Scirpus cyperinus* *Agrostis scabra*	62% 12%	*Typha X glauca* *Typha angustifolia* *Glyceria canadensis* *Scirpus cyperinus*	39% 28% 11% 11%
Invasive Species	*Typha angustifolia*	8%	*Typha X glauca* *Typha angustifolia*	39% 28%
wC	2.5		2.0	
Condition Category	Fair		Fair	
Total Site Condition Category	Fair			

Table 3.31. Mitigation Site 14 plant community vegetation characteristics 2014.

Mit 14 - 2014	Wet Meadow		Shallow Marsh	
Area (acres) 0.77	0.05		0.72	
Dominant Species	*Scirpus cyperinus* *Typha angustifolia* *Juncus effusus*	41% 30% 11%	*Typha angustifolia* *Scirpus cyperinus*	50% 25%
Invasive Species	*Typha angustifolia*	30%	*Typha angustifolia* *Typha x glauca*	50% 8%
wC	2.0		2.3	
Condition Category	Fair		Fair	
Total Site Condition Category	Fair			

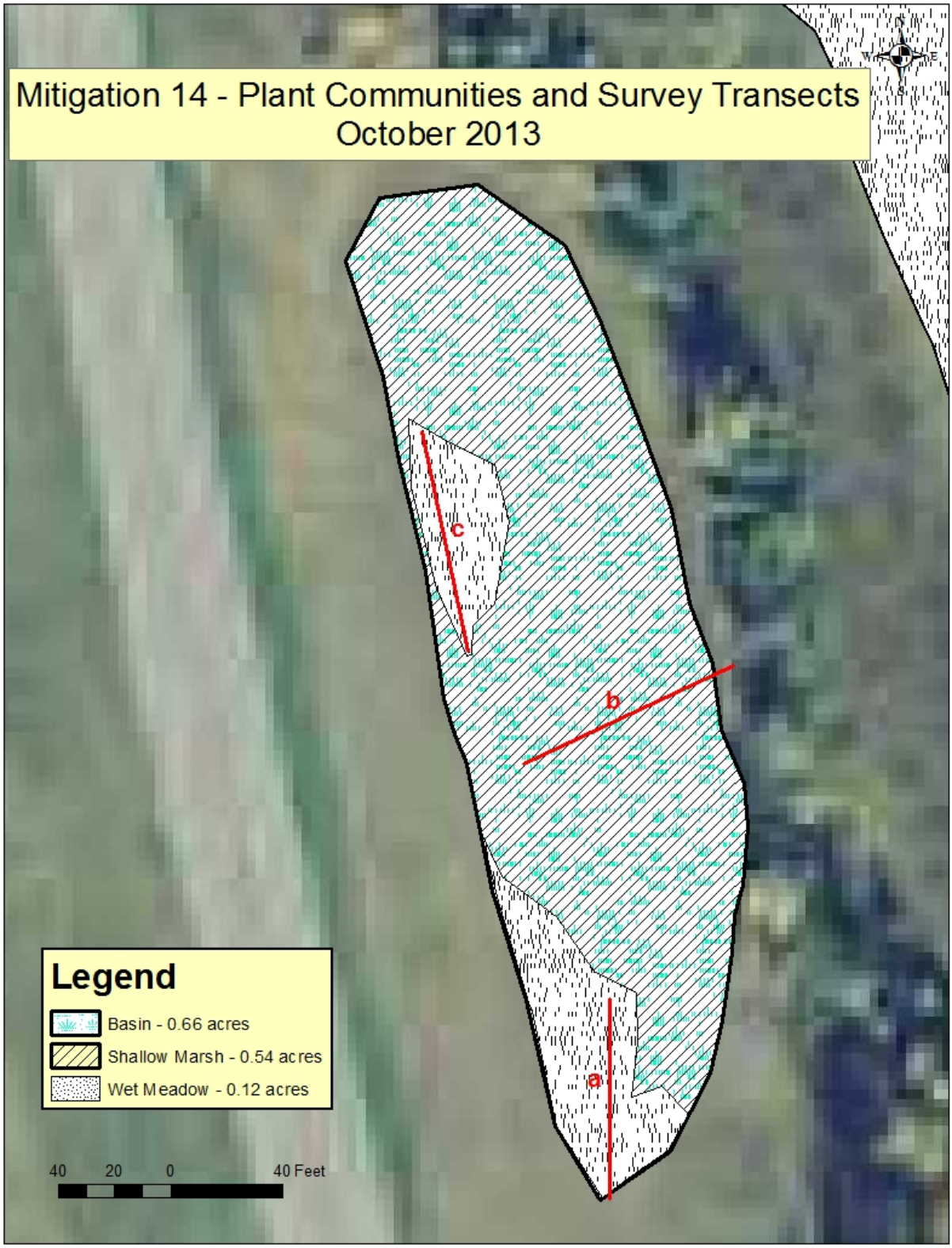


Figure 3.37. Mitigation Site 14 plant community areas 2013.

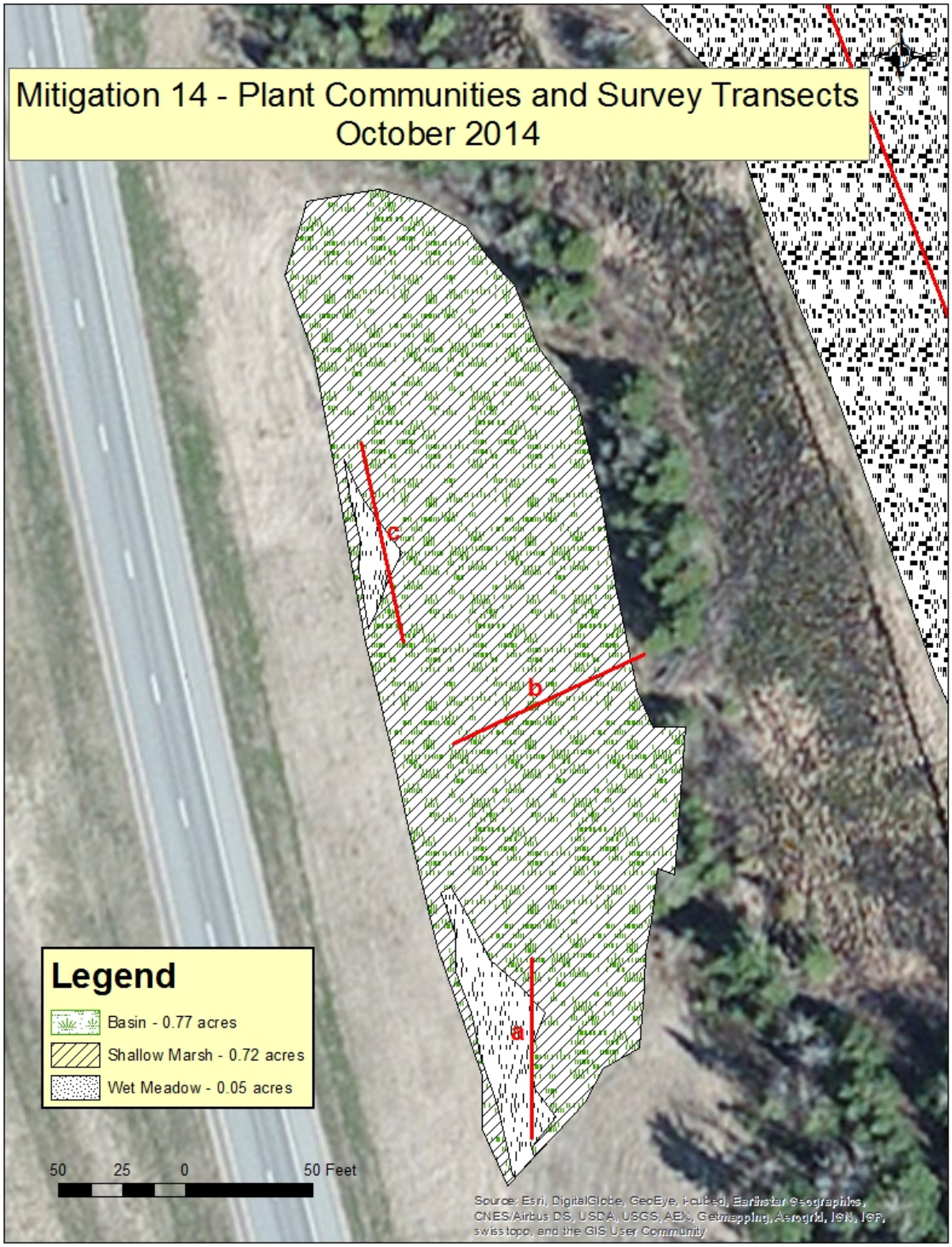


Figure 3.38. Mitigation Site 14 plant community areas 2014.

Seed Mix Evaluations

The plant species that successfully established on the 14 U.S. Trunk Highway 53 mitigation sites that presumably originated from the seed mixes applied to the sites when constructed are listed in Table 3.32. Species are divided into "dominant" (greater than one percent cover) and "present" (less than one percent cover). A number of these species may have come from the soil seed bank as well, but the list gives an idea of what seeded species are adapted to the region.

Table 3.32. Plant species originating from seed mixes on the U.S. Trunk Highway 53 mitigation sites.

Dominant (>1% cover) Plant Species	
Calamagrostis canadensis	Blue-joint grass
Carex lacustris	Sedge, lake
Eleocharis palustris	Spike-rush, great
Glyceria canadensis	Manna grass, rattlesnake
Iris versicolor	Iris, blue-flag
Juncus effusus	Rush, common
Poa palustris	Bluegrass, fowl
Scirpus cyperinus	Woolgrass
Scirpus validus	Bulrush, soft-stem

Present (<1% cover) Plant Species	
Alisma plantago-aquatica	Water Plantain
Aster puniceus	Aster, swamp
Aster umbellatus	Aster, flat-topped
Beckmannia syzigachne	Slough Grass, American
Bromus ciliatus	Brome, fringed
Carex comosa	Sedge, bottlebrush
Carex hystericina	Sedge, porcupine
Carex stricta	Sedge, tussock
Carex vulpinoidea	Sedge, fox
Eleocharis acicularis	Spike-rush, creeping
Eupatorium maculatum	Joe-pye weed
Eupatorium perfoliatum	Boneset
Euthamia graminifolia	Goldenrod, grass-leaved
Glyceria grandis	Manna grass, reed
Helenium autumnale	Sneezeweed
Leersia oryzoides	Cut-grass, rice
Mimulus ringens	Monkey Flower
Solidago gigantea	Goldenrod, giant
Verbena hastata	Vervain, blue

Chapter 4: Conclusions and Recommendations

The 14 mitigation sites within the U.S. Trunk Highway 53 corridor range in their potential to receive wetland mitigation credit. All of the sites consistently meet wetland hydrology criteria with the exception of Mit 11. Table 4.1 is a summary of the mitigation sites, their condition category and potential to receive mitigation credit. The sites contain a variety of plant communities with FQA condition categories ranging from “Poor” to “Exceptional.” As seen in the tables and maps, some sites are trending toward a higher quality wetland while others are going toward poorer quality. About half of the mitigation sites are currently in relatively good condition. During a June 2015 visit to the mitigation sites, members of the Technical Advisory Panel (TAP) evaluated the potential for each site to qualify for wetland mitigation credit. Mitigation Sites 3, 4, 5, 6, 8, 9, and 10 show good to excellent potential for receiving wetland mitigation credit, although portions of Mit 9 and 10 are within a power-line corridor that could result in reduced credits.

Table 4.2 lists the plant communities and their total areas present for all 14 mitigation sites combined. The sites are dominated by wet meadow, sedge meadow and shallow marsh. In comparison, the wetlands primarily affected by the road construction were shrub swamp, wooded swamp, and bog. In an effort to more adequately replace lost wetland functions, tree planting is recommended on the drier wet meadow and sedge meadow sites to increase the woody plant component of these wetlands.

Table 4.3 lists adaptive management activities for each mitigation site that could improve site quality and increase potential for receiving wetland mitigation credit. All mitigation sites would benefit from invasive species control. Invasive species control is probably the most cost effective way to ensure and increase mitigation credits. In the future, early invasive species intervention will improve resulting site quality by increasing the likelihood of native species establishment.

Table 4.1. Mitigation Site plant communities, area, condition category and potential for mitigation credit 2014.

Mit Site	Plant Community	Area (acres)	Condition Category	Total Area (acres)	Total Site Condition Category	Mitigation Credit Potential
Mit 1	Shallow Marsh Wet Meadow	0.73 0.10	Poor Poor	0.83	Poor	Poor
Mit 2	Wet Meadow Alder Thicket Reed Canary	1.15 0.13 2.04	Fair Fair Poor	3.32	Fair	Fair
Mit 3	Sedge Meadow Shallow Marsh Reed Canary	0.59 0.39 0.16	Fair Good Poor	1.04	Fair	Good
Mit 4	Sedge Meadow	1.86	Exceptional	1.86	Exceptional	Excellent
Mit 5	Sedge Meadow	1.87	Exceptional	1.87	Exceptional	Excellent
Mit 6	Shallow Marsh Sedge Meadow Wet Meadow	3.1 2.87 0.10	Fair Good	6.07	Good	Good
Mit 7	Shallow Marsh Wet Meadow	1.1 0.4	Fair Fair	1.5	Fair	Fair
Mit 8	Wet Meadow Sedge Meadow Shrub Carr Shallow Marsh Reed Canary	14.35 1.6 1.49 1.54 0.64	Fair Exceptional Fair Fair Poor	19.83	Fair	Good
Mit 9	Wet Meadow Shallow Marsh Sedge Meadow Bog	5.74 2.01 1.21 0.12	Fair Fair Exceptional Fair	9.24	Good	Good
Mit 10	Wet Meadow Shrub Carr Bog Shallow Marsh	4.59 0.92 0.74 1.15	Good Fair Fair Fair	7.48	Good	Good
Mit 11	Reed Canary Wet Meadow Alder Thicket	1.9 1.23 0.20	Poor Fair	3.02	Fair	Poor
Mit 12	Shallow Marsh	0.62	Fair	0.62	Fair	Poor
Mit 13	Sedge Meadow Shallow Marsh Alder Thicket	2.39 0.44 0.32	Fair Fair	3.15	Fair	Poor
Mit 14	Shallow Marsh Wet Meadow	0.72 0.05	Fair Fair	0.77	Fair	Poor

Table 4.2. Total plant community areas for all 14 mitigation sites.

Plant Community	Acres
Wet Meadow	27.71
Sedge Meadow	12.39
Shallow Marsh	11.80
Reed Canary	4.74
Shrub Carr	2.41
Bog	0.86
Alder Thicket	0.65
Total	**60.56**

Table 4.3. Mitigation Site recommended adaptive management activities to increase mitigation credit potential.

Mit Site	Recommended Adaptive Management Activity
Mit 1	Control invasive cattails with herbicide. As an experiment, fill the site with approximately one foot of salvaged peat and reseed to native plants.
Mit 2	Control invasive reed canary with herbicide. Plant tamarack and black spruce trees.
Mit 3	Control invasive reed canary with herbicide.
Mit 4	Control invasive reed canary and cattails with herbicide. Monitor purple loosestrife and control with beetles if needed.
Mit 5	Control invasive reed canary and cattails with herbicide. Control beavers to prevent flooding.
Mit 6	Control invasive reed canary and cattails with herbicide. Plant tamarack and black spruce trees.
Mit 7	Control invasive reed canary and cattails with herbicide. Power-lines present.
Mit 8	Control invasive reed canary and cattails with herbicide. Plant tamarack and black spruce trees.
Mit 9	Control invasive reed canary, cattails, and tansy with herbicide. Plant tamarack and black spruce trees. Power-lines present.
Mit 10	Control invasive reed canary, cattails, and tansy with herbicide. Stabilize water level. Power-lines present.
Mit 11	Control invasive reed canary with herbicide. Plant tamarack and black spruce trees.
Mit 12	Control invasive cattails with herbicide. Monitor purple loosestrife and control with beetles if needed. Power-lines present.
Mit 13	Control invasive reed canary and cattails with herbicide. Monitor purple loosestrife and control with beetles if needed. Power-lines present.
Mit 14	Control invasive cattails with herbicide.

Tree planting on some of the drier areas could also increase the quality and potential mitigation credit for Mitigation Sites 2, 6, 8, 9, and 11. Tamarack and black spruce have done well when planted on drier sites such as Mit 3. Shrubs such as willow and alder are establishing on their own on a number of sites, which is encouraging.

Reducing and stabilizing water levels to minimize standing water on certain sites may also be beneficial and promote conditions conducive to wet meadow, sedge meadow, bog, shrub carr and forested plant communities rather than shallow marsh. Mit 10 would especially benefit from a reduced water table. This, however, may be difficult to control. Mitigation site inlets and outlets are not always defined and in many cases the only way to reduce the water table relative to the soil surface is by adding fill. This may be effective for certain smaller sites such as Mit 1 and Mit 14, but the cost may be prohibitive. As mentioned, it could be tried experimentally on Mit 1.

If any mitigation sites are renovated and require reseeding, a review of the plants that established from seed mixes (Table 4.3) is recommended. This will allow seed mixes to be refined to include only species that are adapted to the area and have the best chance to survive and flourish. This information can also be useful for future mitigation site plantings in the region.

According to the USACE, mitigation credit is not allowed for wetlands located within power-line corridors. As such, all or portions of Mitigation Sites 1, 7, 9, 10, 12, and 13 would be ineligible for credit.

These 14 sites have shown the potential for creating mitigation wetlands in abandoned borrow pits in conjunction with highway construction. Adaptive management, particularly water level regulation, early invasive species control, and continued long-term annual monitoring can make mitigation sites like these successful options for wetland mitigation credit. Thorough pre-construction planning should be conducted to avoid potential impediments to receiving mitigation credit, such as power-line corridors. Continued monitoring of the sites that have significant potential for mitigation credit is recommended.

References

Eggers, S.D., and D.M. Reed. 1997. *Wetland Plants and Plant Communities of Minnesota and Wisconsin*, Second Edition, U.S. Army Corps of Engineers, St. Paul, MN.

Evans, R.A. and R.M. Love. 1957. "The step-point method of sampling - a practical tool in range research". *Journal of Range Management* 10(5): 208-212.

Johnson, K.W. 2010. Wetland Mitigation in Abandoned Gravel Pits. Minnesota Department of Transportation, Research Final Report # MN/RC 2010-11, Mn/DOT Research Services, Office of Policy Analysis, Research and Innovation, St. Paul, MN.

Milburn, S. A., M. Bourdaghs, and J. J. Husveth. 2007. Floristic Quality Assessment for Minnesota Wetlands. Minnesota Pollution Control Agency, St. Paul, MN.

Minnesota Department of Natural Resources. 2007. *A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method*, Minnesota County Biological Survey Biological Report No. 92, Minnesota Department of Natural Resources, St. Paul, MN.

Minnesota Department of Transportation. 2014. *Seeding Manual 2014 Edition*, Office of Environmental Stewardship Erosion Control Engineering Unit, MnDOT, St. Paul, MN.

Minnesota Pollution Control Agency. 2014. *Rapid Floristic Quality Assessment Manual*. wq-bwm2-02b, Minnesota Pollution Control Agency, St. Paul, MN.

Short Elliot Hendrickson, Inc. 2014. Wetland Delineation Report, Trunk Highway 53 Mitigation Sites M1 - M14, SEH No. MNT01 129639. Short Elliot Hendrickson, Inc., Duluth, MN.

U.S. Army Corps of Engineers. 2005. Technical Standard for Water-Table Monitoring of Potential Wetland Sites, WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Appendix A

Validation of Wetland Mitigation in Abandoned Borrow Areas

Annual Reports
of
Mitigation Site Water Level Monitoring
and
Percent Vegetative Cover by Species

2011-2014 Field Seasons

Validation of Wetland Mitigation
In
Abandoned Borrow Areas

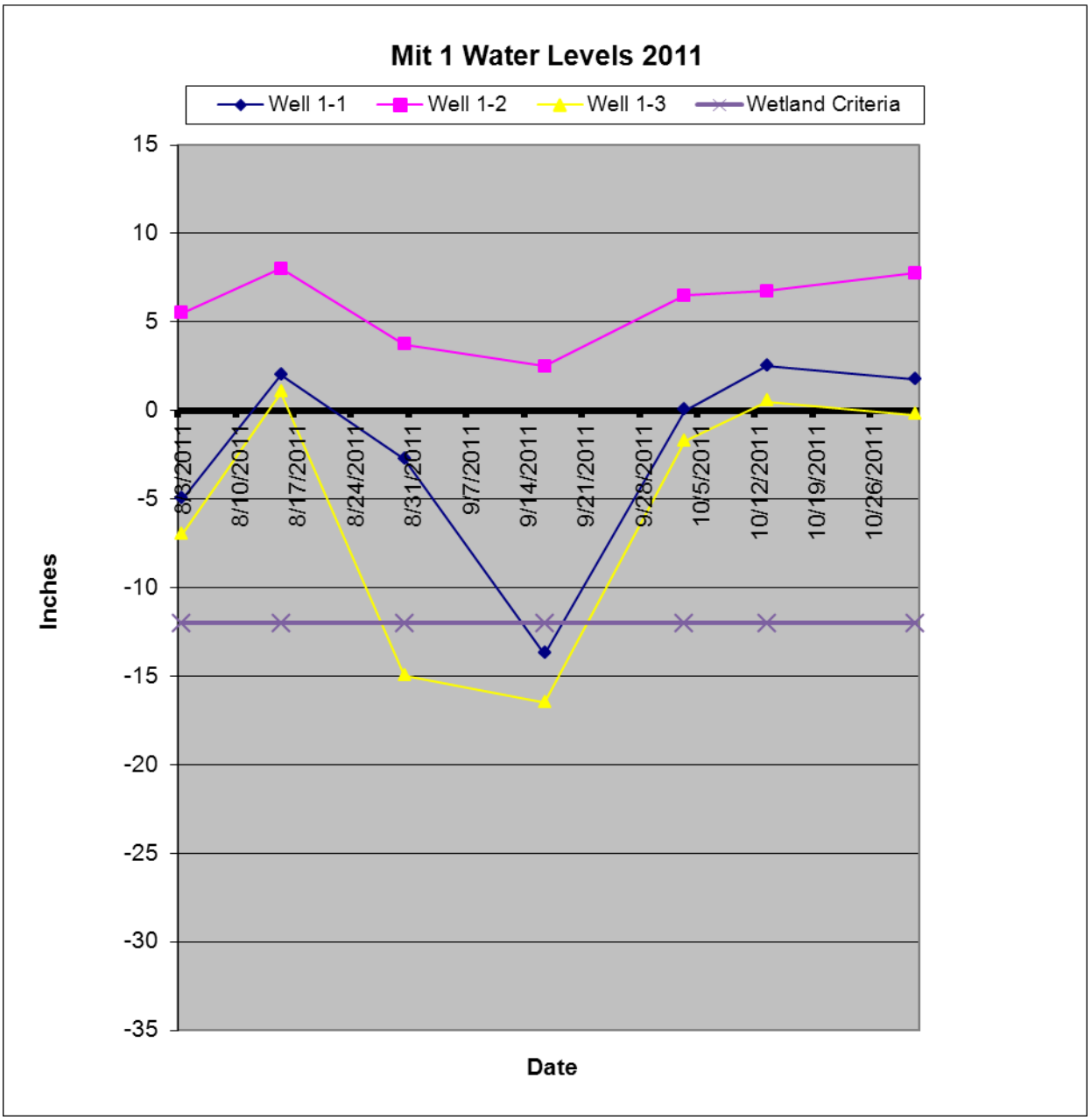
Task 6: Data Analysis and Interpretation – FY 2012

Water Level Monitoring
And
Percent Vegetative Cover by Species

2011 Field Season

Completed June 2013

Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 1 Water Levels: August 3, 2011 – October 31, 2011.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

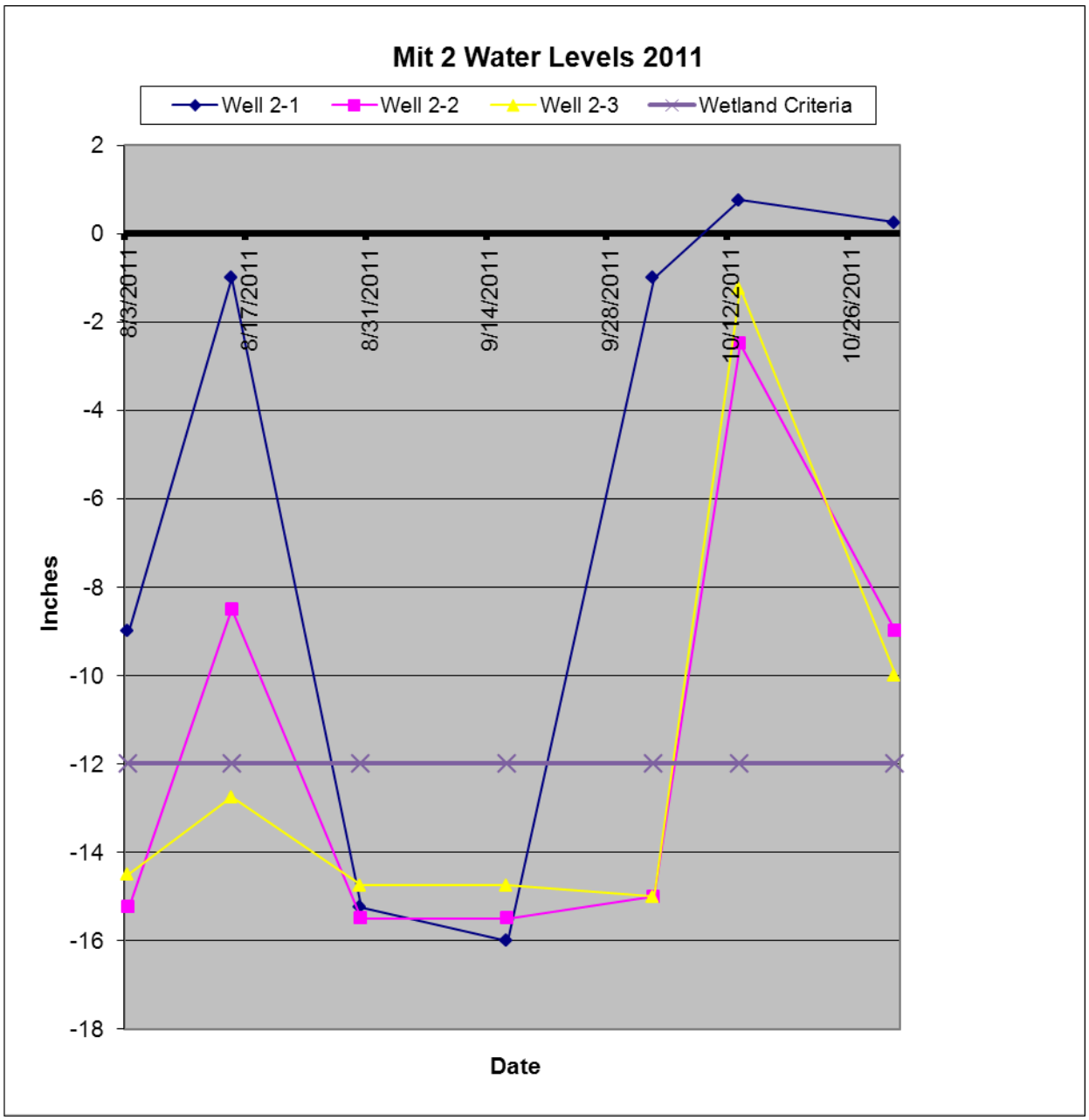
Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha angustifolia*	Invasive		70
	Typha latifolia	Native		20
	Agrostis gigantea	Native		5
	Agrostis hyemalis	Native		5
	Glyceria grandis	Native	W2	2
	Gnaphalium uliginosum	Introduced		2
	Juncus brevicaudatus	Native		2
	Scirpus cyperinus	Native	W2	2
	Juncus sp.	Native		1
			TOTAL COVER	109

Mitigation Site 1 Dominant Species – 2011. Site dominated by invasive species *Typha angustifolia*.

Mitigation Site 1 – All Species Present
Species Richness = 19
Achillea millefolium
Agrostis gigantea
Agrostis hyemalis
Alisma plantago-aquatica
Aster lanceolatus
Cirsium arvense
Glyceria grandis
Gnaphalium uliginosum
Juncus brevicaudatus
Juncus effusus
Juncus nodosus
Juncus sp.
Salix bebbiana
Scirpus cyperinus
Taraxacum officinale
Trifolium arvense
Trifolium hybridum
Typha angustifolia
Typha latifolia

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 2 Water Levels: August 3, 2011 – October 31, 2011.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

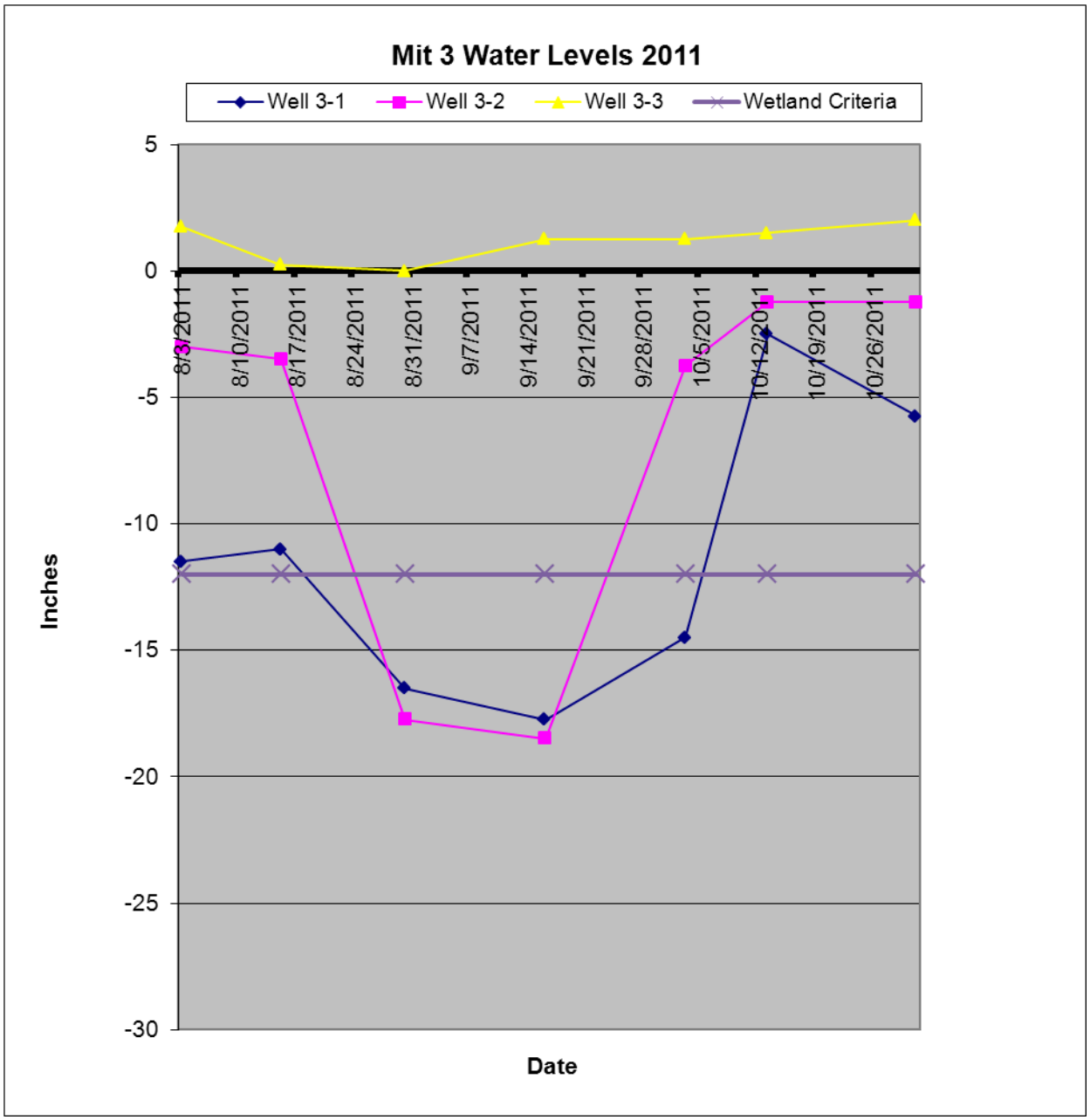
Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Juncus effusus*	Native	W2	50
	Glyceria grandis	Native	W2	40
	Scirpus microcarpus	Native		10
	Phalaris arundinacea	Invasive		10
	Typha latifolia	Native		5
	Potentilla norvegica	Native		2
	Trifolium hybridum	Introduced		1
	Scirpus validus	Native		1
	Potentilla palustris	Native		1
	Onoclea sensibilis	Native		1
	Hieracium aurantiacum	Introduced		1
	Epilobium coloratum	Native		1
	Carex stipata	Native		1
	Beckmannia syzigachne	Native	WT1, W2	1
	Aster lanceolatus	Native		1
	Ranunculus pensylvanicus	Native		0.1
	Galium tinctorium	Native		0.1
			TOTAL COVER	126.2

Mitigation Site 2 Dominant Species – 2011. Site dominated by native species *Juncus effusus* and *Glyceria grandis*, both found in W2 wetland seed mix. 10% cover by invasive species *Phalaris arundinacea.*

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 2 – All Species Present
Species Richness = 31
Aster lanceolatus
Aster puniceus
Beckmannia syzigachne
Betula papyrifera
Bidens frondosa
Callitriche verna
Carex stipata
Chrysanthemum leucanthemum
Epilobium coloratum
Equisetum arvense
Galium tinctorium
Glyceria grandis
Hieracium aurantiacum
Hieracium cespitosum
Juncus effusus
Onoclea sensibilis
Phalaris arundinacea
Poa palustris
Potentilla norvegica
Potentilla palustris
Prunella vulgaris
Ranunculus pensylvanicus
Salix bebbiana
Scirpus cyperinus
Scirpus microcarpus
Scirpus validus
Solidago gigantea
Trifolium hybridum
Trifolium repens
Typha angustifolia
Typha latifolia

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 3 Water Levels: August 3, 2011 – October 31, 2011.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyerpinus*	Native	W2	33
	Trifolium hybridum	Introduced		25
	Cyperaceae sp. (Scirpus?)	Native		25
	Glyceria canadensis	Native		21
	Glyceria grandis	Native	W2	20
	Juncus effusus	Native	W2	16
	Trifolium pratense	Introduced		15
	Cyperaceae sp. (Carex?)	Native		15
	Calamagrostis canadensis	Native	W2	15
	Typha latifolia	Native		13
	Carex rostrata	Native		13
	Saggitaria latifolia	Native		12
	Carex stipata	Native		11
	Carex comosa	Native		9
	Leersia oryzoides	Native		6
	Sparganium chlorocarpum	Native		5
	Scirpus atrovirens	Native		5
	Potentilla palustris	Native		5
	Aster sp.	Native		5
	Agrostis gigantea	Native		5
	Phalaris arundinacea	Invasive		5
	Carex retrorsa	Native		4
	Scirpus validus	Native		4
	Aster lanceolatus	Native		3
	Alnus rugosa	Native		3
	Typha sp. seedlings	Native		3
	Alisma plantago-aquatica	Native		3
	Poa palustris	Introduced		2
	Typha angustifolia	Invasive		2
	Scirpus rivularis	Native		2
	Equisetum arvense	Native		2
	Carex scoparia	Native		2
	Carex lacustris	Native		2
	Bidens frondosa	Native		2
	Achillea millefolium	Native		2
	Glyceria striata	Native		2
	Eupatorium perfoliatum	Native		2
	Aster puniceus	Native	W2	1
	Salix bebbiana	Native		1

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
	Epilobium ciliatum	Native		1
	Scirpus sp. (sterile)	Native		1
	Carex sp.	Native		1
	Carex tenera	Native		1
	Carex intumescens	Native		1
	Populus tremuloides	Native		1
	Hieracium aurantiacum	Introduced		1
			TOTAL COVER	107.9

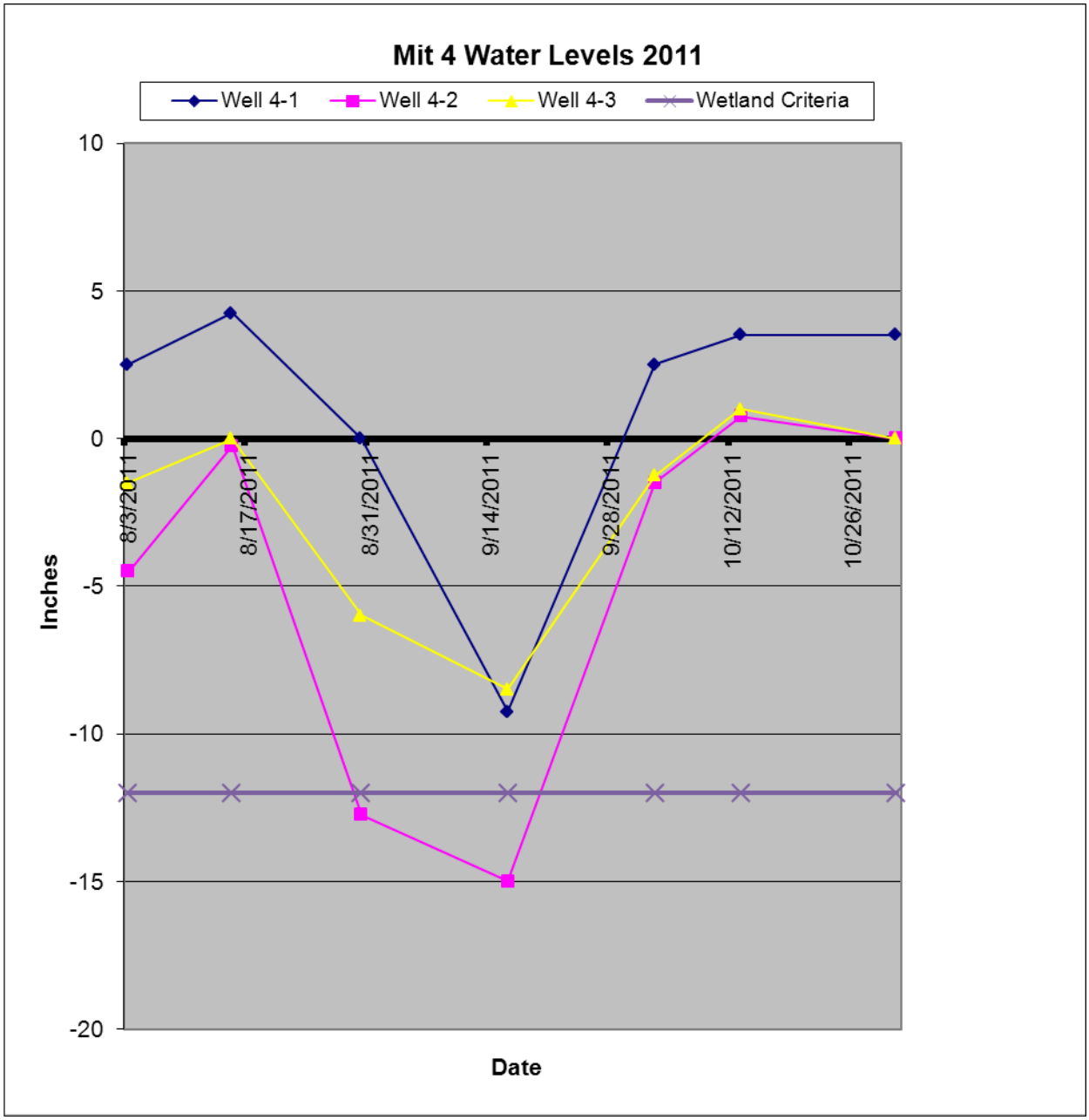
Mitigation Site 3 Dominant Species – 2011. Mean percent cover. n=50. Site dominated by native species *Scirpus cyerpinus* followed by the introduced species *Trifolium hybridum*. Invasive species *Phalaris arundinacea* and *Typha angustifolia* present.

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 3 – All Species Present
Species Richness = 61

Scirpus cyerpinus
Trifolium hybridum
Cyperaceae sp. (Scirpus?)
Glyceria canadensis
Glyceria grandis
Juncus effusus
Trifolium pratense
Cyperaceae sp. (Carex?)
Calamagrostis canadensis
Typha latifolia
Carex rostrata
Saggitaria latifolia
Carex stipata
Carex comosa
Leersia oryzoides
Sparganium chlorocarpum
Scirpus atrovirens
Potentilla palustris
Aster sp.
Agrostis gigantea
Phalaris arundinacea
Carex retrorsa
Scirpus validus
Aster lanceolatus
Alnus rugosa
Typha sp. seedlings
Alisma plantago-aquatica
Poa palustris
Typha angustifolia
Scirpus rivularis
Equisetum arvense
Carex scoparia
Carex lacustris
Bidens frondosa
Achillea millefolium
Glyceria striata
Eupatorium perfoliatum
Aster puniceus
Salix bebbiana
Epilobium ciliatum
Scirpus sp. (sterile)
Carex sp.
Carex tenera
Carex intumescens
Populus tremuloides
Hieracium aurantiacum
Agrostis hyemalis
Salix discolor
Polygonum saggitatum
Viola sp.
Salix sp. seedling
Rubus strigosus
Polygonum sp.
Mimulus ringens
Galium tinctorium
Eupatorium sp. seedling
Epilobium sp. seedling
Elymus sp.
Dicot seedlings
Cerastium fontana
Bidens cernua

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 4 Water Levels: August 3, 2011 – October 31, 2011.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	76
	Scirpus microcarpus	Native		18
	Saggitaria latifolia	Native		16
	Calamagrostis canadensis	Native	W2	15
	Glyceria canadensis	Native		14
	Juncus effusus	Native	W2	13
	Dicot seedlings	Unknown		10
	Carex rostrata	Native		10
	Glyceria grandis	Native	W2	8
	Typha angustifolia	Invasive		7
	Carex lacustris	Native		6
	Iris versicolor	Native		6
	Typha hybrid	Invasive		5
	Typha latifolia	Native		5
	Eleocharis smallii	Native		5
	Sphagnum moss	Native		5
	Utricularia intermedia	Native		5
	Bidens cernua	Native		5
	Carex lasiocarpa	Native		4
	Torreyochloa pallida	Rare		4
	Juncus brevicaudatus	Native		3
	Alisma plantago-aquatica	Native		3
	Eleocharis obtusa	Native		3
	Viola pallens	Native		3
	Salix bebbiana	Native		3
	Polygonum saggitatum	Native		3
	Solidago gigantea	Native	W2	3
	Epilobium leptophyllum	Native		2
	Epilobium ciliatum	Native		2
	Polygonum hydropiper	Introduced		2
	Eupatorium maculatum	Native	W2	2
	Leersia oryzoides	Native		2
	Agrostis gigantea	Native		2
	Aster lanceolatus	Native		2
	Aster puniceus	Native	W2	2
	Campanula aparinoides	Native		2
	Carex retrorsa	Native		2
	Impatiens capensis	Native		2
	Mentha arvensis	Native		2

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
	Salix petiolaris	Native		2
	Salix sp. seedling	Native		2
	Triadenum fraseri	Native		2
	Lythrum salicaria	Invasive		2
	Onoclea sensibilis	Native		2
	Bidens frondosa	Native		2
	Carex tenera	Native		2
	Polygonum pensylvanicum	Native		2
	Potentilla palustris	Native		2
	Phalarias arundincea	Invasive		1
	Poa palustris	Introduced		1
	Larix laricina	Native		1
	Hypericum canadense	Native		1
	Carex stipata	Native		1
	Anaphalis margaritacea	Native		1
	Aster umbellatus	Native	W2	1
	Betula papyrifera	Native		1
	Carex cannescens	Native		1
	Carex sp. (Ovales)	Native		1
	Chamaedaphne calyculata	Native		1
	Dryopteris cristata	Native		1
	Epilobium coloratum	Native		1
	Euthamia graminifolia	Native		1
	Galium tinctorium	Native		1
	Glyceria septentrionalis	Native		1
	Juncus nodosus	Native		1
	Lemna minor	Native		1
	Potentilla norvegica	Native		1
	Rumex orbiculatus	Native		1
	Thelypteris palustris	Native		1
	Veronica scutellata	Native		1
	Agrostis hyemalis	Native		1
	Beckmannia syzigachne	Native	WT1,W2	1
			TOTAL COVER	138

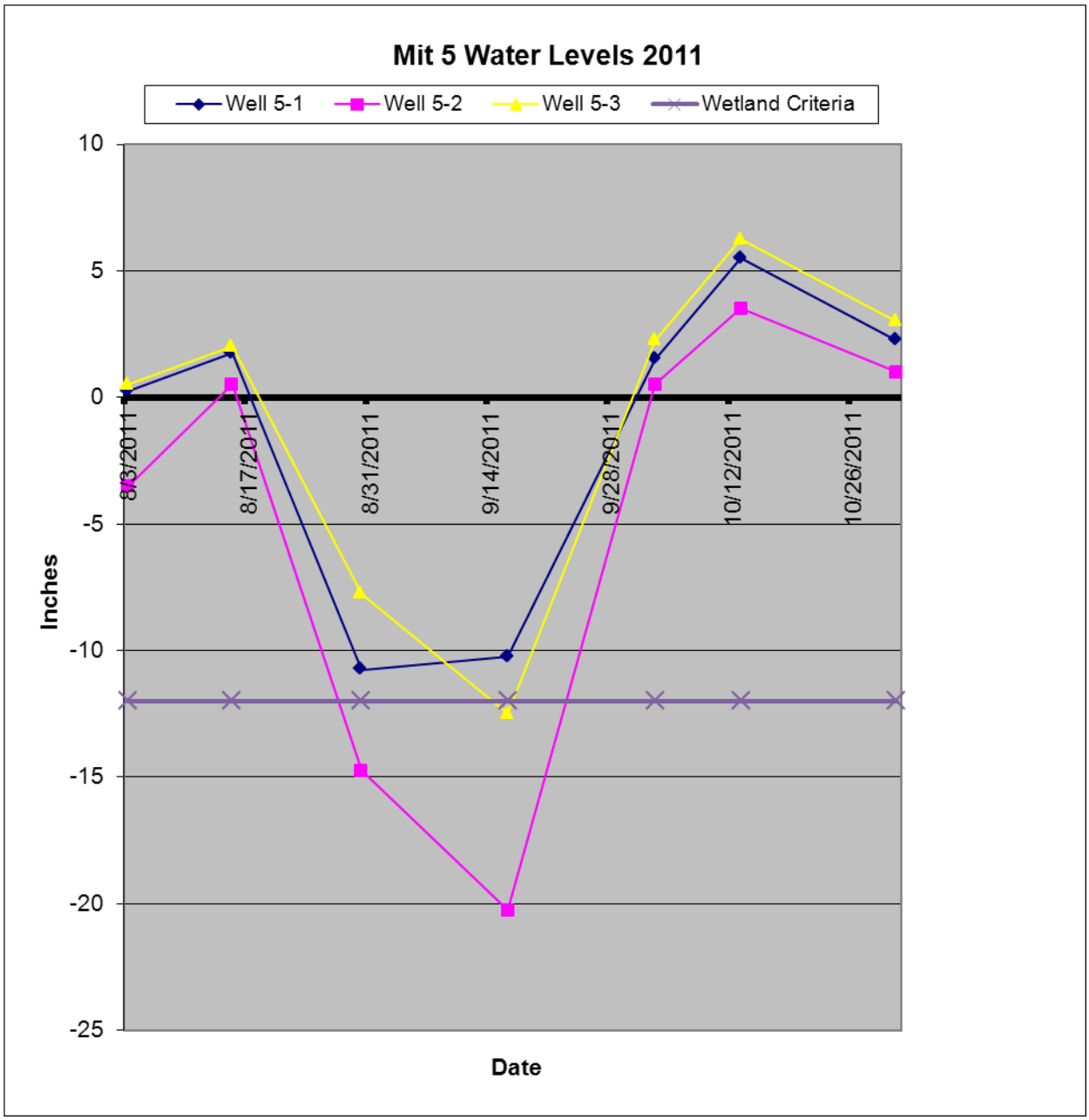
Mitigation Site 4 Dominant Species – 2011. Mean percent cover. n=50. Site highly dominated by native species *Scirpus cyerpinus*. Invasive species *Typha angustifolia*, *Lythrum salicaria*, and *Phalarias arundincea* present.

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 4 – All Species Present
Species Richness = 81

Scirpus cyperinus
Scirpus microcarpus
Saggitaria latifolia
Calamagrostis canadensis
Glyceria canadensis
Juncus effusus
Dicot seedlings
Carex rostrata
Glyceria grandis
Typha angustifolia
Carex lacustris
Iris versicolor
Typha hybrid
Typha latifolia
Eleocharis smallii
Sphagnum moss
Utricularia intermedia
Bidens cernua
Carex lasiocarpa
Torreyochloa pallida
Juncus brevicaudatus
Alisma plantago-aquatica
Eleocharis obtusa
Viola pallens
Salix bebbiana
Polygonum saggitatum
Solidago gigantea
Epilobium leptophyllum
Epilobium ciliatum
Polygonum hydropiper
Eupatorium maculatum
Leersia oryzoides
Agrostis gigantea
Aster lanceolatus
Aster puniceus
Campanula aparinoides
Carex retrorsa
Impatiens capensis
Mentha arvensis
Salix petiolaris
Salix sp. seedling
Triadenum fraseri
Lythrum salicaria
Onoclea sensibilis
Bidens frondosa
Carex tenera
Polygonum pensylvanicum
Potentilla palustris
Phalarias arundincea
Poa palustris
Larix laricina
Hypericum canadense
Carex stipata
Anaphalis margaritacea
Aster umbellatus
Betula papyrifera
Carex cannescens
Carex sp. (Ovales)
Chamaedaphne calyculata
Dryopteris cristata
Epilobium coloratum
Euthamia graminifolia
Galium tinctorium
Glyceria septentrionalis
Juncus nodosus
Lemna minor
Potentilla norvegica
Rumex orbiculatus
Thelypteris palustris
Veronica scutellata
Agrostis hyemalis
Beckmannia syzigachne
Sium suave
Achillea millefolium
Callitriche verna
Cardamine pensylvanica
Chelone glabra
Juncus filiformis
Polygonum amphibium
Populus tremuloides
Scutelaria galericulata

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 5 Water Levels: August 3, 2011 – October 31, 2011.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Carex rostrata*	Native		56
	Scirpus cyperinus	Native	W2	37
	Glyceria canadensis	Native		20
	Carex sp. (stricta or aquatilis)	Native		20
	Carex cannescens	Native		16
	Saggitaria latifolia	Native		14
	Glyceria grandis	Native	W2	13
	Salix petiolaris	Native		9
	Carex lacustris	Native		9
	Scirpus microcarpus	Native		9
	Calamagrostis canadensis	Native	W2	8
	Grass seedlings	Unknown		7
	Bidens frondosa	Native		5
	Carex stricta	Native		5
	Cyperaceae seedlings	Native		5
	Juncus effusus	Native	W2	5
	Lysimachia thyrsiflora	Native		4
	Utricularia minor	Native		4
	Carex stipata	Native		4
	Typha latifolia	Native		4
	Carex retrorsa	Native		4
	Alisma plantago-aquatica	Native		4
	Polygonum pensylvanicum	Native		4
	Salix exigua	Native		4
	Scirpus atrovirens	Native		4
	Torreyochloa pallida	Rare		4
	Eleocharis obtusa	Native		3
	Polygonum amphibium	Native		3
	Alnus rugosa	Native		2
	Bidens cernua	Native		2
	Phalaris arundinacea	Invasive		2
	Ranunculus pensylvanicus	Native		2
	Polygonum saggitatum	Native		2
	Aster lanceolatus	Native		2
	Eleocharis smallii	Native		2
	Leersia oryzoides	Native		2
	Salix planifolia	Native		2
	Salix sp. seedlings	Native		2
	Scirpus validus	Native		2

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
	Viola pallens	Native		2
	Polygonum hydropiper	Introduced		2
	Eupatorium maculatum	Native	W2	2
	Salix bebbiana	Native		1
	Cicuta bulbifera	Native		1
	Epilobium letptophyllum	Native		1
	Salix discolor	Native		1
	Typha angustifolia	Invasive		1
	Carex tenera	Native		1
	Sium suave	Native		1
	Caltha palustris	Native		0
	Galium tinctorium	Native		0
	Rumex orbiculatus	Native		0
			TOTAL COVER	121

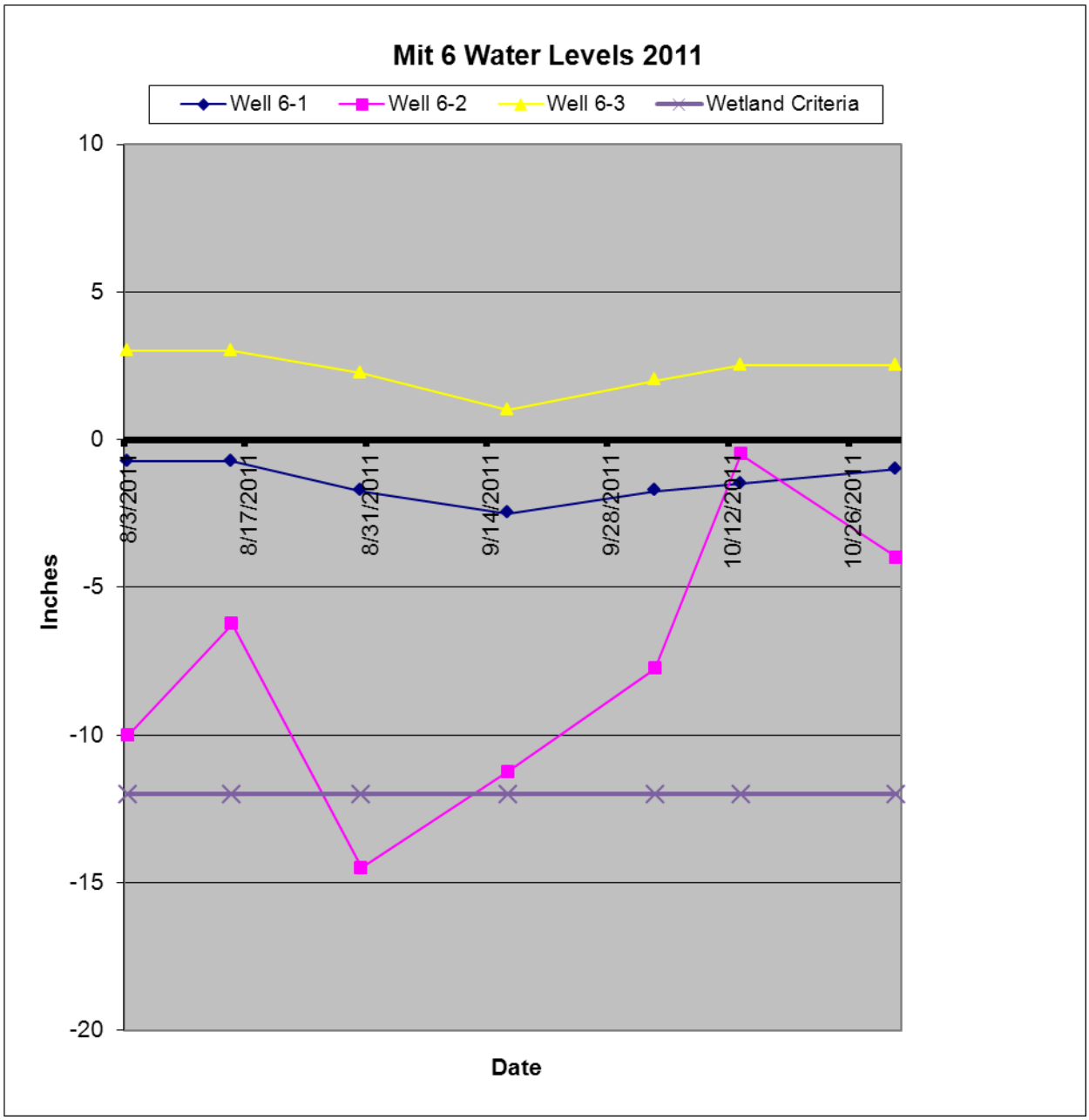
Mitigation Site 5 Dominant Species – 2011. Mean percent cover. n=50. Site dominated by native species *Carex rostrata, Scirpus cyerpinus*, and other native species. Invasive species *Phalarias arundincea* and *Typha angustifolia* present.

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 5 – All Species Present
Species Richness = 52

Carex rostrata
Scirpus cyperinus
Glyceria canadensis
Carex sp. (stricta or aquatilis)
Carex cannescens
Saggitaria latifolia
Glyceria grandis
Salix petiolaris
Carex lacustris
Scirpus microcarpus
Calamagrostis canadensis
Grass seedlings
Bidens frondosa
Carex stricta
Cyperaceae seedlings
Juncus effusus
Lysimachia thyrsiflora
Utricularia minor
Carex stipata
Typha latifolia
Carex retrorsa
Alisma plantago-aquatica
Polygonum pensylvanicum
Salix exigua
Scirpus atrovirens
Torreyochloa pallida
Eleocharis obtusa
Polygonum amphibium
Alnus rugosa
Bidens cernua
Phalaris arundinacea
Ranunculus pensylvanicus
Polygonum saggitatum
Aster lanceolatus
Eleocharis smallii
Leersia oryzoides
Salix planifolia
Salix sp. seedlings
Scirpus validus
Viola pallens
Polygonum hydropiper
Eupatorium maculatum
Salix bebbiana
Cicuta bulbifera
Epilobium letptophyllum
Salix discolor
Typha angustifolia
Carex tenera
Sium suave
Caltha palustris
Galium tinctorium
Rumex orbiculatus

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 6 Water Levels: August 3, 2011 – October 31, 2011.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha latifolia*	Native		80
	Glyceria grandis	Native	W2	30
	Typha angustifolia	Invasive		15
	Scirpus cyperinus	Native	W2	10
	Alisma plantago-aquatica	Native		2
			TOTAL COVER	137

Mitigation Site 6 – Plot 1 Dominant Species – 2011. Site dominated by native species *Typha latifolia* and *Glyceria grandis*. 15% cover by invasive species *Typha angustifolia*.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	40
	Carex lacustris	Native		10
	Juncus filiformis	Native		5
	Carex tribuloides	Native		5
	Carex scoparia	Native		5
	Carex rostrata	Native		5
	Carex stipata	Native		5
	Anaphalis margaritacea	Native		5
	Epilobium coloratum	Native		2
	Carex interior	Native		2
	Potentilla norvegica	Native		1
	Galium tinctorium	Native		1
			TOTAL COVER	86

Mitigation Site 6 – Plot 2 Dominant Species – 2011. Site dominated by native species, primarily *Scirpus cyperinus*. No invasive species present.

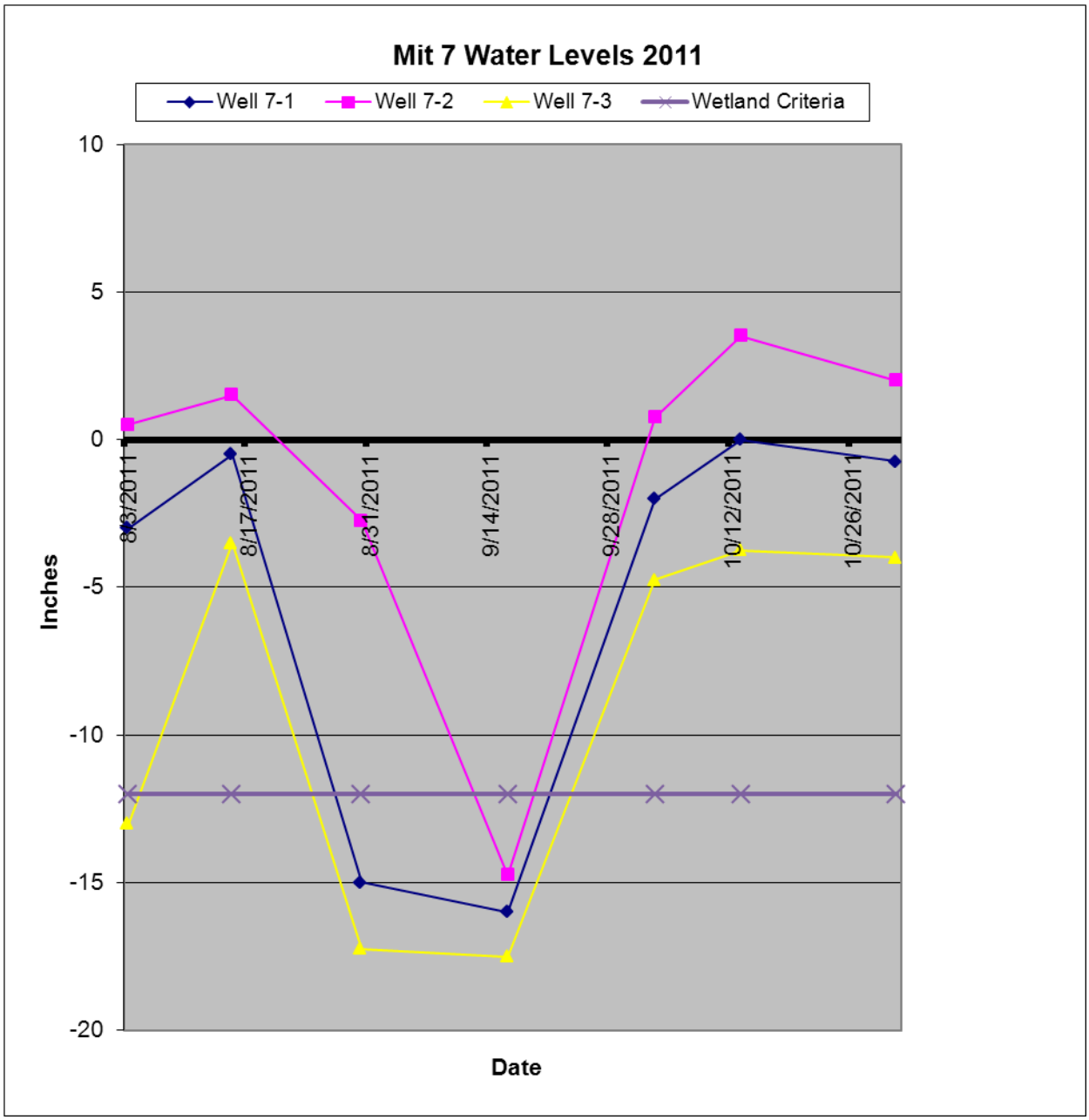
Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha latifolia*	Native		40
	Typha angustifolia	Invasive		30
	Glyceria grandis	Native	W2	20
	Eleocharis smallii	Native		20
	Alisma plantago-aquatica	Native		20
	Carex cannescens	Native		5
	Carex stipata	Native		2
	Sium suave	Native		1
			TOTAL COVER	138

Mitigation Site 6 – Plot 3 Dominant Species – 2011. Site dominated by native species *Typha latifolia*, *Glyceria grandis, Eleocharis smallii*, and *Alisma plantago-aquatica*. 30% cover by invasive species *Typha angustifolia*.

Mitigation Site 6 – All Species Present
Species Richness = 19
Alisma plantago-aquatica
Anaphalis margaritacea
Carex cannescens
Carex interior
Carex lacustris
Carex rostrata
Carex scoparia
Carex stipata
Carex tribuloides
Eleocharis smallii
Epilobium coloratum
Galium tinctorium
Glyceria grandis
Juncus filiformis
Potentilla norvegica
Scirpus cyperinus
Sium suave
Typha angustifolia
Typha latifolia

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 7 Water Levels: August 3, 2011 – October 31, 2011.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

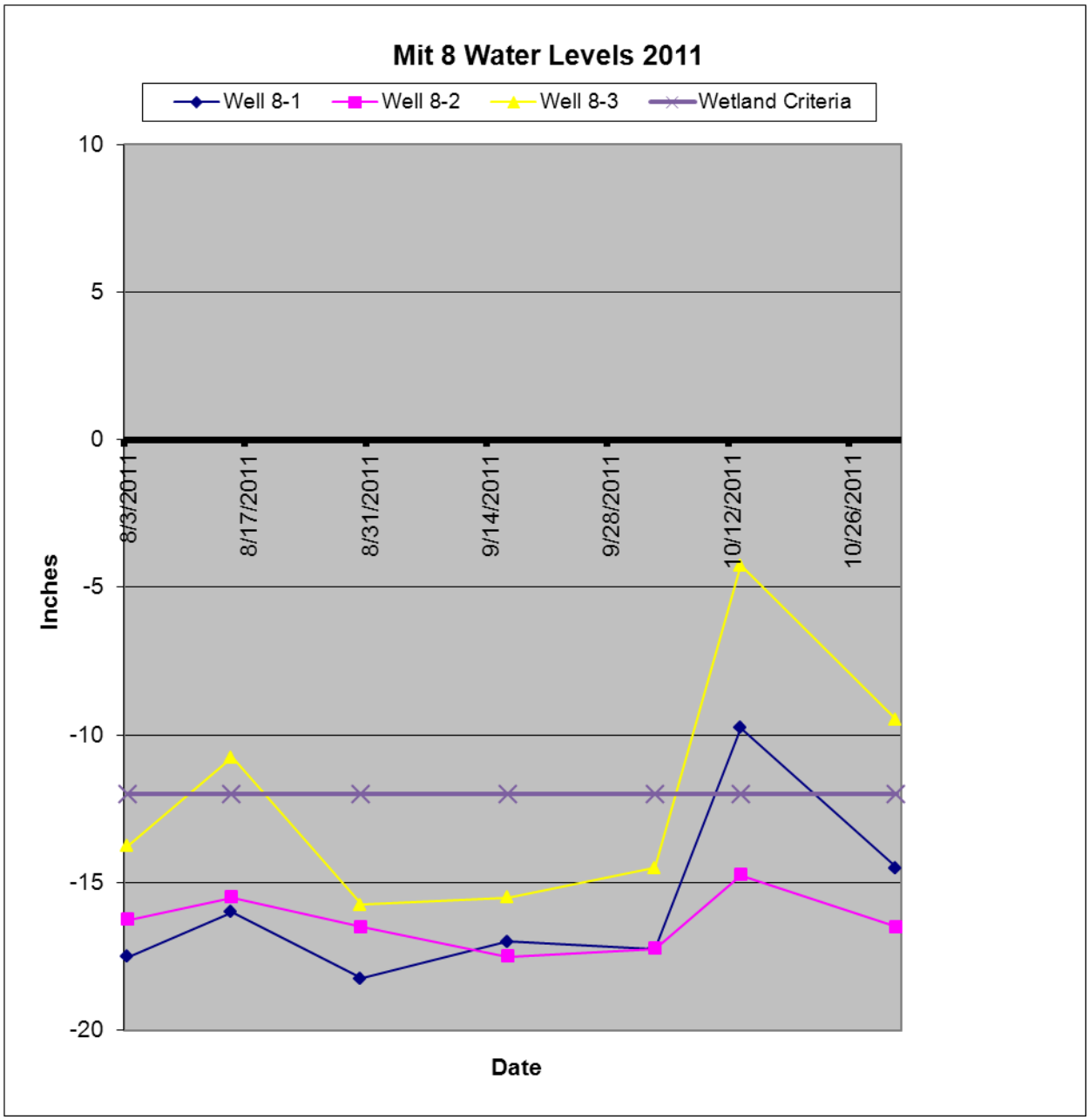
Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha angustifolia*	Invasive		80
	Scirpus cyperinus	Native	W2	50
	Glyceria grandis	Native	W2	30
	Juncus effusus	Native	W2	10
	Carex scoparia	Native		10
	Typha latifolia	Native		5
	Juncus filiformis	Native		5
			TOTAL COVER	190

Mitigation Site 7 – Dominant Species – 2011. Site dominated by invasive species *Typha angustifolia.* Significant cover by native species *Scirpus cyperinus* and *Glyceria grandis*, both found in W2 wetland seed mix.

Mitigation Site 7 – All Species Present
Species Richness = 24
Agrostis hyemalis
Alisma plantago-aquatica
Alnus rugosa
Beckmannia syzigachne
Calamagrostis canadensis
Carex scoparia
Carex stipata
Chrysanthemum leucanthemum
Epilobium coloratum
Epilobium leptophyllum
Equisetum sylvaticum
Glyceria canadense
Glyceria grandis
Juncus effusus
Juncus filiformis
Populus tremuloides
Ranunculus acris
Salix bebbiana
Scirpus cyperinus
Scirpus validus
Tanacetum vulgare
Trifolium repens
Typha angustifolia
Typha latifolia

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 8 Water Levels: August 3, 2011 – October 31, 2011.

The site only met wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface at one of the three wells. Note that this monitoring period did not include the traditionally high-water spring timeframe.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	40
	Carex stipata	Native		10
	Carex scoparia or tenera	Native		10
	Juncus effusus	Native	W2	5
	Aster lanceolatus	Native		5
	Salix bebbiana	Native		2
	Glyceria grandis	Native	W2	2
	Carex hystricina	Native		2
	Betula papyrifera	Native		2
	Anaphalis margaritacea	Native		2
	Agrostis hyemalis	Native		2
	Populus tremuloides	Native		1
	Euthamia graminifolia	Native	W2	1
	Carex cannescens	Native		1
	Viola novae-angliae	Native		0.1
	Phalaris arundinacea	Invasive		0.1
	Cirsium arvense	Introduced		0.1
			TOTAL COVER	85.3

Mitigation Site 8 - Plot 1 Dominant Species – 2011. Site dominated by native species, primarily *Scirpus cyperinus*. Only 0.1 percent cover by the invasive species *Phalaris arundinacea*.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Glyceria grandis*	Native	W2	50
	Scirpus cyperinus	Native	W2	30
	Calamagrostis canadensis	Native	W2	10
	Carex tenera	Native		5
	Carex stipata	Native		5
	Salix bebbiana	Native		2
	Juncus effusus	Native	W2	2
	Carex rostrata	Native		2
	Cirsium arvense	Introduced		1
	Aster puniceus	Native	W2	1
	Carex interior	Native		0.1
	Carex cannescens	Native		0.1
	Beckmannia syzigachne	Native	WT1, W2	0.1
			TOTAL COVER	108.3

Mitigation Site 8 - Plot 2 Dominant Species – 2011. Site dominated by native species, primarily *Glyceria grandis* and *Scirpus cyperinus* both found in W2 wetland seed mix. No invasive species present.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	50
	Typha latifolia	Native		40
	Glyceria grandis	Native	W2	20
			TOTAL COVER	110

Mitigation Site 8 - Plot 3 Dominant Species – 2011. Site dominated by all native species. No invasive species present.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

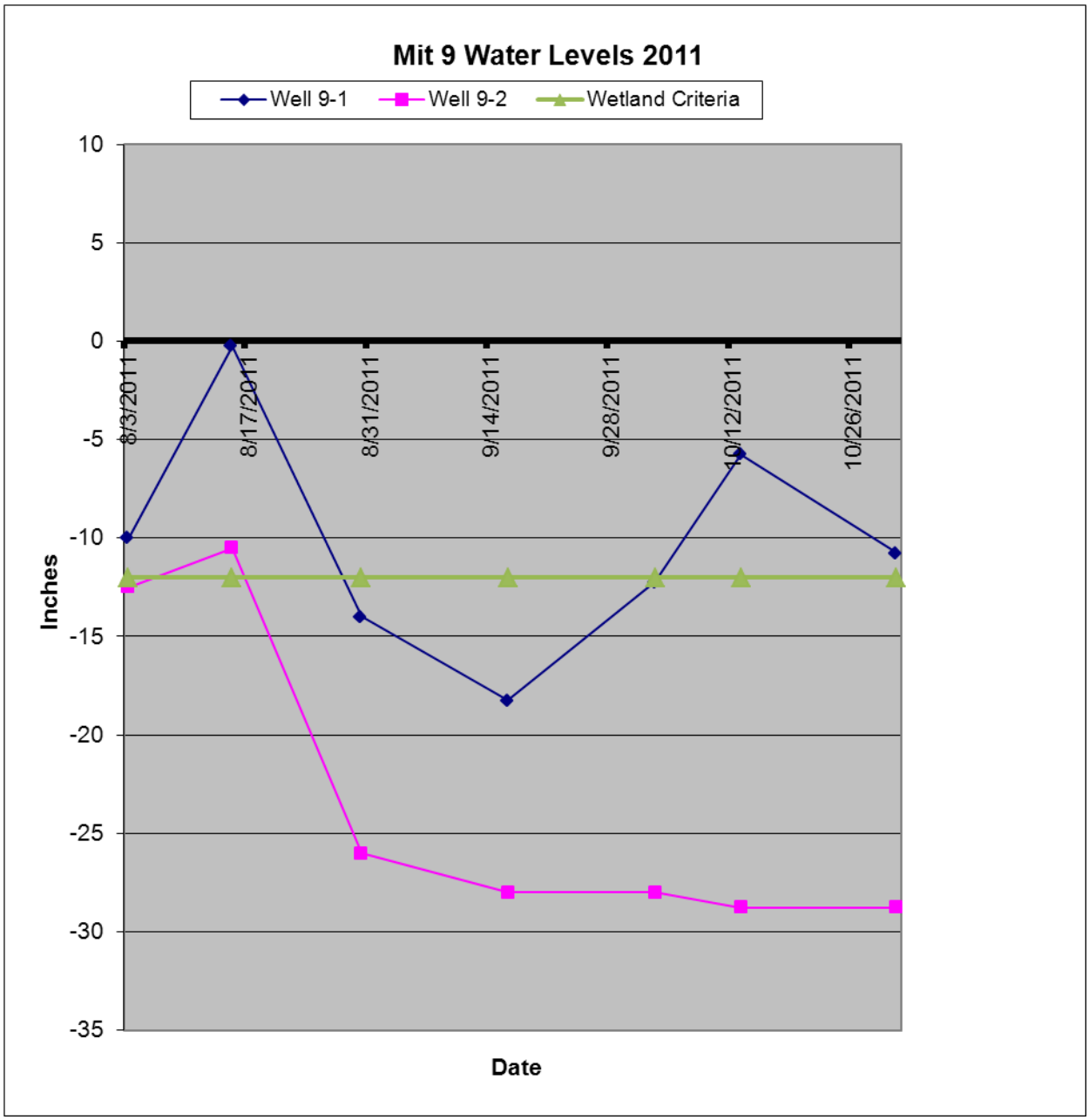
Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	80
	Calamagrostis canadensis	Native	W2	10
	Scirpus microcarpus	Native		5
	Salix bebbiana	Native		5
	Populus tremuloides	Native		5
	Juncus effusus	Native	W2	5
	Fragaria virginiana	Native		5
	Glyceria grandis	Native	W2	2
	Betula papyrifera	Native		2
	Aster lanceolatus	Native		2
	Aster puniceus	Native	W2	2
			TOTAL COVER	123

Mitigation Site 8 - Plot 4 Dominant Species – 2011. Site dominated by native species, primarily *Scirpus cyperinus* and *Calamagrostis canadensis* both found in W2 wetland seed mix. No invasive species present.

Mitigation Site 8 – All Species Present
Species Richness = 29

Agrostis hyemalis
Alisma plantago-aquatica
Anaphalis margaritacea
Aster lanceolatus
Aster puniceus
Beckmannia syzigachne
Betula papyrifera
Calamagrostis canadensis
Carex cannescens
Carex hystricina
Carex interior
Carex rostrata
Carex scoparia or tenera
Carex stipata
Carex tenera
Cirsium arvense
Euthamia graminifolia
Fragaria virginiana
Glyceria grandis
Juncus effusus
Phalaris arundinacea
Populus tremuloides
Salix bebbiana
Scirpus cyperinus
Scirpus microcarpus
Scirpus validus
Sparganium glomeratum
Typha latifolia
Viola novae-angliae

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 9 Water Levels: August 3, 2011 – October 31, 2011.

The site only met wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface at one of two wells. Note that this monitoring period did not include the traditionally high-water spring timeframe.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha angustifolia*	Invasive		80
	Scirpus cyperinus	Native	W2	30
	Carex cannescens	Native		25
	Viola pallens	Native		10
	Calamagrostis canadensis	Native	W2	5
	Sphagnum moss	Native		2
	Salix petiolaris	Native		2
	Salix bebbiana	Native		2
	Betula pumila	Native		2
	Alnus rugosa	Native		2
	Salix discolor	Native		1
	Calla palustris	Native		1
	Bidens cernua	Native		1
	Poa palustris	Native	WT1, W2	0.1
	Epilobium ciliatum	Native		0.1
	Agrostis hyemalis	Native		0.1
			TOTAL COVER	163.3

Mitigation Site 9 – Plot 1 Dominant Species – 2011. Site dominated by invasive species *Typha angustifolia.* Significant cover by native species *Scirpus cyperinus* and *Carex cannescens*.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Euthamia graminifolia*	Native	W2	25
	Glyceria canadense	Native		20
	Agrostis gigantea	Native		20
	Viola pallens	Native		10
	Festuca rubra	Native		10
	Cirsium arvense	Introduced		10
	Scirpus cyperinus	Native	W2	5
	Hieracium aurantiacum	Introduced		5
	Calamagrostis canadensis	Native	W2	5
	Bidens frondosa	Native		5
	Sonchus sp.	Introduced		2
	Rubus strigosus	Native		2
	Potentilla palustris	Native		2
	Lycopus uniflorus	Native		2
	Lotus corniculatus	Introduced		2
	Achillea millefolium	Native		2
	Solidago nemoralis	Native		1
	Polygonum pensylvanicum	Native		1
	Plantago major	Introduced		1
	Eupatorium maculatum	Native	W2	1
	Anaphalis margaritacea	Native		1
			TOTAL COVER	132

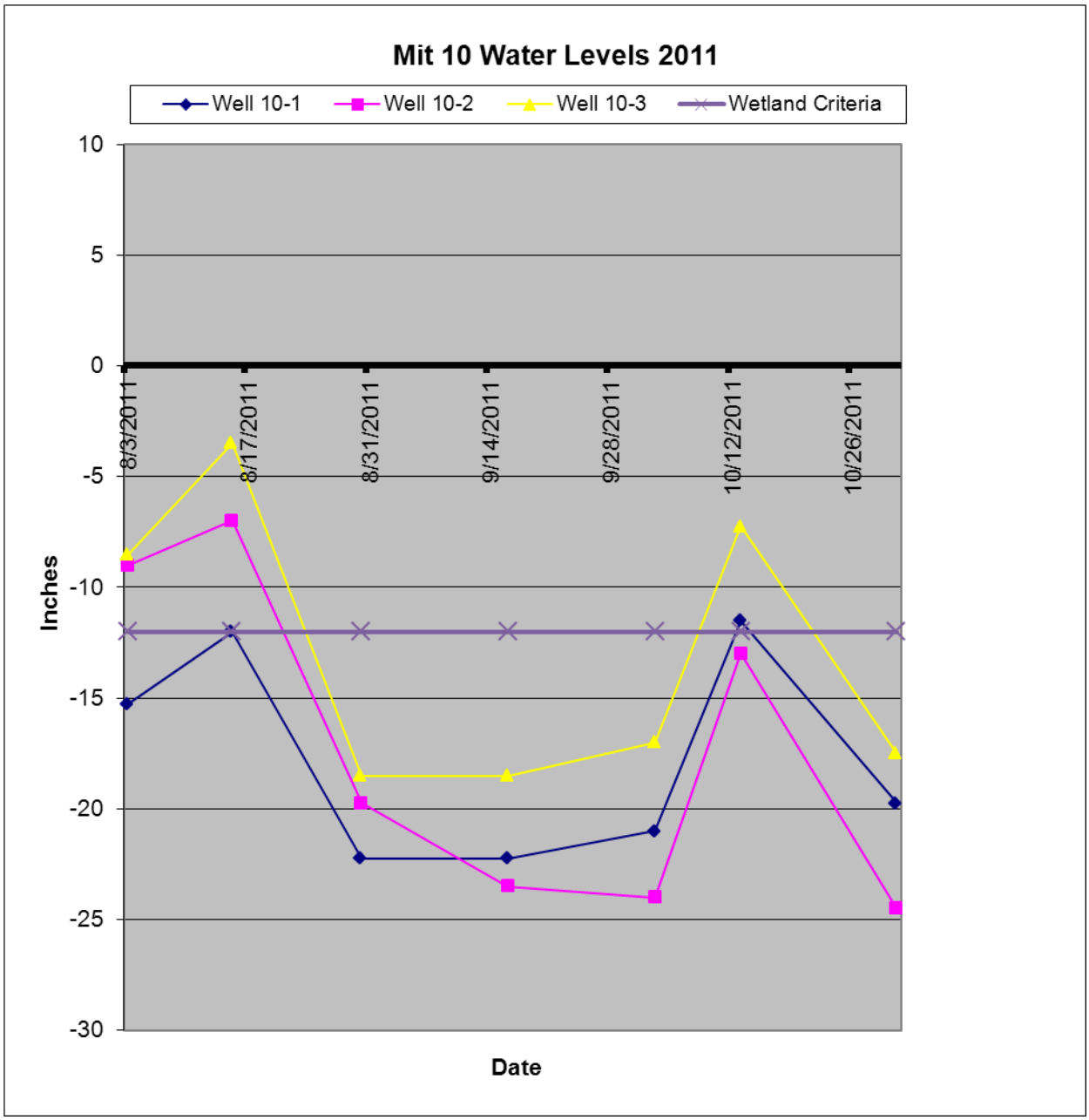
Mitigation Site 9 – Plot 2 Dominant Species – 2011. Site dominated equally by several native species. Several introduced species present. No invasive species.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 9 – All Species Present
Species Richness = 51

Achillea millefolium
Agrostis gigantea
Agrostis hyemalis
Alnus rugosa
Anaphalis margaritacea
Aster macrophyllus
Betula papyrifera
Betula pumila
Bidens cernua
Bidens frondosa
Calamagrostis canadensis
Calla palustris
Carex cannescens
Carex tenera
Chamaedaphne calyculata
Cirsium arvense
Epilobium ciliatum
Equisetum arvense
Equisetum hyemale
Eriophorum angustifolium
Eupatorium maculatum
Euthamia graminifolia
Festuca ovina
Festuca rubra
Glyceria canadense
Glyceria grandis
Hieracium aurantiacum
Iris versicolor
Lotus corniculata
Lycopus uniflorus
Oenothera parviflora
Phleum pratense
Plantago major
Poa palustris
Polygonum pensylvanicum
Potentilla palustris
Rubus strigosus
Salix bebbiana
Salix discolor
Salix exigua
Salix pedicullaris
Salix petiolaris
Salix pyrifolia
Scirpus cyperinus
Solidago gigantea
Solidago nemoralis
Sonchus sp.
Sphagnum moss
Tanacetum vulgare
Typha angustifolia
Viola pallens

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 10 Water Levels: August 3, 2011 – October 31, 2011.

The site only met wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface at two of three wells. Note that this monitoring period did not include the traditionally high-water spring timeframe.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Salix bebbiana*	Native		40
& Shrub Carr	*Scirpus cyperinus*	Native	W2	30
	Cyperaceae seedlings	Native		30
	Typha spp.	Invasive		10
	Juncus effusus	Native	W2	10
	Grass seedlings	Unknown		10
	Dicot seedlings	Unknown		10
	Beckmannia syzigachne	Native	WT1,W2	10
	Trifolium hybridum	Introduced		5
	Juncus brevicaudatus	Native		5
	Agrostis hyemalis	Native		5
	Sparganium chlorocarpum	Native		2
	Salix petiolaris	Native		2
	Salix lucida	Native		2
	Populus tremuloides	Native		2
	Carex trisperma	Native		2
	Carex sp. (Ovales)	Native		2
	Tanacetum vulgare	Invasive		1
	Betula papyrifera	Native		1
			TOTAL COVER	179

Mitigation Site 10 – Plot 1 Dominant Species – 2011. Site dominated equally by several native species. Invasive species present include *Typha spp*. and *Tanacetum vulgare*.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Open Bog	*Poa palustris*	Native	WT1, W2	40
	Chamaedaphne calyculata	Native		30
	Carex oligosperma	Native		20
	Beckmannia syzigachne	Native	WT1, W2	20
	Carex sp.	Native		15
	Carex cannescens	Native		15
	Agrostis gigantea	Native		10
	Scirpus cyperinus	Native	W2	5
	Lysimachia thyrsiflora	Native		5
	Iris versicolor	Native	W2	5
	Lycopus uniflorus	Native		2
	Tanacetum vulgare	Invasive		1
	Epilobium coloratum	Native		1
			TOTAL COVER	169

Mitigation Site 10 – Plot 2 Dominant Species – 2011. Site dominated equally by several native species including bog plants *Chamaedaphne calyculata* and *Carex oligosperma*. Invasive species present is *Tanacetum vulgare*.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Open Bog	*Sphagnum moss*	Native		70
	Carex oligosperma	Native		60
	Poa palustris	Native	WT1, W2	15
	Carex sp.	Native		15
	Polytrichum moss	Native		10
	Chamaedaphne calyculata	Native		10
	Viola pallens	Native		5
	Agrostis hyemalis	Native		5
	Salix petiolaris	Native		2
	Scirpus cyperinus	Native	W2	1
	Andromeda glaucophylla	Native		1
	Vaccinium oxycoccus	Native		0.1
	Typha latifolia	Native		0.1
	Salix bebbiana	Native		0.1
	Lycopus uniflorus	Native		0.1
	Bidens cernua	Native		0.1
	Betula sp. seedling	Native		0.1
			TOTAL COVER	194.6

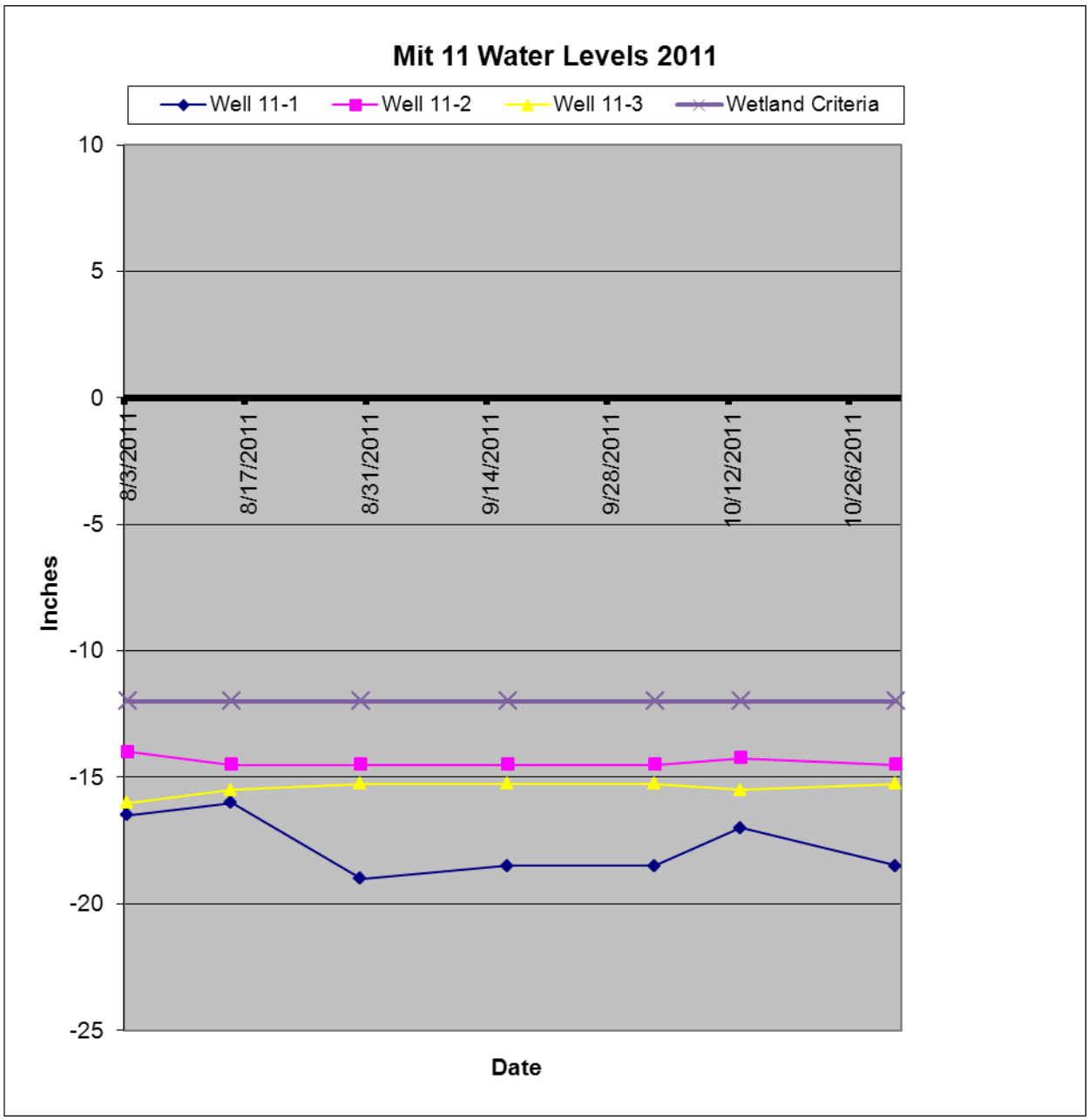
Mitigation Site 10 – Plot 3 Dominant Species – 2011. Site dominated by native bog species *Sphagnum moss* and *Carex oligosperma*. No invasive species present.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 10 – All Species Present
Species Richness = 62

Agropyron repens
Agrostis gigantea
Agrostis hyemalis
Andromeda glaucophylla
Beckmannia syzigachne
Betula papyrifera
Betula sp. seedling
Bidens cernua
Callitriche verna
Carex cannescens
Carex oligosperma
Carex sp.
Carex stricta
Carex trisperma
Chamaedaphne calyculata
Chrysanthemum leucanthemum
Cyperaceae seedlings
Dicot seedlings
Epilobium coloratum
Epilobium leptophyllum
Equisetum arvense
Equisetum fluviatile
Eriophorum angustifolium
Glyceria grandis
Grass seedlings
Hieracium cespitosum
Iris versicolor
Juncus brevicaudatus
Juncus effusus
Kalmia polifolia
Lycopus uniflorus
Lysimachia thyrsiflora
Menyanthes
Phalaris arundinacea
Plantago major
Poa palustris
Polygonum saggitatum
Polytrichum moss
Populus tremuloides
Potamogeton amplexicaulis
Potentilla palustris
Rumex acetosella
Salix bebbiana
Salix lucida
Salix petiolaris
Sarracenia purpurea
Scirpus cyperinus
Scirpus validus
Solidago gigantea
Sparganium chlorocarpum
Sparganium glomeratum
Sphagnum moss
Tanacetum vulgare
Triadenum fraseri
Trifolium hybridum
Typha angustifolia
Typha latifolia
Typha spp.
Vaccinium oxycoccus
Viola pallens

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 11 Water Levels: August 3, 2011 – October 31, 2011.

The site did not meet wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface at any time during the monitoring period. Note that this monitoring period did not include the traditionally high-water spring timeframe.

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Juncus effusus*	Native	W2	40
	Trifolium hybridum	Introduced		30
	Scirpus validus	Native		25
	Agrostis gigantea	Native		10
	Scirpus cyperinus	Native	W2	5
	Beckmannia syzigachne	Native	WT1, W2	5
	Typha latifolia	Native		2
	Phalaris arundinacea	Invasive		1
	Hypericum canadense	Native		1
	Plantago major	Introduced		0.1
			TOTAL COVER	119.1

Mitigation Site 11 – Plot 1 Dominant Species – 2011. Site dominated by native and introduced species. The invasive species *Phalaris arundinacea* is present.

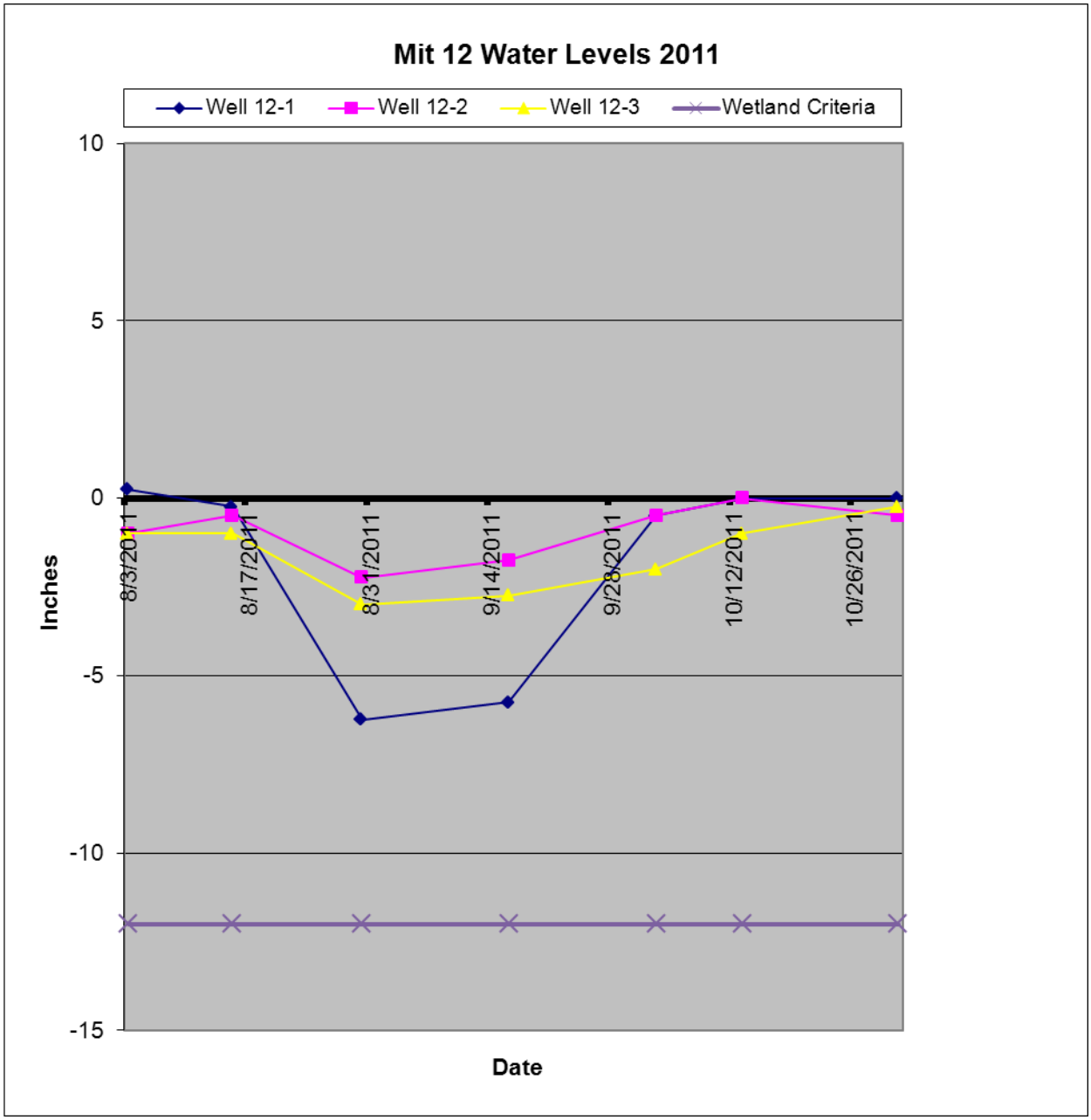
Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Agrostis gigantea*	Native		80
	Phalaris arundinacea	Invasive		30
	Trifolium hybridum	Introduced		20
	Scirpus cyperinus	Native	W2	10
	Trifolium pratense	Introduced		5
	Viola pallens	Native		2
	Ranunculus acris	Introduced		2
	Potentilla norvegica	Native		2
	Euthamia graminifolia	Native	W2	2
	Beckmannia syzigachne	Native	WT1, W2	2
			TOTAL COVER	155

Mitigation Site 11 – Plot 2 Dominant Species – 2011. Site dominated by native, invasive and introduced species.

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 11 – All Species Present
Species Richness = 30
Achillea millefolium
Agrostis gigantea
Alnus rugosa
Aster lanceolatus
Beckmannia syzigachne
Calamagrostis canadensis
Caltha natans
Chrysanthemum leucanthemum
Cirsium arvense
Erigeron annuus
Euthamia graminifolia
Hypericum canadense
Juncus effusus
Lotus corniculata
Phalaris arundinacea
Phleum pratense
Plantago major
Potentilla norvegica
Ranunculus acris
Ranunculus pensylvanicus
Rudebeckia hirta
Scirpus cyperinus
Scirpus validus
Solidago gigantea
Tanacetum vulgare
Trifolium hybridum
Trifolium pratense
Trifolium repens
Typha latifolia
Viola pallens

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 12 Water Levels: August 3, 2011 – October 31, 2011.

The site met the wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface during the entire monitoring period.

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

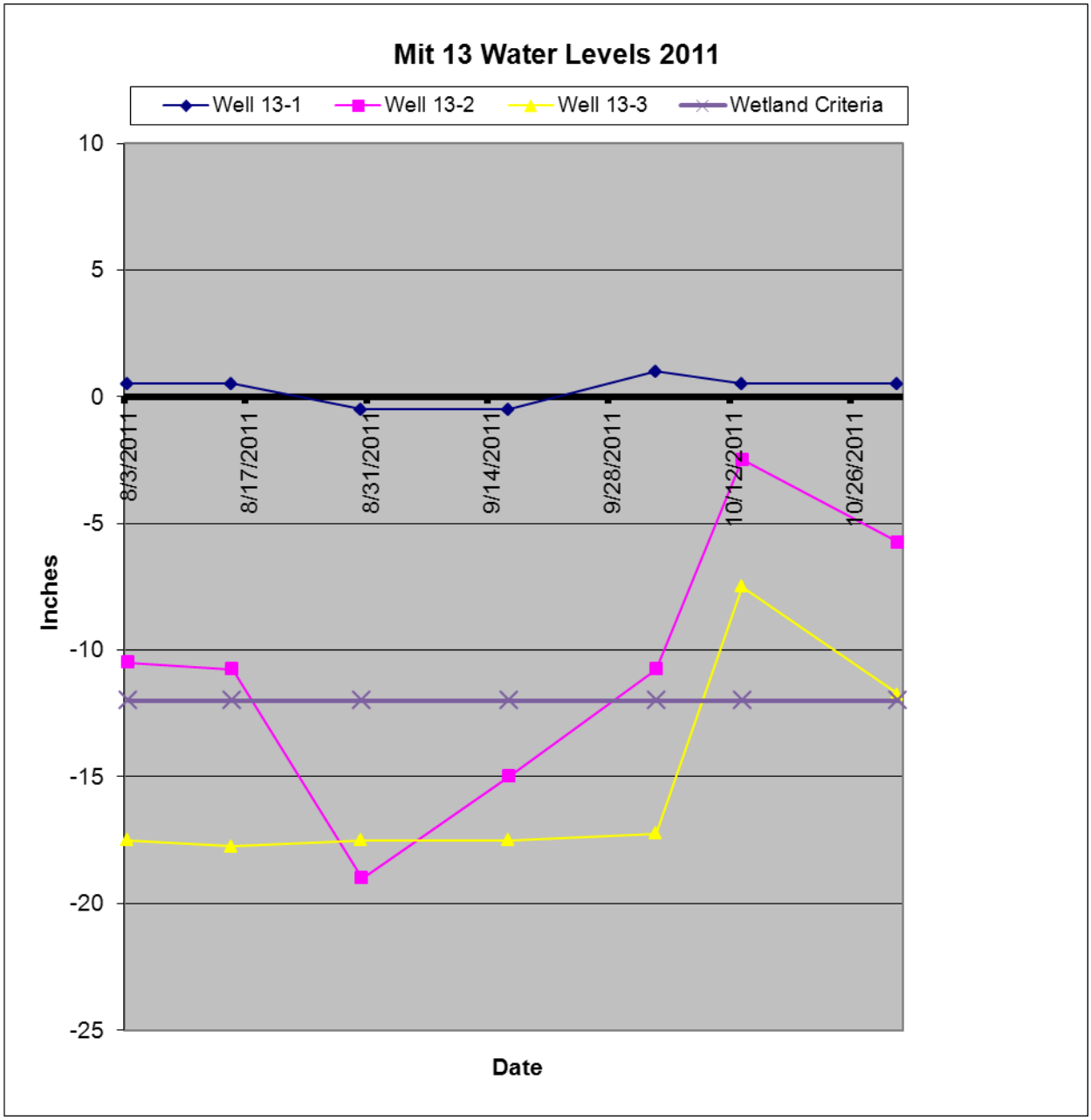
Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Juncus effusus*	Native	W2	70
	Typha latifolia	Native		30
	Glyceria grandis	Native	W2	20
	Beckmannia syzigachne	Native	WT1, W2	5
	Typha angustifolia	Invasive		2
	Scirpus validus	Native		2
	Polygonum saggitatum	Native		2
	Lythrum salicaria	Invasive		2
	Potentilla norvegica	Native		1
	Epilobium coloratum	Native		1
	Carex sp.	Native		1
	Caltha sp. seedlings	Native		0.1
			TOTAL COVER	136.1

Mitigation Site 12 – Dominant Species – 2011. Site dominated by native species, predominantly *Juncus effusus*. The invasive species *Typha angustifolia* and *Lythrum salicaria* are present.

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 12 – All Species Present
Species Richness = 30
Alisma plantago-aquatica
Alnus rugosa
Beckmannia syzigachne
Betula papyrifera
Caltha natans
Caltha sp. seedlings
Carex sp.
Carex trisperma
Epilobium coloratum
Equisetum arvense
Glyceria grandis
Glyceria striata
Hieracium aurantiacum
Juncus brevicaudatus
Juncus effusus
Lysimachia terrestris
Lythrum salicare
Onoclea sensibilis
Poa palustris
Polygonum saggitatum
Populus tremuloides
Potentilla norvegica
Potentilla palustris
Rumex acetosella
Saggitaria latifolia
Scirpus microcarpus
Scirpus validus
Sphagnum
Typha angustifolia
Typha latifolia

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 13 Water Levels: August 3, 2011 – October 31, 2011.

The site met the wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	30
	Carex cannescens	Native		30
	Beckmannia syzigachne	Native	WT1, W2	30
	Juncus effusus	Native	W2	10
	Lythrum salicaria	Invasive		5
	Juncus brevicaudatus	Native		5
	Equisetum arvense	Native		5
	Carex stipata	Native		5
	Carex interior	Native		5
	Viola pallens	Native		2
	Carex sp.	Native		2
	Agrsostis hyemalis	Native		2
	Populus tremuloides	Native		1
	Hieraciuma aurantiacum	Introduced		1
	Betula papyrifera	Native		1
	Anaphalis margaritacea	Native		1
	Carex brunnescens	Native		1
	Taraxacum officinalis	Introduced		0.1
	Spiraea alba	Native		0.1
	Salix sp. seedlings	Native		0.1
	Potentilla norvegica	Native		0.1
	Eupatorium maculatum	Native	W2	0.1
	Equisetum sylvaticum	Native		0.1
	Cirsium arvense	Introduced		0.1
			TOTAL COVER	136.7

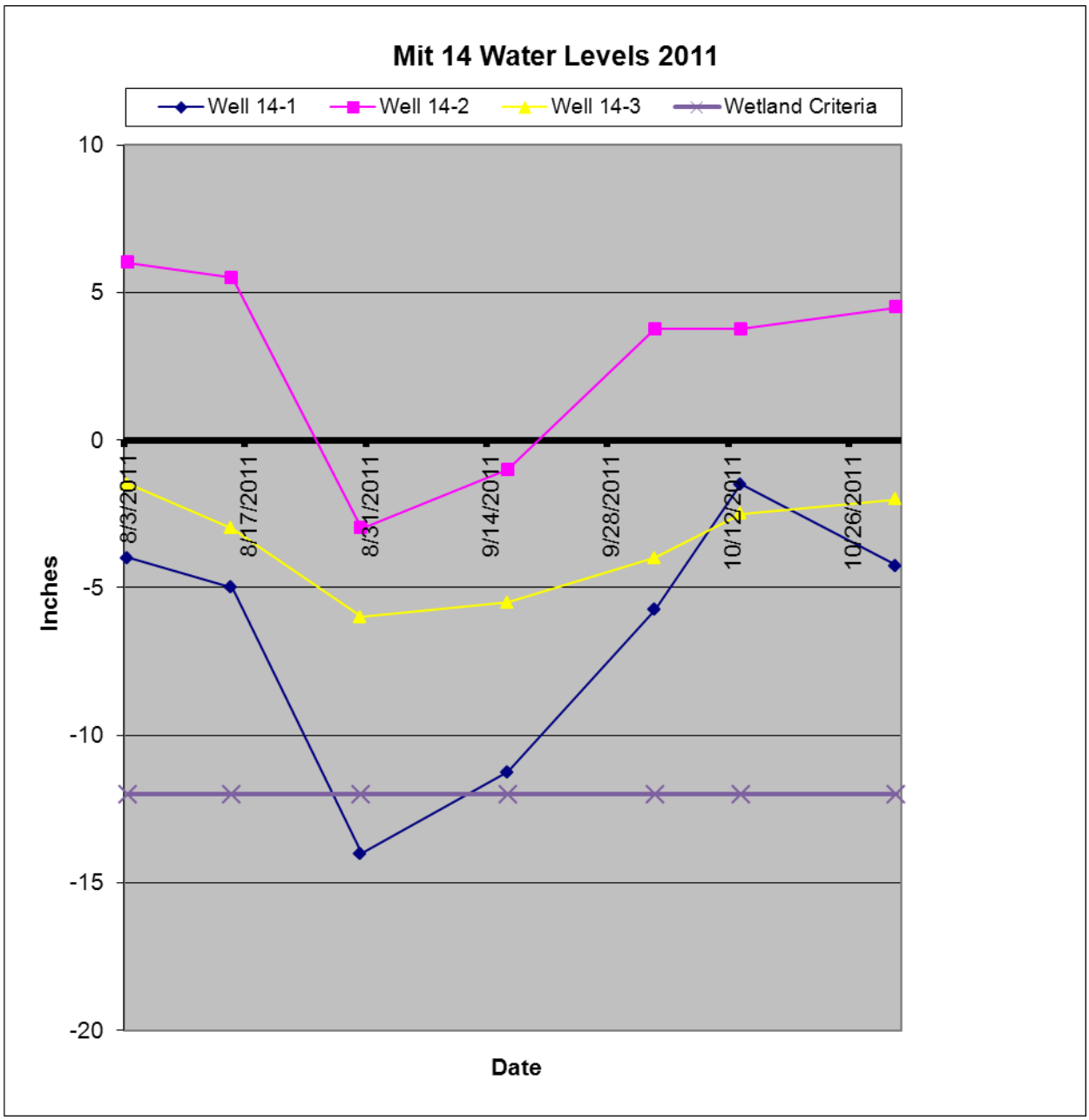
Mitigation Site 13 – Dominant Species – 2011. Site equally dominated by several native species. The invasive species *Lythrum salicaria* and several introduced species are present.

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Mitigation Site 13 – All Species Present
Species Richness = 52

Abies balsamea
Agrostis hyemalis
Alnus rugosa
Anaphalis margaritacea
Beckmannia syzigachne
Betula papyrifera
Calla palustris
Caltha natans
Carex brunnescens
Carex cannescens
Carex interior
Carex lasiocarpa
Carex leptalea
Carex retrorsa
Carex sp
Carex stipata
Carex trisperma
Cirsium arvense
Drosera rotundifolia
Eleocharis acicularis
Epilobium leptophyllum
Equisetum arvense
Equisetum sylvaticum
Eupatorium maculatum
Glyceria canadense
Hieracium aurantiacum
Iris versicolor
Juncus brevicaudatus
Juncus effusus
Lysimachia thyrsiflora
Lythrum salicaria
Menyanthes
Phalaris arundinacea
Polygonum amphibium
Populus tremuloides
Potamogeton sp.
Potentilla norvegica
Potentilla palustris
Salix discolor
Salix sp. seedlings
Scirpus cyperinus
Scutellaria galericulata
Sparganium chlorocarpum
Sparganium glomeratum
Sphagnum
Spiraea alba
Taraxacum officinalis
Trifolium hybridum
Trifolium repens
Typha latifolia
Utricularia sp.
Viola pallens

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012



Mitigation Site 14 Water Levels: August 3, 2011 – October 31, 2011.

The site met the wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface for most of the monitoring period.

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 6: Annual Report – FY2012

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha latifolia*	Native		60
	Typha angustifolia	Invasive		20
	Scirpus cyperinus	Native		10
	Carex cannescens	Native		1
			TOTAL COVER	91

Mitigation Site 14 – Dominant Species – 2011. Site is dominated by native *Typha latifolia*. The invasive species *Typha angustifolia* is also present.

Mitigation Site 14 – All Species Present
Species Richness = 17
Beckmannia syzigachne
Carex cannescens
Glyceria canadense
Glyceria striata
Juncus effusus
Populus tremuloides
Pteridium aquilinum
Salix petiolaris
Salix bebbiana
Salix discolor
Salix lucida
Salix pyrifolia
Scirpus atrovirens
Scirpus cyperinus
Sphagnum
Typha angustifolia
Typha latifolia

Validation of Wetland Mitigation
In
Abandoned Borrow Areas

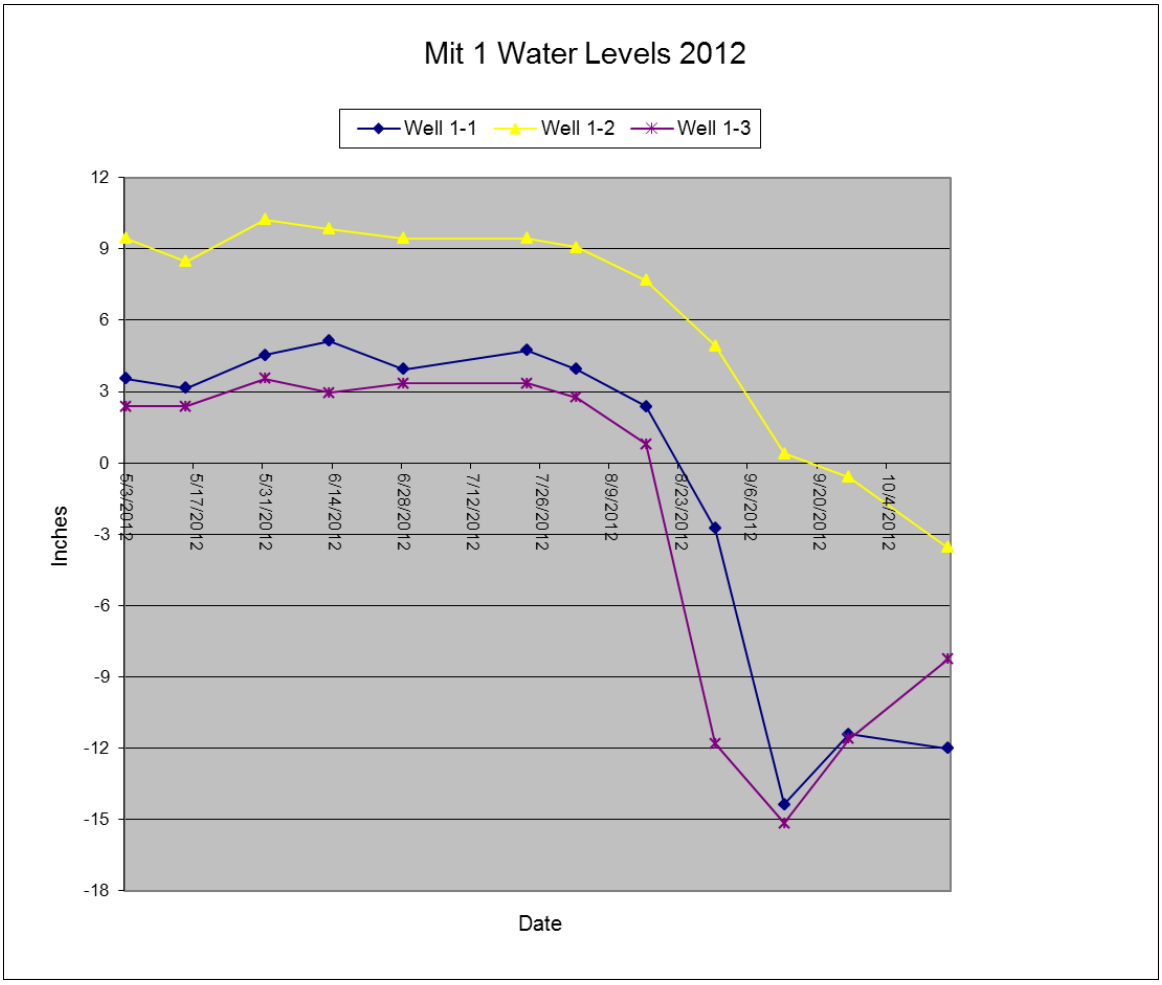
Task 7: Data Analysis and Interpretation – FY 2013

Water Level Monitoring
And
Percent Vegetative Cover by Species

2012 Field Season

Completed June 2014

Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 1 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha* species mixed*	Invasive		100
	Scirpus cyperinus	Native	W2	25
	Juncus brevicaudatus	Native		10
	Agrostis gigantea	Native		5
	Alisma plantago-aquatica	Native		2
	Agrostis hyemalis	Native		1
	Aster puniceus	Native	W2	1
	Carex tenera	Native		1
	Glyceria grandis	Native	W2	1
TOTAL COVER				146

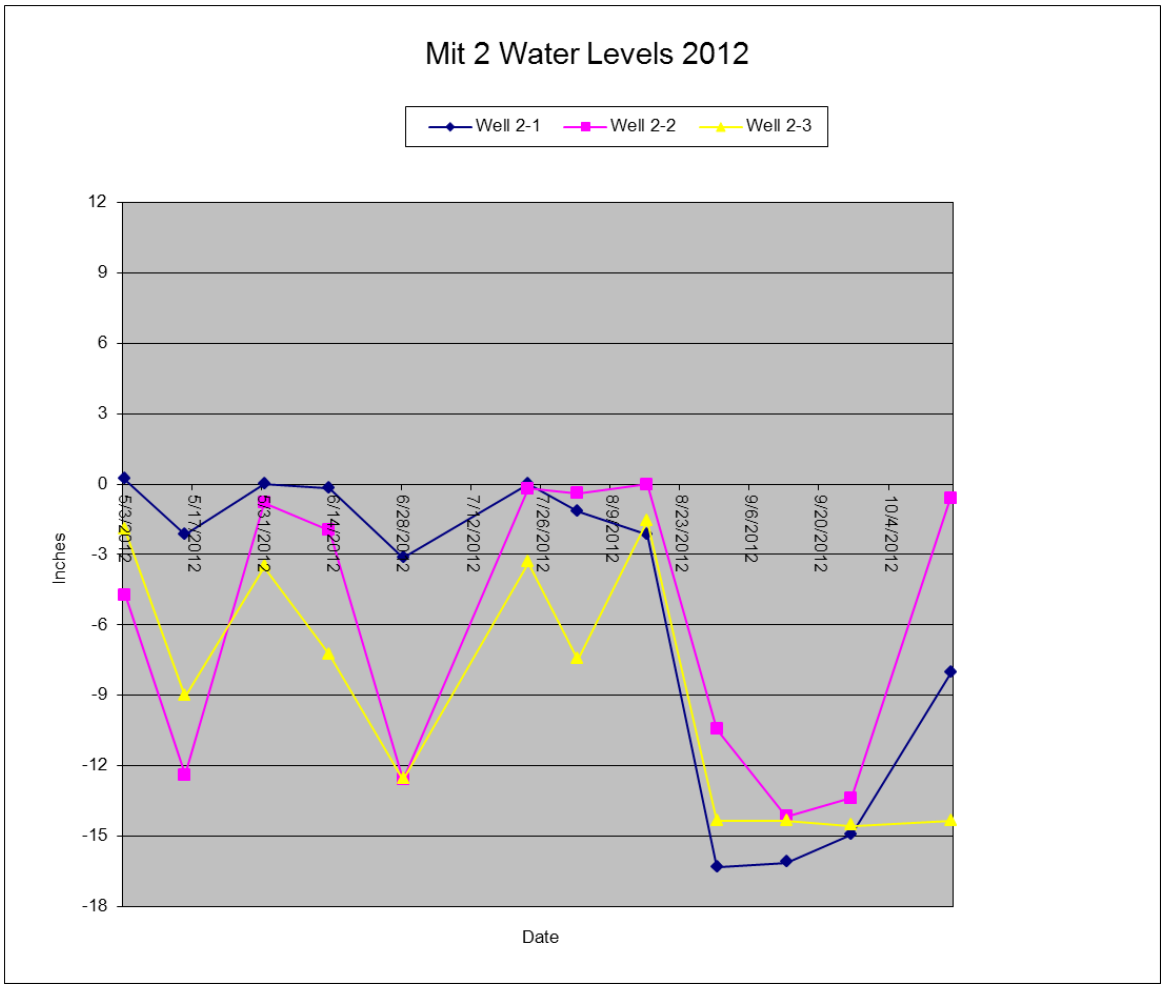
Mitigation Site 1, Plot 1 Dominant Species – July 2012. Plot dominated by invasive *Typha* species. Native *Scirpus cyperinus* moderately dominant.
**T. angustifolia, T. latifolia*, hybrids

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha* species mixed*	Invasive		100
	Scirpus cyperinus	Native	W2	25
	Juncus brevicaudatus	Native		10
	Agrostis seedlings	Native		5
	Carex tenera	Native		5
	Eleocaris acicularis	Native		5
	Glyceria grandis	Native	W2	5
	Gnaphalium uliginosum	Introduced		5
	Epilobium ciliatum	Native		1
	Aster puniceus	Native	W2	0.1
	Onoclea sensibilis	Native		0.1
	Taraxicum officinale	Introduced		0.1
TOTAL COVER				161.3

Mitigation Site 1, Plot 1 Dominant Species – September 2012. Plot dominated by invasive *Typha* species. Native *Scirpus cyperinus* moderately dominant. Introduced species *Gnaphalium uliginosum* and *Taraxicum officinale* present.
**T. angustifolia, T. latifolia*, hybrids

Mitigation Site 1 – All Species Present
Species Richness = 24
Achillea millefolium
Agrostis gigantea
Agrostis hyemalis
Alisma plantago-aquatica
Aster lanceolatus
Aster puniceus
Carex tenera
Cirsium arvense
Eleocaris acicularis
Epilobium ciliatum
Glyceria grandis
Gnaphalium uliginosum
Juncus brevicaudatus
Juncus effusus
Juncus nodosus
Onoclea sensibilis
Salix bebbiana
Scirpus cyperinus
Taraxicum officinale
Trifolium arvense
Trifolium hybridum
Typha angustifolia
Typha hybrid
Typha latifolia

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 2 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Juncus effusus*	Native	W2	50
	Scirpus microcarpus	Native		15
	Phalaris arundinacea	Invasive		15
	Glyceria grandis	Native	W2	10
	Typha latifolia	Native		10
	Scirpus validus	Native		2
	Aster lanceolatus	Native		1
	Onoclea sensibilis	Native		1
	Trifolium hybridum	Introduced		1
	Ranunculus pensylvanicus	Native		0.1
			TOTAL COVER	105.1

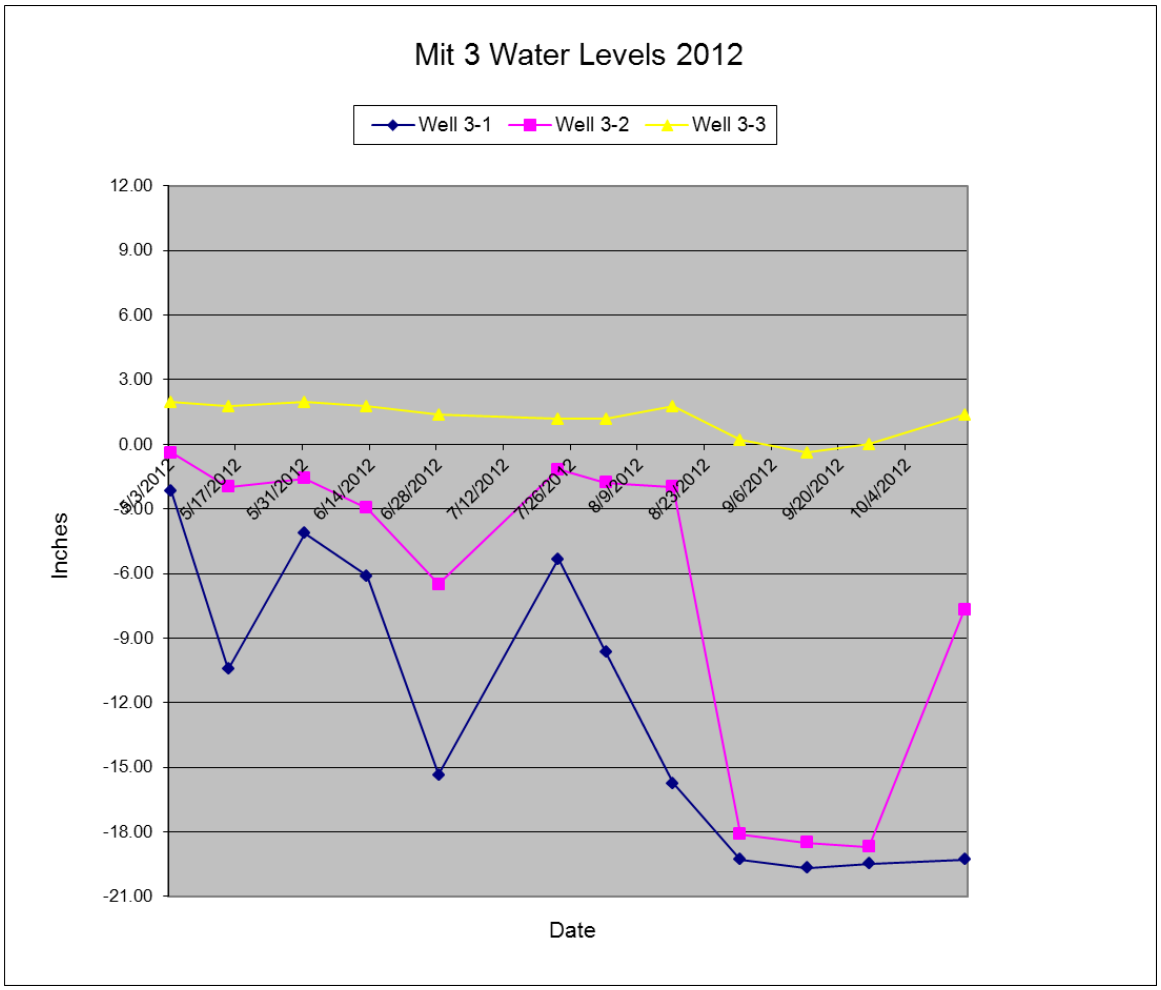
Mitigation Site 2, Plot 1 Dominant Species – July 2012. Plot dominated by native *Juncus effusus* and *Scirpus microcarpus*. Invasive species *Phalaris arundinacea* moderately dominant. Introduced species *Trifolium hybridum* present.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Juncus effusus*	Native	W2	50
	Scirpus microcarpus	Native		40
	Phalaris arundinacea	Invasive		15
	Aster lanceolatus	Native		10
	Glyceria grandis	Native	W2	10
	Typha latifolia	Native		10
	Calamagrostis canadensis	Native	W2	5
	Carex lacustris	Native		2
	Scirpus validus	Native		2
	Typha angustigolia	Invasive		2
	Onoclea sensibilis	Native		1
	Trifolium hybridum	Introduced		1
	Stachys hispida	Native		0.1
			TOTAL COVER	148.1

Mitigation Site 2, Plot 1 Dominant Species – September 2012. Plot dominated by native *Juncus effusus* and *Scirpus microcarpus*. Invasive species *Phalaris arundinacea* moderately dominant. Invasive species *Typha angustigolia* and introduced species *Trifolium hybridum* present.

Mitigation Site 2 – All Species Present
Species Richness = 34
Aster lanceolatus
Aster puniceus
Beckmannia syzigachne
Betula papyrifera
Bidens frondosa
Calamagrostis canadensis
Callitriche verna
Carex lacustris
Carex stipata
Chrysanthemum leucanthemum
Epilobium coloratum
Equisetum arvense
Galium tinctorium
Glyceria grandis
Hieracium aurantiacum
Hieracium cespitosum
Juncus effusus
Onoclea sensibilis
Phalaris arundinacea
Poa palustris
Potentilla norvegica
Potentilla palustris
Prunella vulgaris
Ranunculus pensylvanicus
Salix bebbiana
Scirpus cyperinus
Scirpus microcarpus
Scirpus validus
Solidago gigantea
Stachys hispida
Trifolium hybridum
Trifolium repens
Typha angustigolia
Typha latifolia

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 3 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Typha sp.* seedlings	Unknown		40.0
	Scirpus cyerpinus	Native	W2	36.9
	Trifolium hybridum	Introduced		30.0
	Saggitaria latifolia	Native		27.2
	Typha latifolia	Native		16.6
	Calamagrostis canadensis	Native	W2	16.2
	Glyceria canadensis	Native		15.7
	Carex rostrata	Native		10.8
	Carex sp.	Native		10.0
	Glyceria grandis	Native	W2	7.3
	Juncus effusus	Native	W2	6.7
	Agrostis gigantea	Native		6.0
	Alnus rugosa	Native		5.7
	Cyperaceae sp.	Native		5.5
	Scirpus sp.	Native		5.3
	Carex stipata	Native		5.1
	Carex scoparia	Native		5.0
	Eupatorium perfoliatum	Native	W2	5.0
	Salix bebbiana	Native		5.0
	Scirpus microcarpus	Native		5.0
	Typha angustifolia	Invasive		4.8
	Scirpus validus	Native		4.3
	Poa palustris	Native	WT1,W2	3.8
	Phalaris arundinacea	Invasive		3.5
	Agrostis hyemalis	Native		2.0
	Alisma plantago-aquatica	Native		2.0
	Carex comosa	Native		2.0
	Eleocharis smallii	Native		2.0
	Onoclea sensibilis	Native		2.0
	Salix sp. seedlings	Native		2.0
	Carex tenera	Native		1.7
	Carex intumescens	Native		1.7
	Aster puniceus	Native	W2	1.5
	Aster lanceolatus	Native		1.3
	Glyceria striata	Native	W2	1.3
	Ranunculus pensylvanicus	Native		1.0
	Salix discolor	Native		1.0
	Viola sp.	Native		1.0
	Populus tremuloides	Native		0.7
	Aster umbellatus	Native	W2	0.6

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Epilobium sp.* seedling	Native		0.1
			TOTAL COVER	93.1

Mitigation Site 3 Dominant Species – July 2012. Mean percent cover. n=50. Site dominated by *Typha* seedlings, native species *Scirpus cyerpinus* and introduced species *Trifolium hybridum*. Invasive species *Phalaris arundinacea* and *Typha angustifolia* also present.

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyerpinus*	Native	W2	39.5
	Calamagrostis canadensis	Native	W2	33.8
	Saggitaria latifolia	Native		30.3
	Trifolium hybridum	Introduced		25.0
	Typha latifolia	Native		19.5
	Carex rostrata	Native		17.4
	Glyceria canadensis	Native		15.9
	Scirpus microcarpus	Native		13.8
	Carex lacustris	Native		10.0
	Phalaris arundinacea	Invasive		9.8
	Scirpus validus	Native		7.5
	Typha angustifolia	Invasive		6.5
	Agrostis gigantea	Native		6.3
	Glyceria grandis	Native	W2	5.8
	Alnus rugosa	Native		5.7
	Juncus effusus	Native	W2	5.4
	Aster puniceus	Native	W2	5.0
	Aster lanceolatus	Native		4.0
	Carex sp.	Native		3.5
	Scirpus atrovirens	Native		3.5
	Carex comosa	Native		2.0
	Carex intumescens	Native		2.0
	Cirsium arvense	Introduced		2.0
	Eupatorium perfoliatum	Native	W2	2.0
	Onoclea sensibilis	Native		2.0
	Salix bebbiana	Native		2.0
	Salix sp. seedling	Native		2.0
	Scirpus sp.	Native		2.0
	Carex stipata	Native		1.8
	Poa palustris	Native	WT1,W2	1.6
	Populus tremuloides	Native		1.5
	Carex tenera	Native		1.2
	Agrostis hyemalis	Native		1.0
	Aster umbellatus	Native	W2	1.0
	Cyperaceae sp.	Native		1.0
	Eleocharis smallii	Native		1.0
	Leersia oryzoides	Native	W2	1.0
	Salix petiolaris	Native		1.0
			TOTAL COVER	120.3

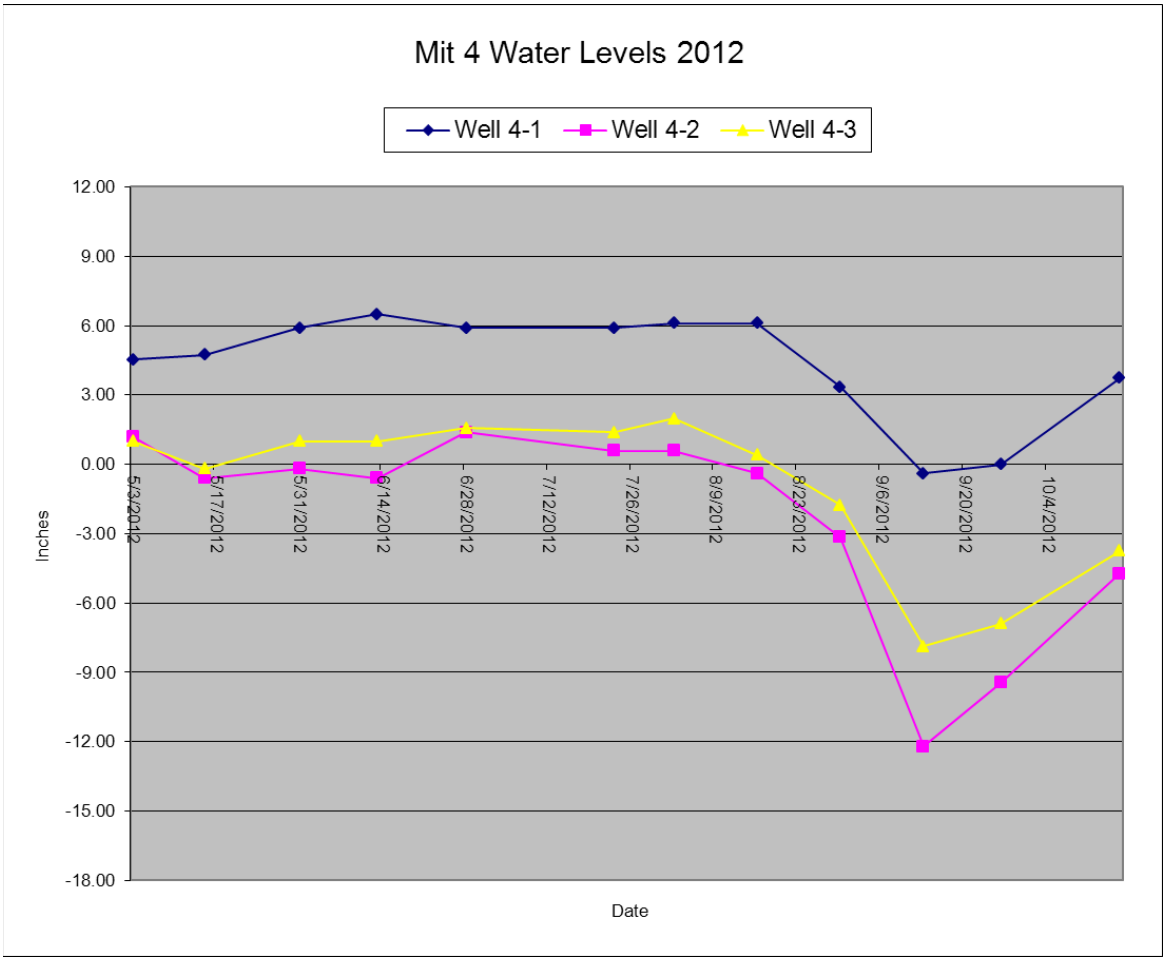
Mitigation Site 3 Dominant Species – September 2012. Mean percent cover. n=50. Site dominated by native species *Scirpus cyerpinus*, *Calamagrostis canadensis*, *Saggitaria latifolia*, and introduced species *Trifolium hybridum*. Invasive species *Phalaris arundinacea* and *Typha angustifolia* also present.

Mitigation Site 3 – All Species Present

Species Richness = 46

Agrostis gigantea
Agrostis hyemalis
Alisma plantago-aquatica
Alnus rugosa
Aster lanceolatus
Aster puniceus
Aster umbellatus
Calamagrostis canadensis
Carex comosa
Carex intumescens
Carex lacustris
Carex rostrata
Carex scoparia
Carex sp.
Carex stipata
Carex tenera
Cirsium arvense
Cyperaceae sp.
Eleocharis smallii
Epilobium sp. seedling
Eupatorium perfoliatum
Glyceria canadensis
Glyceria grandis
Glyceria striata
Juncus effusus
Leersia oryzoides
Onoclea sensibilis
Phalaris arundinacea
Poa palustris
Populus tremuloides
Ranunculus pensylvanicus
Saggitaria latifolia
Salix bebbiana
Salix discolor
Salix petiolaris
Salix sp. seedling
Scirpus atrovirens
Scirpus cyerpinus
Scirpus microcarpus
Scirpus sp. (sterile)
Scirpus validus
Trifolium hybridum
Typha angustifolia
Typha latifolia
Typha sp. seedlings
Viola sp.

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 4 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	70.9
	Scutelaria galericulata	Native		50.0
	Carex rostrata	Native		26.7
	Carex aquatilis	Native		17.5
	Carex sp.	Native		15.0
	Saggitaria latifolia	Native		13.4
	Scirpus microcarpus	Native		12.5
	Calamagrostis canadensis	Native	W2	11.8
	Juncus effuses	Native	W2	10.1
	Typha latifolia	Native		9.3
	Carex lacustris	Native		9.0
	Glyceria canadensis	Native		8.3
	Typha angustifolia	Invasive		6.3
	Carex stipata	Native		5.6
	Triadenum fraseri	Native		5.0
	Utricularia intermedia	Native		5.0
	Lysimachia thyrsiflora	Native		4.8
	Carex cannescens	Native		4.5
	Carex lasiocarpa	Native		4.1
	Aster lanceolatus	Native		3.8
	Salix bebbiana	Native		3.7
	Glyceria grandis	Native	W2	3.7
	Epilobium ciliatum	Native		3.5
	Dryopteris cristata	Native		3.0
	Euthamia graminifolia	Native	W2	2.7
	Onoclea sensibilis	Native		2.6
	Salix petiolaris	Native		2.3
	Aster puniceus	Native	W2	2.3
	Lythrum salicare	Invasive		2.3
	Epilobium leptophyllum	Native		2.2
	Alnus rugosa	Native		2.0
	Betula pumila	Native		2.0
	Larix laricina	Native		2.0
	Leersia oryzoides	Native	W2	2.0
	Potentilla norvegica	Native		2.0
	Sphagnum moss	Native		2.0
	Thelypteris palustris	Native		2.0
	Poa palustris	Native	WT1,W2	1.9
	Carex retrorsa	Native		1.5
	Epilobium coloratum	Native		1.5

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Eupatorium maculatum*	Native	W2	1.5
	Juncus brevicaudatus	Native		1.5
	Agrostis hyemalis	Native		1.3
	Carex tenera	Native		1.0
	Aster sp.	Native		1.0
	Aster umbellatus	Native	W2	1.0
	Beckmannia syzigachne	Native	WT1,W2	1.0
	Bidens frondosa	Native		1.0
	Carex crinite	Native		1.0
	Galium tinctorium	Native		1.0
	Phalarias arundincea	Invasive		1.0
	Potentilla palustris	Native		1.0
	Agrostis gigantea	Native		0.8
	Polygonum saggitatum	Native		0.8
	Viola pallens	Native		0.4
	Alisma plantago-aquatica	Native		0.1
	Polygonum amphibium	Native		0.1
	Rumex orbiculatus	Native		0.1
			TOTAL COVER	140.8

Mitigation Site 4 Dominant Species – July 2012. Mean percent cover. n=50. Site dominated by native species *Scirpus cyerpinus*, *Scutelaria galericulata*, and *Carex*. Invasive species *Typha angustifolia*, *Lythrum salicaria*, and *Phalarias arundincea* present.

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	70.9
	Scutelaria galericulata	Native		50.0
	Carex rostrata	Native		26.7
	Carex aquatilis (sterile)	Native		17.5
	Carex sp. (other)	Native		15.0
	Saggitaria latifolia	Native		13.4
	Scirpus microcarpus	Native		12.5
	Calamagrostis canadensis	Native	W2	11.8
	Juncus effusus	Native	W2	10.1
	Typha latifolia	Native		9.3
	Carex lacustris	Native		9.0
	Glyceria canadensis	Native		8.3
	Typha angustifolia	Invasive		6.3
	Carex stipata	Native		5.6
	Triadenum fraseri	Native		5.0
	Utricullaria intermedia	Native		5.0
	Lysimachia thyrsiflora	Native		4.8
	Carex canescens	Native		4.5
	Carex lasiocarpa	Native		4.1
	Aster lanceolatus	Native		3.8
	Salix bebbiana	Native		3.7
	Glyceria grandis	Native	W2	3.7
	Epilobium ciliatum	Native		3.5
	Dryopteris cristata	Native		3.0
	Euthamia graminifolia	Native	W2	2.7
	Onoclea sensibilis	Native		2.6
	Salix petiolaris	Native		2.3
	Aster puniceus	Native	W2	2.3
	Lythrum salicare	Invasive		2.3
	Epilobium leptophyllum	Native		2.2
	Alnus rugosa	Native		2.0
	Betula pumila	Native		2.0
	Larix laricina	Native		2.0
	Leersia oryzoides	Native	W2	2.0
	Potentilla norvegica	Native		2.0
	Sphagnum moss	Native		2.0
	Thelypteris palustris	Native		2.0
	Poa palustris	Native	WT1,W2	1.9
	Carex retrorsa	Native		1.5
	Epilobium coloratum	Native		1.5

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Eupatorium maculatum*	Native	W2	1.5
	Juncus brevicaudatus	Native		1.5
	Agrostis hyemalis	Native		1.3
	Carex tenera	Native		1.0
	Aster sp.	Native		1.0
	Aster umbellatus	Native	W2	1.0
	Beckmannia syzigachne	Native	WT1,W2	1.0
	Bidens frondosa	Native		1.0
	Carex crinita	Native		1.0
	Galium tinctorium	Native		1.0
	Phalarias arundincea	Invasive		1.0
	Potentilla palustris	Native		1.0
	Agrostis gigantea	Native		0.8
	Polygonum saggitatum	Native		0.8
	Viola pallens	Native		0.4
	Alisma plantago-aquatica	Native		0.1
	Polygonum amphibium	Native		0.1
	Rumex orbiculatus	Native		0.1
			TOTAL COVER	140.8

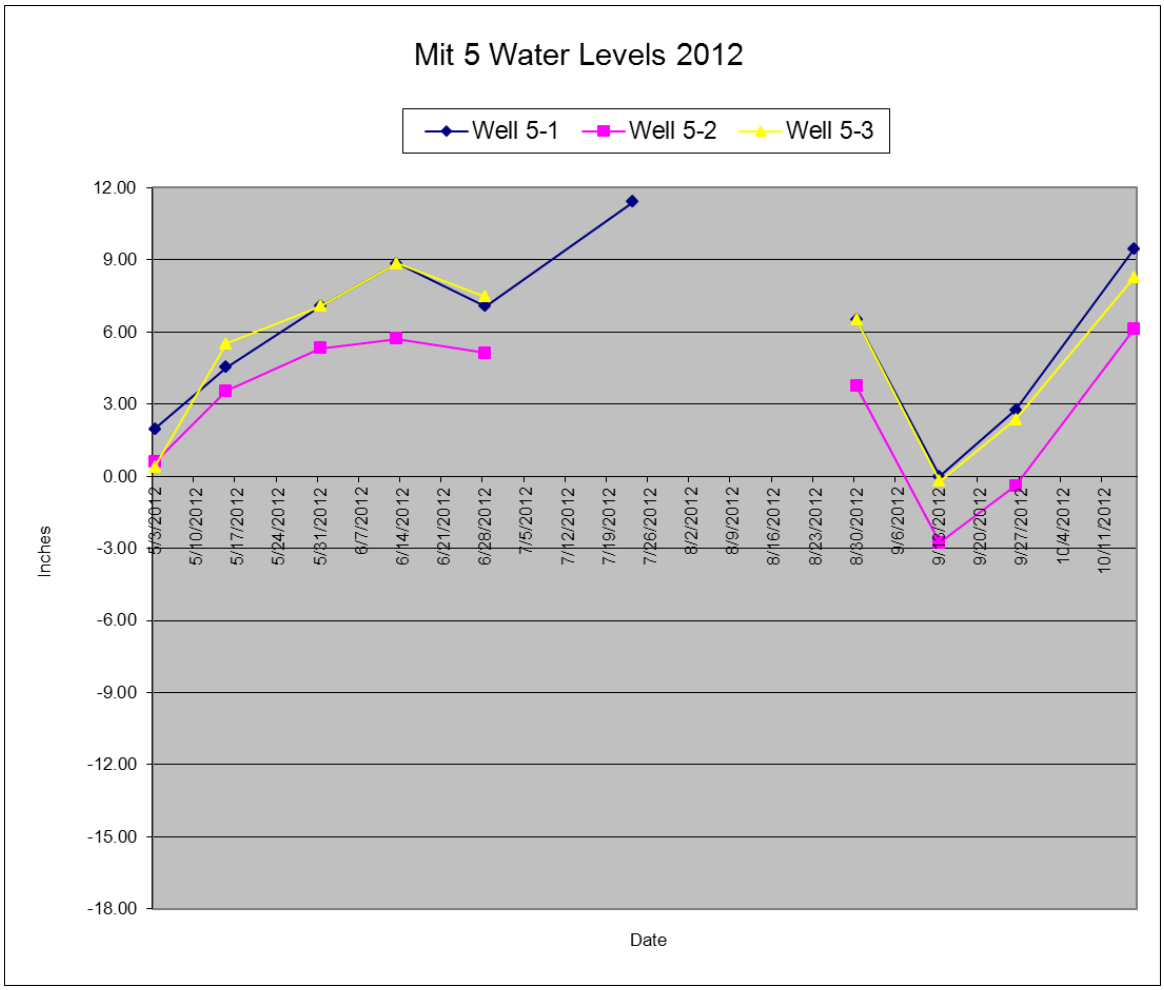
Mitigation Site 4 Dominant Species – September 2012. Mean percent cover. n=50. Site dominated by native species *Scirpus cyerpinus, Scutelaria galericulata,* and *Carex*. Invasive species *Typha angustifolia, Lythrum salicaria,* and *Phalarias arundincea* present.

Mitigation Site 4 – All Species Present

Species Richness = 58

Agrostis gigantea
Agrostis hyemalis
Alisma plantago-aquatica
Alnus rugosa
Aster lanceolatus
Aster puniceus
Aster sp.
Aster umbellatus
Beckmannia syzigachne
Betula pumila
Bidens frondosa
Calamagrostis canadensis
Carex aquatilis
Carex cannescens
Carex crinita
Carex lacustris
Carex lasiocarpa
Carex retrorsa
Carex rostrata
Carex sp.
Carex stipata
Carex tenera
Dryopteris cristata
Epilobium ciliatum
Epilobium coloratum
Epilobium leptophyllum
Eupatorium maculatum
Euthamia graminifolia
Galium tinctorium
Glyceria canadensis
Glyceria grandis
Juncus brevicaudatus
Juncus effusus
Larix laricina
Leersia oryzoides
Lysimachia thyrsiflora
Lythrum salicare
Onoclea sensibilis
Phalarias arundincea
Poa palustris
Polygonum amphibium
Polygonum saggitatum
Potentilla norvegica
Potentilla palustris
Rumex orbiculatus
Saggitaria latifolia
Salix bebbiana
Salix petiolaris
Scirpus cyperinus
Scirpus microcarpus
Scutelaria galericulata
Sphagnum moss
Thelypteris palustris
Triadenum fraseri
Typha angustifolia
Typha latifolia
Utricularia intermedia
Viola pallens

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 5 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface. The site was flooded by beaver activity from July through mid-August.

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Carex rostrata*	Native		45.8
	Scirpus cyperinus	Native	W2	37.6
	Glyceria canadensis	Native		22.5
	Calamagrostis canadensis	Native	W2	15.6
	Carex lacustris	Native		15.0
	Salix petiolaris	Native		12.6
	Glyceria grandis	Native	W2	11.0
	Carex sp.	Native		5.5
	Carex canescens	Native		5.5
	Carex stricta	Native		5.0
	Eleocharis smallii	Native		4.2
	Carex stipata	Native		4.0
	Typha latifolia	Native		3.9
	Lysimachia sp.	Native		3.8
	Leersia oryzoides	Native	W2	3.5
	Sagittaria latifolia	Native		3.4
	Polygonum amphibium	Native		3.0
	Scirpus microcarpus	Native		3.0
	Carex retrorsa	Native		2.8
	Alnus rugosa	Native		2.3
	Scirpus sp.	Native		2.3
	Alisma plantago-aquatica	Native		2.0
	Salix exigua	Native		2.0
	Salix planifolia	Native		2.0
	Scirpus validus	Native		2.0
	Juncus effusus	Native	W2	1.9
	Utricullaria minor	Native		1.8
	Polygonum sagittatum	Native		1.5
	Sparganium chlorocarpum	Native		1.5
	Typha angustifolia	Invasive		1.5
	Phalaris arundinacea	Invasive		1.3
	Salix discolor	Native		1.3
	Salix bebbiana	Native		1.3
	Salix spp. seedlings	Native		1.3
	Caltha palustris	Native		1.0
	Cardamine pensylvanica	Native		1.0
	Carex tenera	Native		1.0
	Mimulus ringens	Native		1.0
	Ranunculus pensylvanicus	Native		0.9
	Poa palustris	Native	WT1,W2	0.8

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Sium suave*	Native		0.6
	Beckmannia syzigachne	Native	WT1,W2	0.3
	Epilobium leptophyllum	Native		0.1
	Agrostis hyemalis	Native		0.1
	Aster sp.	Native		0.1
	Epilobium coloratum	Native		0.1
	Galium tinctorum	Native		0.1
			TOTAL COVER	121.8

Mitigation Site 5 Dominant Species – July 2012. Mean percent cover. n=50. Site dominated by native species *Carex rotrata*, *Scirpus cyerpinus*, and *Glyceria canadensis*. Invasive species *Typha angustifolia*, and *Phalarias arundincea* present.

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Carex rostrata*	Native		49.6
	Scirpus cyperinus	Native	W2	42.3
	Glyceria canadensis	Native		33.4
	Carex lacustris	Native		20.4
	Calamagrostis canadensis	Native	W2	19.3
	Salix petiolaris	Native		15.5
	Carex sp.	Native		7.5
	Carex cannescens	Native		6.8
	Scirpus microcarpus	Native		6.2
	Juncus effusus	Native	W2	5.3
	Carex stricta	Native		5.0
	Leersia oryzoides	Native	W2	5.0
	Typha latifolia	Native		4.9
	Glyceria grandis	Native	W2	4.3
	Scirpus atrovirens	Native		3.0
	Eleocharis smallii	Native		2.5
	Salix planifolia	Native		2.5
	Salix bebbiana	Native		2.3
	Phalaris arundinacea	Invasive		2.3
	Alisma plantago-aquatica	Native		2.0
	Carex stipata	Native		2.0
	Salix sp. seedlings	Native		2.0
	Scirpus validus	Native		2.0
	Aster lanceolatus	Native		1.5
	Typha angustifolia	Invasive		1.5
	Lysimachia thyrsiflora	Native		1.4
	Polygonum amphibium	Native		1.3
	Salix discolor	Native		1.2
	Utricullaria minor	Native		1.1

Eggers and Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Beckmannia syzigachne*	Native	WT1,W2	1.0
	Carex tenera	Native		1.0
	Mimulus ringens	Native		1.0
	Polygonum saggitatum	Native		1.0
	Rumex orbiculatus	Native		1.0
	Saggitaria latifolia	Native		1.0
	Salix exigua	Native		1.0
	Sparganium chlorocarpum	Native		1.0
	Alnus rugosa	Native		0.7
	Agrostis hyemalis	Native		0.1
	Aster sp.	Native		0.1
	Bidens cernua	Native		0.1
	Cicuta bulbifera	Native		0.1
	Epilobium letptophyllum	Native		0.1
	Galium tinctorium	Native		0.1
	Poa palustris	Native	WT1,W2	0.1
	Sium suave	Native		0.1
			TOTAL COVER	140.2

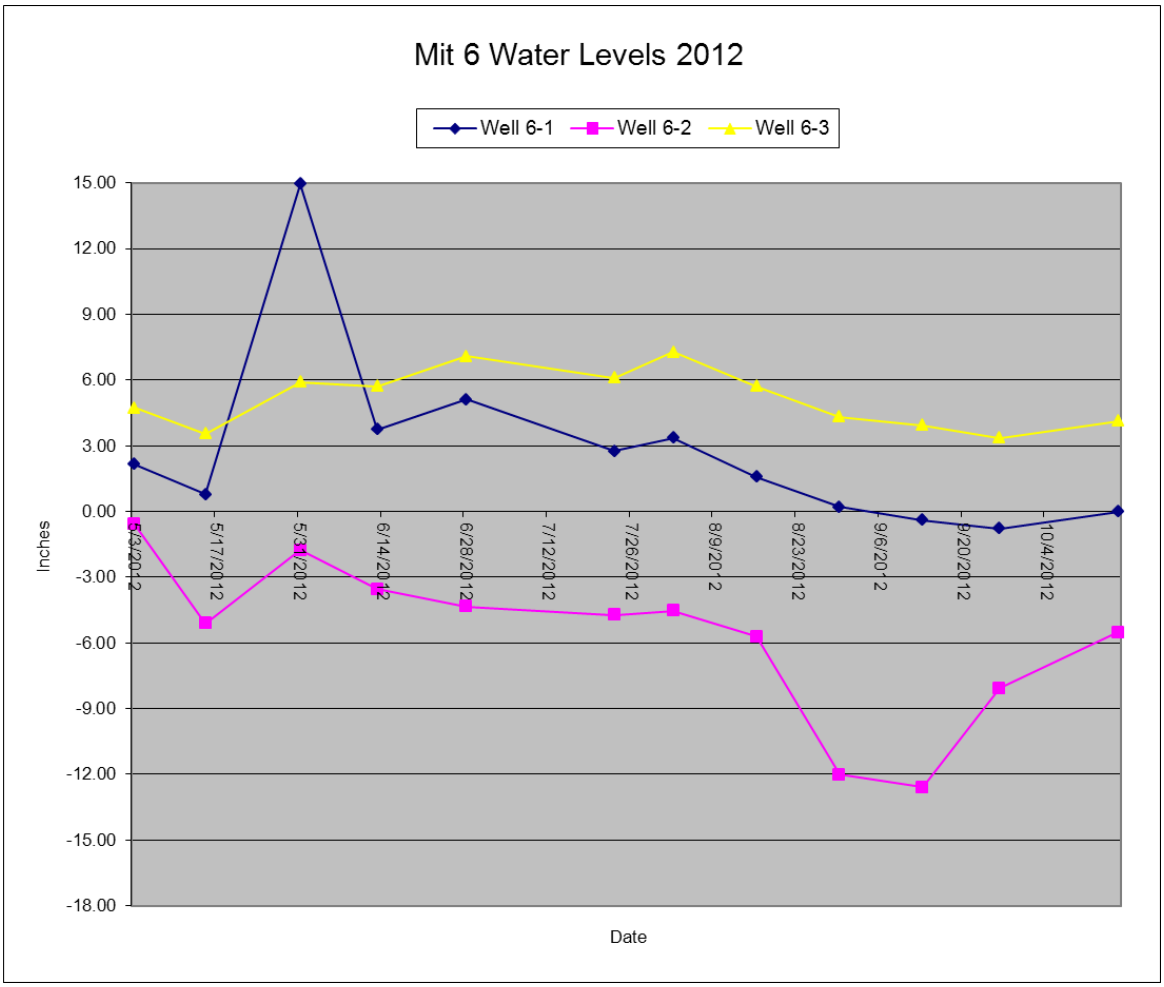
Mitigation Site 5 Dominant Species – September 2012. Mean percent cover. n=50. Site dominated by native species *Carex rotrata*, *Scirpus cyerpinus*, and *Glyceria canadensis*. Invasive species *Phalarias arundincea* and *Typha angustifolia* present.

Mitigation Site 5 – All Species Present

Species Richness = 53

Agrostis hyemalis
Alisma plantago-aquatica
Alnus rugosa
Aster lanceolatus
Aster sp.
Beckmannia syzigachne
Bidens cernua
Calamagrostis canadensis
Caltha palustris
Cardamine pensylvanica
Carex canescens
Carex lacustris
Carex retrorsa
Carex rostrata
Carex sp.
Carex stipata
Carex stricta
Carex tenera
Cicuta bulbifera
Eleocharis smallii
Epilobium coloratum
Epilobium leptophyllum
Galium tinctorum
Glyceria canadensis
Glyceria grandis
Juncus effusus
Leersia oryzoides
Lysimachia sp.
Lysimachia thyrsiflora
Mimulus ringens
Phalaris arundinacea
Poa palustris
Polygonum amphibium
Polygonum saggitatum
Ranunculus pensylvanicus
Rumex orbiculatus
Sagittaria latifolia
Salix bebbiana
Salix discolor
Salix exigua
Salix petiolaris
Salix planifolia
Salix sp. seedlings
Scirpus atrovirens
Scirpus cyperinus
Scirpus microcarpus
Scirpus sp.
Scirpus validus
Sium suave
Sparganium chlorocarpum
Typha angustifolia
Typha latifolia
Utricullaria minor

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 6 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha* species mixed*	Invasive		90
	Glyceria canadensis	Native		30
	Glyceria grandis	Native	W2	30
	Scirpus cyperinus	Native	W2	2
	Juncus brevicaudauts	Native		1
	Lemna minor	Native		0.1
			TOTAL COVER	153.1

Mitigation Site 6, Plot 1 Dominant Species – July 2012. Plot dominated by invasive *Typha* species. Native species *Glyceria Canadensis* and *Glyceria grandis* moderately dominant.
**T. angustifolia, T. latifolia*, hybrids

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Carex rostrata*	Native		70
	Scirpus cyperinus	Native	W2	30
	Calamagrostis canadensis	Native	W2	20
	Carex scoparia	Native		10
	Carex lacustris	Native		5
	Agrostis hyemalis	Native		2
	Poa palustris	Native	WT1,W2	2
	Anaphalis margaritacea	Native		1
	Aster lanceolatus	Native		1
	Betula papyrifera	Native		1
	Juncus brevicuadatus	Native		1
	Salix bebbiana	Native		1
	Phalaris arundinacea	Invasive		0.1
			TOTAL COVER	144.1

Mitigation Site 6, Plot 2 Dominant Species – July 2012. Plot dominated by native *Carex rostrata*, *Scirpus cyperinus* and *Calamagrostis Canadensis*. Invasive species *Phalaris arundinacea* present.

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha* species mixed*	Invasive		80
	Eleocharis smallii	Native		25
	Alisma plantago-aquatica	Native		20
	Equisetum fluviatile	Native		10
	Scirpus cyperinus	Native	W2	10
	Bidens frondosa	Native		5
	Carex rostrata	Native		5
	Glyceria grandis	Native	W2	5
	Scirpus microcarpus	Native		5
	Sium suave	Native		5
	Carex cannescens	Native		2
			TOTAL COVER	172

Mitigation Site 6, Plot 3 Dominant Species – July 2012. Plot dominated by invasive *Typha* species. Native species *Eleocharis smallii* and *Alisma plantago-aquatica* moderately dominant.
**T. angustifolia*, *T. latifolia*, hybrids

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha* species mixed*	Invasive		90
	Glyceria grandis	Native	W2	40
	Glyceria canadensis	Native		20
	Scirpus cyperinus	Native	W2	10
	Carex sp.	Native		2
	Lemna minor	Native		2
			TOTAL COVER	164

Mitigation Site 6, Plot 1 Dominant Species – September 2012. Plot dominated by invasive *Typha* species. Native species *Glyceria Canadensis* and *Glyceria grandis* moderately dominant.
**T. angustifolia*, *T. latifolia*, hybrids

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Carex rostrata*	Native		70
	Calamagrostis canadensis	Native	W2	30
	Scirpus cyperinus	Native	W2	30
	Carex lacustris	Native		5
	Salix discolor	Native		5
	Anaphalis margaritacea	Native		2
	Betula papyrifera	Native		2
	Carex scoparia	Native		2
	Cirsium arvense	Introduced		2
	Rubus strigosus	Native		2
	Salix petiolaris	Native		2
	Aster lanceolatus	Native		1
	Aster puniceus	Native	W2	1
	Hieracium aurantiacum	Introduced		1
	Hypericum mutilum	Native		1
	Onoclea sensibilis	Native		1
	Populus tremuloides	Native		1
	Salix bebbiana	Native		1
	Salix humilis	Native		1
	Agrostis hyemails	Native		0.1
	Cirsium vulgare	Introduced		0.1
	Poa palustris	Native	WT1,W2	0.1
	Potentilla norvegica	Native		0.1
			TOTAL COVER	160.4

Mitigation Site 6, Plot 2 Dominant Species – September 2012. Plot dominated by native *Carex rostrata*, *Scirpus cyperinus* and *Calamagrostis Canadensis*. Introduced species *Cirsium arvense, Hieracium aurantiacum,* and *Cirsium vulgare* present.

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha* species mixed*	Invasive		100
	Calamagrostis canadensis	Native	W2	5
	Carex rostrata	Native		5
	Scirpus cyperinus	Native	W2	5
	Scirpus microcarpus	Native		5
	Alisma plantago-aquatica	Native		2
	Eleocharis smallii	Native		2
	Glyceria canadensis	Native		2
	Glyceria grandis	Native	W2	2
	Bidens cernua	Native		1
	Bidens frondosa	Native		1
	Polygonum hydropiper	Introduced		1
	Carex stipata	Native		0.1
	Equisetum fluviatile	Native		0.1
	Sium suave	Native		0.1
			TOTAL COVER	131.3

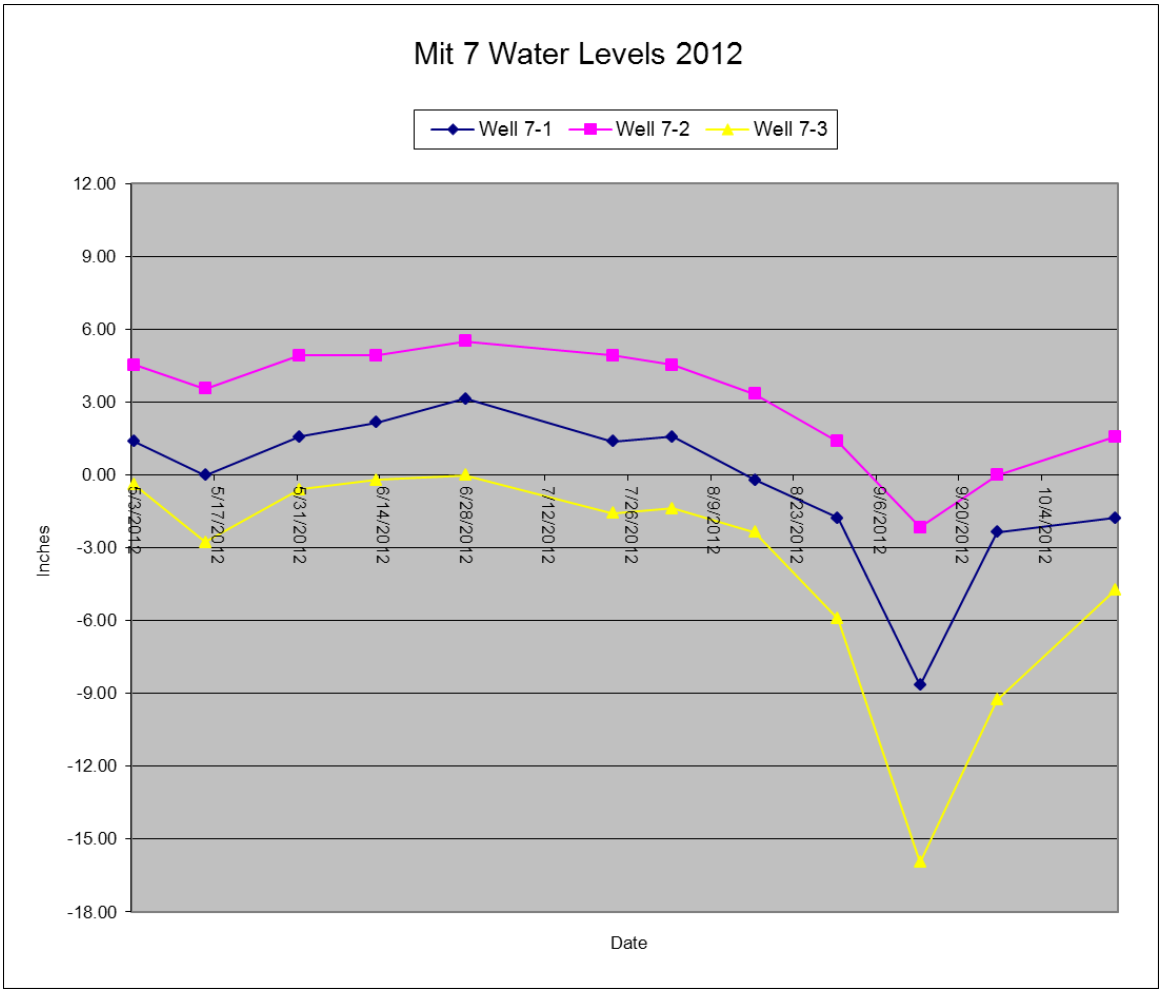
Mitigation Site 6, Plot 3 Dominant Species – September 2012. Plot dominated by invasive *Typha* species. Introduced species *Polygonum hydropiper* present.
**T. angustifolia, T. latifolia*, hybrids

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 6 – All Species Present
Species Richness = 46

Agrostis hyemails
Alisma plantago-aquatica
Anaphalis margaritacea
Aster lanceolatus
Aster puniceus
Betula papyrifera
Bidens cernua
Bidens frondosa
Calamagrostis canadensis
Carex cannescens
Carex interior
Carex lacustris
Carex rostrata
Carex scoparia
Carex sp.
Carex stipata
Carex tribuloides
Cirsium arvense
Cirsium vulgare
Eleocharis smallii
Epilobium coloratum
Equisetum fluviatile
Galium tinctorium
Glyceria canadensis
Glyceria grandis
Hieracium aurantiacum
Hypericum mutilum
Juncus brevicaudauts
Juncus filiformis
Lemna minor
Onoclea sensibilis
Phalaris arundinacea
Poa palustris
Polygonum hydropiper
Populus tremuloides
Potentilla norvegica
Rubus strigosus
Salix bebbiana
Salix discolor
Salix humilis
Salix petiolaris
Scirpus cyperinus
Scirpus microcarpus
Sium suave
Typha angustifolia
Typha latifolia

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 7 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Scirpus cyperinus*	Native	W2	95
	Typha angustifolia	Invasive		95
	Glyceria canadensis	Native		10
	Glyceria grandis	Native	W2	10
	Juncus effusus	Native	W2	10
	Carex scoparia	Native		5
	Poa palustris	Native	WT1,W2	5
	Typha latifolia	Native		2
	Phalaris arundinacea	Invasive		2
			TOTAL COVER	234

Mitigation Site 7, Plot 1 Dominant Species – July 2012. Plot co-dominated by invasive *Typha angustifolia* and native *Scirpus cyperinus* species. Invasive species *Phalaris arundinacea* present.

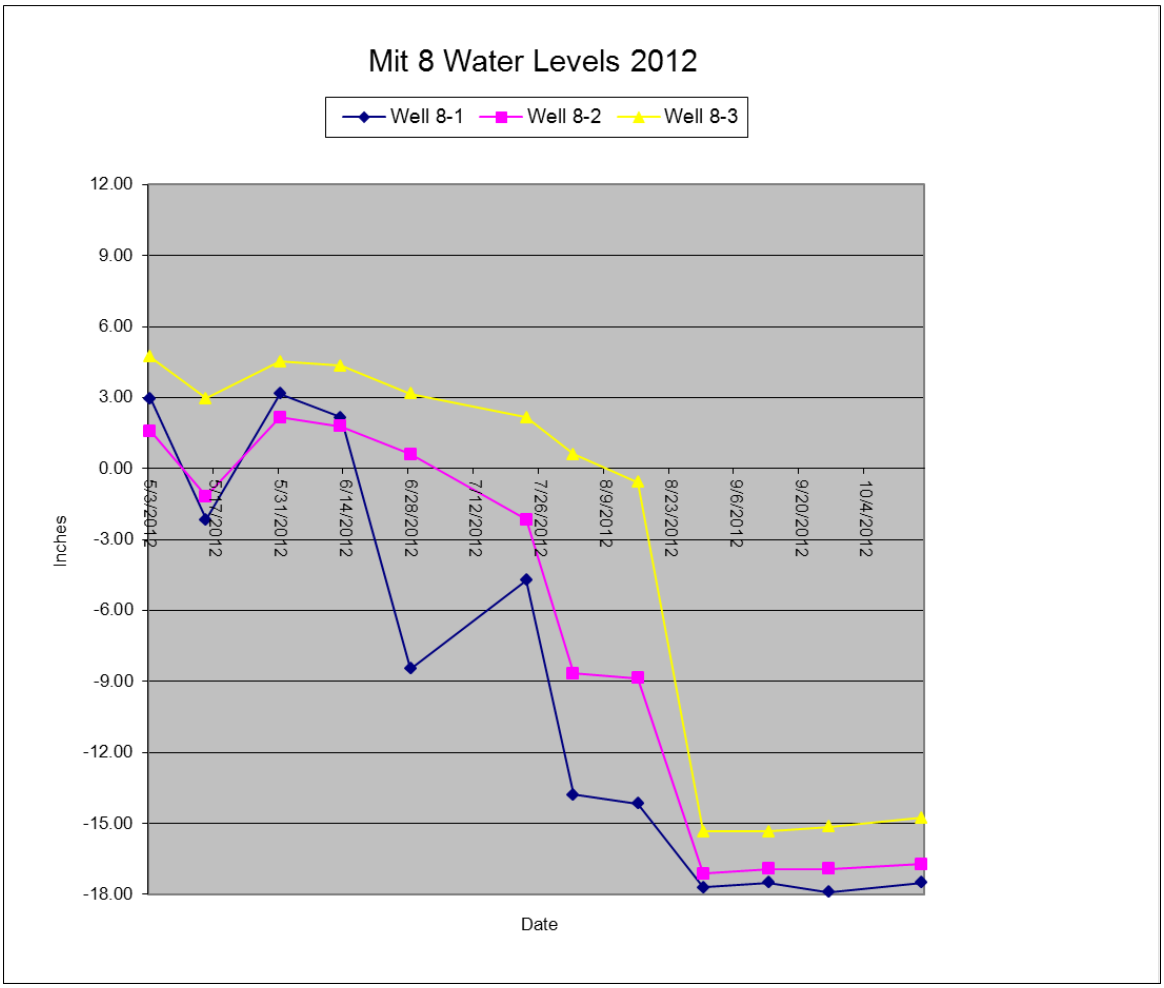
Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Scirpus cyperinus*	N	W2	90
	Typha angustifolia	I		80
	Juncus effusus	N	W2	15
	Calamagrostis canadensis	N	W2	10
	Glyceria grandis	N	W2	10
	Glyceria canadensis	N		5
	Epilobium leptophyllum	N		2
	Typha latifolia	N		2
	Agrostis hyemalis	N		1
	Carex scoparia	N		1
	Phalaris arundinacea	I		1
	Scirpus atrovirens	N		1
			TOTAL COVER	218

Mitigation Site 7, Plot 1 Dominant Species – September 2012. Plot co-dominated by invasive *Typha angustifolia* and native *Scirpus cyperinus* species. *Juncus effusus* moderately dominant. Invasive species *Phalaris arundinacea* present.

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 7 – All Species Present
Species Richness = 27
Agrostis hyemalis
Alisma plantago-aquatica
Alnus rugosa
Beckmannia syzigachne
Calamagrostis canadensis
Carex scoparia
Carex stipata
Chrysanthemum leucanthemum
Epilobium coloratum
Epilobium leptophyllum
Equisetum sylvaticum
Glyceria canadensis
Glyceria grandis
Juncus effusus
Juncus filiformis
Phalaris arundinacea
Poa palustris
Populus tremuloides
Ranunculus acris
Salix bebbiana
Scirpus atrovirens
Scirpus cyperinus
Scirpus validus
Tanacetum vulgare
Trifolium repens
Typha angustifolia
Typha latifolia

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 8 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	100
	Phalaris arundinacea	Invasive		5
	Populus tremuloides	Native		5
	Salix bebbiana	Native		5
	Solidago gigantea	Native	W2	5
	Aster lanceolatus	Native		2
	Carex tenera	Native		2
			TOTAL COVER	124

Mitigation Site 8, Plot 1 Dominant Species – July 2012. Plot dominated by native *Scirpus cyperinus* species. Invasive species *Phalaris arundinacea* present.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Scirpus cyperinus*	Native	W2	70
	Calamagrostis canadensis	Native	W2	30
	Glyceria grandis	Native	W2	20
	Aster lanceolatus	Native		10
	Cyperaceae sp.	Native		5
	Juncus effusus	Native	W2	5
	Carex retrorsa	Native		2
	Poa palustris	Native	WT1,W2	2
	Salix bebbiana	Native		2
	Aster puniceus	Native	W2	1
	Carex stipata	Native		1
	Carex tenera	Native		1
	Cirsium arvense	Introduced		1
			TOTAL COVER	150

Mitigation Site 8, Plot 2 Dominant Species – July 2012. Plot dominated by native *Scirpus cyperinus, Calamagrostis canadensis,* and *Glyceria grandis*. Introduced species *Cirsium arvense* present.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Carex lacustris*	Native		70
	Typha species mixed	Invasive		50
	Glyceria grandis	Native	W2	25
	Carex rostrata	Native		10
	Scirpus cyperinus	Native	W2	10
	Scirpus microcarpus	Native		10
	Epilobium leptophyllum	Native		2
			TOTAL COVER	177

Mitigation Site 8, Plot 3 Dominant Species – July 2012. Plot co-dominated by native *Carex lacustris* and invasive mixed *Typha* species. *Glyceria grandis* moderately dominant.

***Mitigation Site 8, Plot 4 – Survey missed July 2012**

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Calamagrostis canadensis*	Native	W2	50
	Scirpus cyperinus	Native	W2	50
	Salix bebbiana	Native		20
	Populus tremuloides	Native		15
	Betula papyrifera	Native		5
	Juncus effusus	Native	W2	5
	Aster lanceolatus	Native		2
	Scirpus microcarpus	Native		2
			TOTAL COVER	149

Mitigation Site 8, Plot 5 Dominant Species – July 2012. Plot co-dominated by native *Calamagrostis canadensis* and *Scirpus cyperinus*. Native shrub/tree species *Salix bebbiana* and *Populus tremuloides* moderately dominant.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Scirpus cyperinus*	Native	W2	95
	Aster lanceolatus	Native		15
	Phalaris arundinacea	Invasive		10
	Eupatorium maculatum	Native	W2	5
	Populus tremuloides	Native		5
	Salix bebbiana	Native		5
	Cirsium arvense	Introduced		1
	Rubus strigosus	Native		1
			TOTAL COVER	137

Mitigation Site 8, Plot 1 Dominant Species – September 2012. Plot dominated by native *Scirpus cyperinus*. Invasive species *Phalaris arundinacea* and introduced species *Cirsium arvense* present.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Scirpus cyperinus*	Native	W2	60
	Calamagrostis canadensis	Native	W2	40
	Glyceria grandis	Native	W2	20
	Aster lanceolatus	Native		10
	Phalaris arundinacea	Invasive		10
	Juncus effusus	Native	W2	5
	Poa palustris	Native	WT1,W2	5
	Aster puniceus	Native	W2	2
	Cirsium arvense	Introduced		2
	Salix bebbiana	Native		2
	Carex atherodes	Native		1
	Cyperaceae sp.	Native		1
	Salix petiolaris	Native		1
			TOTAL COVER	159

Mitigation Site 8, Plot 2 Dominant Species – September 2012. Plot dominated by native *Scirpus cyperinus, Calamagrostis canadensis,* and *Glyceria grandis.* Invasive species *Phalaris arundinacea* and introduced species *Cirsium arvense* present.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Carex lacustris*	Native		85
	Typha species mixed	Invasive		40
	Carex rostrata	Native		10
	Scirpus cyperinus	Native	W2	10
	Scirpus microcarpus	Native		10
	Calamagrostis canadensis	Native	W2	5
	Glyceria grandis	Native	W2	2
	Rumex sp.	Native		1
			TOTAL COVER	163

Mitigation Site 8, Plot 3 Dominant Species – September 2012. Plot co-dominated by native *Carex lacustris* and invasive mixed *Typha* species.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Typha angustifolia*	Invasive		85
	Scirpus cyperinus	Native	W2	70
	Glyceria grandis	Native	W2	30
	Typha latifolia	Native		5
	Epilobium leptophyllum	Native		2
	Epilopbium ciliatum	Native		1
	Scirpus validus	Native		1
			TOTAL COVER	194

Mitigation Site 8, Plot 4 Dominant Species – September 2012. Plot co-dominated by invasive *Typha angustifolia* and native *Scirpus cyperinus* species. *Glyceria grandis* moderately dominant.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Calamagrostis canadensis*	Native	W2	70
	Scirpus cyperinus	Native	W2	40
	Salix bebbiana	Native		20
	Juncus effusus	Native	W2	15
	Populus tremuloides	Native		15
	Aster lanceolatus	Native		5
	Betula papyrifera	Native		5
	Carex lacustris	Native		5
	Scirpus microcarpus	Native		5
	Poa palustris	Native	WT1,W2	2
	Salix eriocephala	Native		2
	Aster modestus	Native		1
	Aster puniceus	Native	W2	1
	Euthamia graminifolia	Native	W2	1
	Tanacetum vulgare	Invasive		1
			TOTAL COVER	188

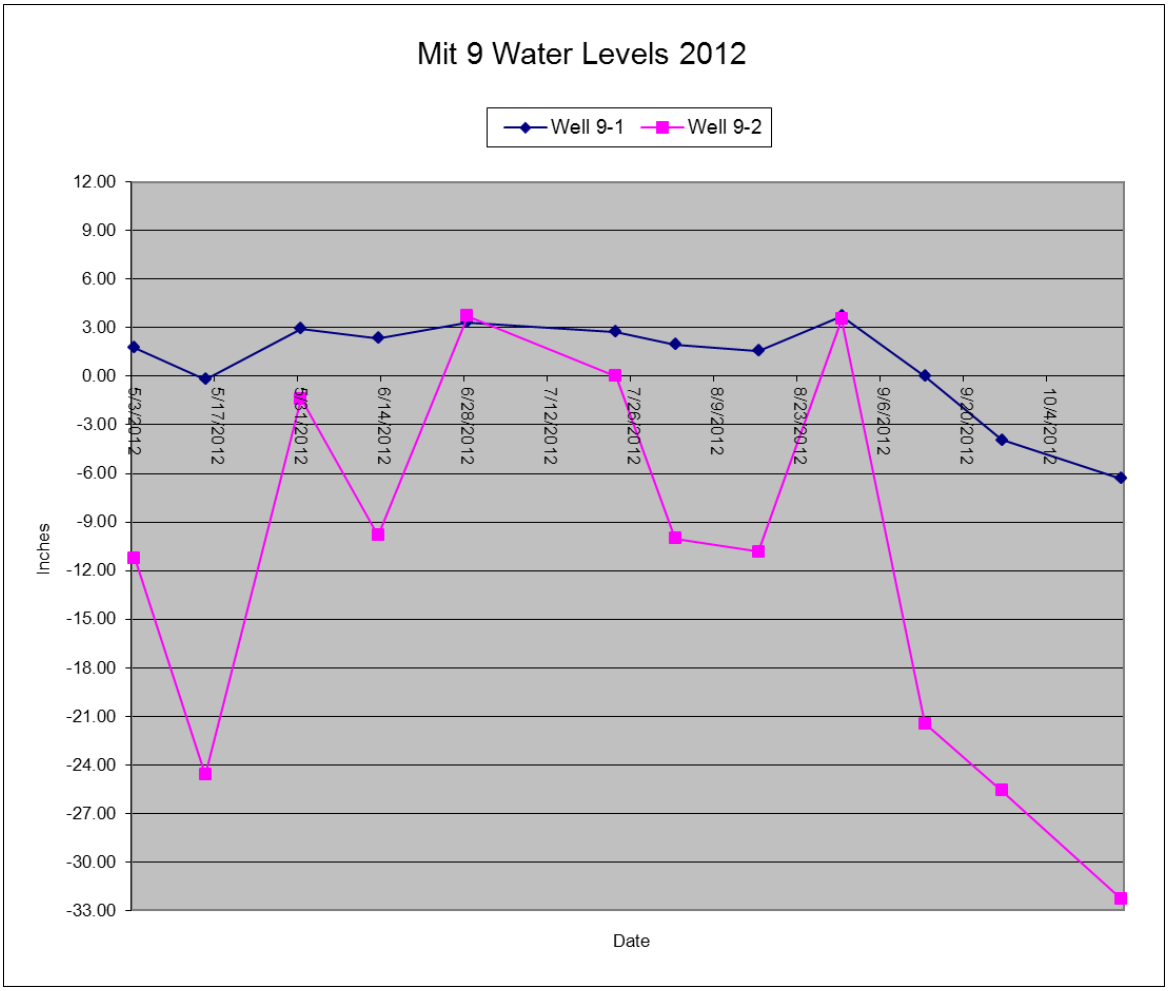
Mitigation Site 8, Plot 5 Dominant Species – September 2012. Plot co-dominated by native *Calamagrostis canadensis* and *Scirpus cyperinus* species. Native *Salix bebbiana*, *Juncus effusus*, and *Populus tremuloides* moderately dominant. Invasive species *Tanacetum vulgare* present.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 8 – All Species Present
Species Richness = 45

Agrostis hyemalis
Alisma plantago-aquatica
Anaphalis margaritacea
Aster lanceolatus
Aster modestus
Aster puniceus
Beckmannia syzigachne
Betula papyrifera
Calamagrostis canadensis
Carex atherodes
Carex cannescens
Carex hystricina
Carex interior
Carex lacustris
Carex retrorsa
Carex rostrata
Carex scoparia
Carex stipata
Carex tenera
Cirsium arvense
Cyperaceae sp.
Epilobium leptophyllum
Epilopbium ciliatum
Eupatorium maculatum
Euthamia graminifolia
Fragaria virginiana
Glyceria grandis
Juncus effusus
Phalaris arundinacea
Poa palustris
Populus tremuloides
Rubus strigosus
Rumex sp.
Salix bebbiana
Salix eriocephala
Salix petiolaris
Scirpus cyperinus
Scirpus microcarpus
Scirpus validus
Solidago gigantea
Sparganium glomeratum
Tanacetum vulgare
Typha angustifolia
Typha latifolia
Viola novae-angliae

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 9 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha angustifolia*	Invasive		60
	Scirpus sp.	Native		50
	Typha latifolia	Native		30
	Betula pumila	Native		10
	Calamagrostis canadensis	Native	W2	10
	Carex cannescens	Native		10
	Salix bebbiana	Native		10
	Viola pallens	Native		10
	Alnus rugosa	Native		5
	Salix discolor	Native		5
	Sphagnum moss	Native		5
	Carex sp.	Native		2
	Salix petiolaris	Native		2
	Agrostis hyemalis	Native		0.1
	Equisetum fluviatile	Native		0.1
	Menyanthes trifoliata	Native		0.1
			TOTAL COVER	209.3

Mitigation Site 9, Plot 1 Dominant Species – July 2012. Plot co-dominated by invasive *Typha angustifolia* and native *Scirpus* species. Native *Typha latifolia* moderately dominant.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Glyceria canadensis*	Native		50
	Euthamia graminifolia	Native	W2	25
	Scirpus cyperinus	Native	W2	20
	Agrostis gigantea	Native		10
	Calamagrostis canadensis	Native	W2	10
	Carex interior	Native		10
	Festuca rubra	Native		10
	Viola pallens	Native		10
	Cirsium arvense	Introduced		5
	Fragaria virginiana	Native		5
	Lycopus uniflorus	Native		5
	Rubus strigosus	Native		2
	Eupatorium maculatum	Native	W2	1
	Lotus corniculatus	Introduced		1
	Poa palustris	Native	WT1,W2	1
	Salix bebbiana	Native		0.1
			TOTAL COVER	165.1

Mitigation Site 9, Plot 2 Dominant Species – July 2012. Plot dominated by native *Glyceria canadensis*. Native *Euthamia graminifolia* and *Scirpus cyperinus* moderately dominant. Introduced species *Cirsium arvense* and *Lotus corniculatus* present.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Calamagrostis canadensis*	Native	W2	80
	Typha angustifolia	Invasive		60
	Scirpus sp.	Native		50
	Sphagnum moss	Native		35
	Typha latifolia	Native		25
	Betula pumila	Native		10
	Carex sp.	Native		10
	Lysimachia terrestris	Native		10
	Salix bebbiana	Native		10
	Viola pallens	Native		10
	Alnus rugosa	Native		5
	Salix discolor	Native		5
	Salix petiolaris	Native		2
			TOTAL COVER	312

Mitigation Site 9, Plot 1 Dominant Species – September 2012. Plot dominated by native *Calamagrostis canadensis* and *Scirpus* species, along with invasive *Typha angustifolia*. Native *Sphagnum* moss and *Typha latifolia* moderately dominant.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Glyceria canadensis*	Native		55
	Carex sp.	Native		25
	Euthamia graminifolia	Native	W2	25
	Viola pallens	Native		20
	Agrostis gigantea	Native		10
	Calamagrostis canadensis	Native	W2	10
	Equisetum arvense	Native		10
	Rubus strigosus	Native		10
	Scirpus cyperinus	Native	W2	10
	Festuca rubra	Native		5
	Hieracium cespitosum	Introduced		1
	Typha latifolia	Native		1
			TOTAL COVER	182

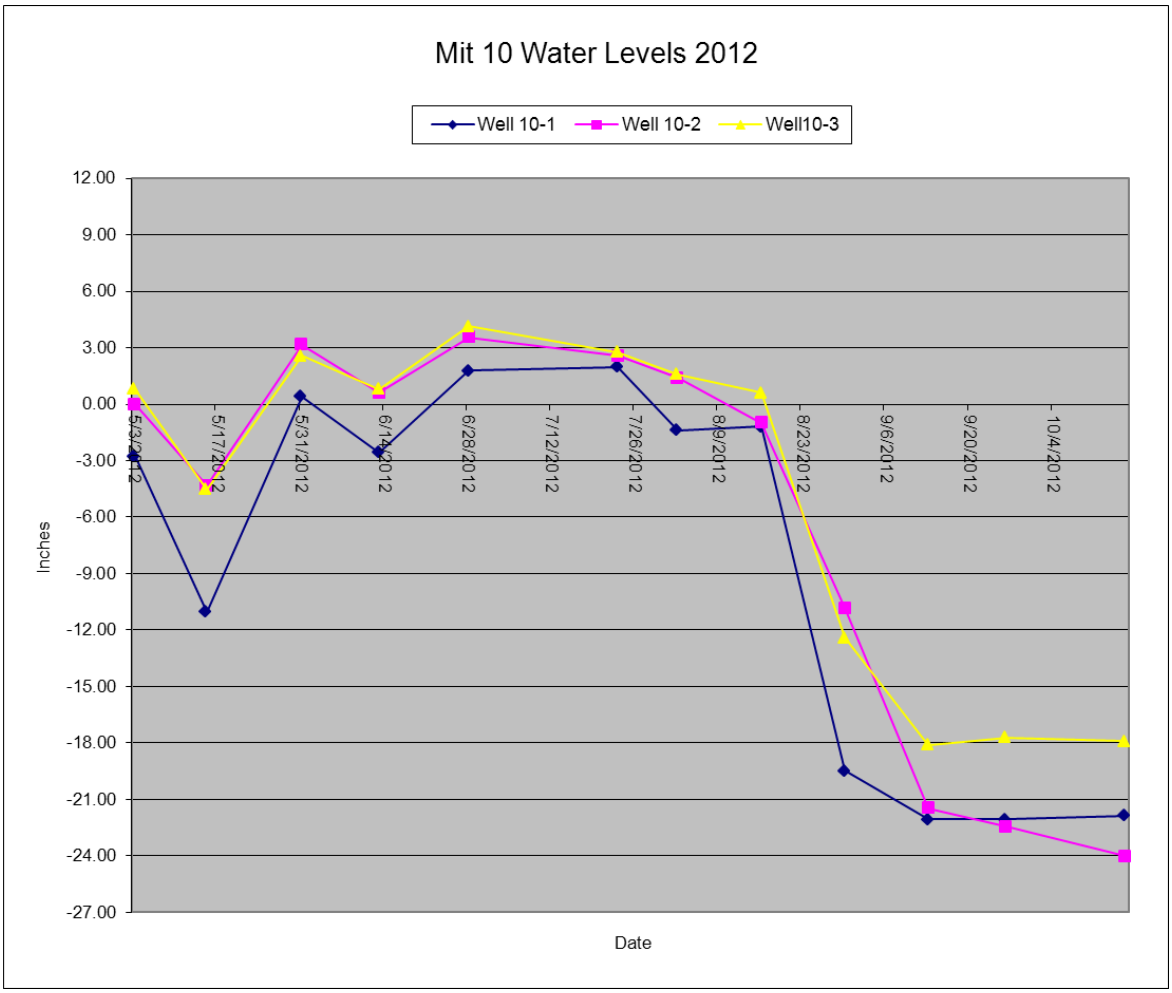
Mitigation Site 9, Plot 2 Dominant Species – September 2012. Plot dominated by native *Glyceria canadensis*. Native *Carex* species, *Euthamia graminifolia*, and *Viola pallens* are moderately dominant. Introduced species *Hieracium cespitosum* present.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 9 – All Species Present
Species Richness = 60

Achillea millefolium
Agrostis gigantea
Agrostis hyemalis
Alnus rugosa
Anaphalis margaritacea
Aster macrophyllus
Betula papyrifera
Betula pumila
Bidens cernua
Bidens frondosa
Calamagrostis canadensis
Calla palustris
Carex cannescens
Carex interior
Carex sp.
Carex tenera
Chamaedaphne calyculata
Cirsium arvense
Epilobium ciliatum
Equisetum arvense
Equisetum fluviatile
Equisetum hyemale
Eriophorum angustifolium
Eupatorium maculatum
Euthamia graminifolia
Festuca ovina
Festuca rubra
Fragaria virginiana
Glyceria canadensis
Glyceria grandis
Hieracium aurantiacum
Hieracium cespitosum
Iris versicolor
Lotus corniculatus
Lycopus uniflorus
Lysimachia terrestris
Menyanthes trifoliata
Oenothera parviflora
Phleum pratense
Plantago major
Poa palustris
Polygonum pensylvanicum
Potentilla palustris
Rubus strigosus
Salix bebbiana
Salix discolor
Salix exigua
Salix pedicellaris
Salix petiolaris
Salix pyrifolia
Scirpus cyperinus
Scirpus sp.
Solidago gigantea
Solidago nemoralis
Sonchus sp.
Sphagnum moss
Tanacetum vulgare
Typha angustifolia
Typha latifolia
Viola pallens

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 10 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow & Shrub Carr	*Salix bebbiana*	Native		30
	Agrostis hyemalis	Native		20
	Scirpus cyperinus	Native	W2	20
	Juncus effusus	Native	W2	10
	Populus balsaminifera	Native		5
	Populus tremuloides	Native		5
	Juncus brevicaudatus	Native		2
	Juncus tenuis	Native		2
	Typha latifolia	Native		2
	Carex deflexa	Native		1
	Carex tenera	Native		1
	Salix petiolaris	Native		1
			TOTAL COVER	99

Mitigation Site 10, Plot 1 Dominant Species – July 2012. Plot dominated by native *Salix bebbiana, Agrostis hyemalis,* and *Scirpus cyperinus*.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Open Bog	*Carex oligosperma*	Native		80
	Sphagnum moss	Native		50
	Chamaedaphne calyculata	Native		30
	Carex sp.	Native		20
	Poa palustris	Native	WT1,W2	20
	Scirpus cyperinus	Native	W2	10
	Salix bebbiana	Native		2
	Salix petiolaris	Native		2
	Typha latifolia	Native		1
	Eriophorum angustifolium	Native		0.1
	Euthamia graminifolia	Native	W2	0.1
			TOTAL COVER	215.2

Mitigation Site 10, Plot 2 Dominant Species – July 2012. Plot co-dominated by native *Carex oligosperma* and *Sphagnum* species. Native *Chamaedaphne calyculata, Carex* species, and *Poa palustris* moderately dominant.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Open Bog	*Sphagnum* moss	Native		100
	Carex oligosperma	Native		90
	Agrostis hyemalis	Native		30
	Carex sp.	Native		25
	Chamaedaphne calyculata	Native		20
	Polytrichum moss	Native		10
	Lycopus uniflorus	Native		2
	Poa palustris	Native	WT1,W2	2
	Salix bebbiana	Native		2
	Salix petiolaris	Native		2
	Andromeda glaucophylla	Native		1
	Scirpus cyperinus	Native	W2	1
	Typha latifolia	Native		1
			TOTAL COVER	286

Mitigation Site 10, Plot 3 Dominant Species – July 2012. Plot co-dominated by native *Sphagnum* species and *Carex oligosperma*. Native *Agrostis hyemalis*, *Carex* species, and *Chamaedaphne calyculata* moderately dominant.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow & Shrub Carr	*Scirpus cyperinus*	Native	W2	45
	Polytrichum moss	Native		40
	Agrostis hyemalis	Native		30
	Salix bebbiana	Native		25
	Juncus brevicaudatus	Native		10
	Populus tremuloides	Native		10
	Salix petiolaris	Native		10
	Juncus effusus	Native	W2	5
	Typha latifolia	Native		5
	Carex oligosperma	Native		2
	Carex rostrata	Native		2
	Salix sp.	Native		2
	Betula papyrifera	Native		0.1
	Populus balsaminifera	Native		0.1
			TOTAL COVER	186.2

Mitigation Site 10, Plot 1 Dominant Species – September 2012. Plot dominated by native *Scirpus cyperinus* and *Polytrichum* moss. Native *Agrostis hyemalis* and *Salix bebbiana* moderately dominant.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Open Bog	*Carex oligosperma*	Native		80
	Sphagnum moss	Native		50
	Agrostis hyemalis	Native		30
	Poa palustris	Native	WT1,W2	25
	Carex rostrata	Native		20
	Chamaedaphne calyculata	Native		20
	Scirpus cyperinus	Native	W2	15
	Calamagrostis canadensis	Native	W2	10
	Iris versicolor	Native	W2	10
	Aster lanceolatus	Native		5
	Salix bebbiana	Native		2
	Salix petiolaris	Native		2
	Carex paupercula	Native		1
	Typha latifolia	Native		1
	Andromeda glaucophylla	Native		0.1
	Eriophorum angustifolium	Native		0.1
	Euthamia graminifolia	Native	W2	0.1
			TOTAL COVER	271.3

Mitigation Site 10, Plot 2 Dominant Species – September 2012. Plot dominated by native *Carex oligosperma* and *Sphagnum* moss. Native *Agrostis hyemalis, Poa palustris, Carex rostrata, Chamaedaphne calyculata* and *Scirpus cyperinus* moderately dominant.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Open Bog	*Sphagnum* moss	Native		100
	Carex oligosperma	Native		95
	Carex rostrata	Native		25
	Agrostis hyemalis	Native		20
	Polytrichum moss	Native		10
	Lycopus uniflorus	Native		5
	Salix bebbiana	Native		5
	Chamaedaphne calyculata	Native		2
	Salix petiolaris	Native		2
	Typha latifolia	Native		2
	Andromeda glaucophylla	Native		1
	Poa palustris	Native	WT1,W2	1
	Scirpus cyperinus	Native	W2	1
			TOTAL COVER	269

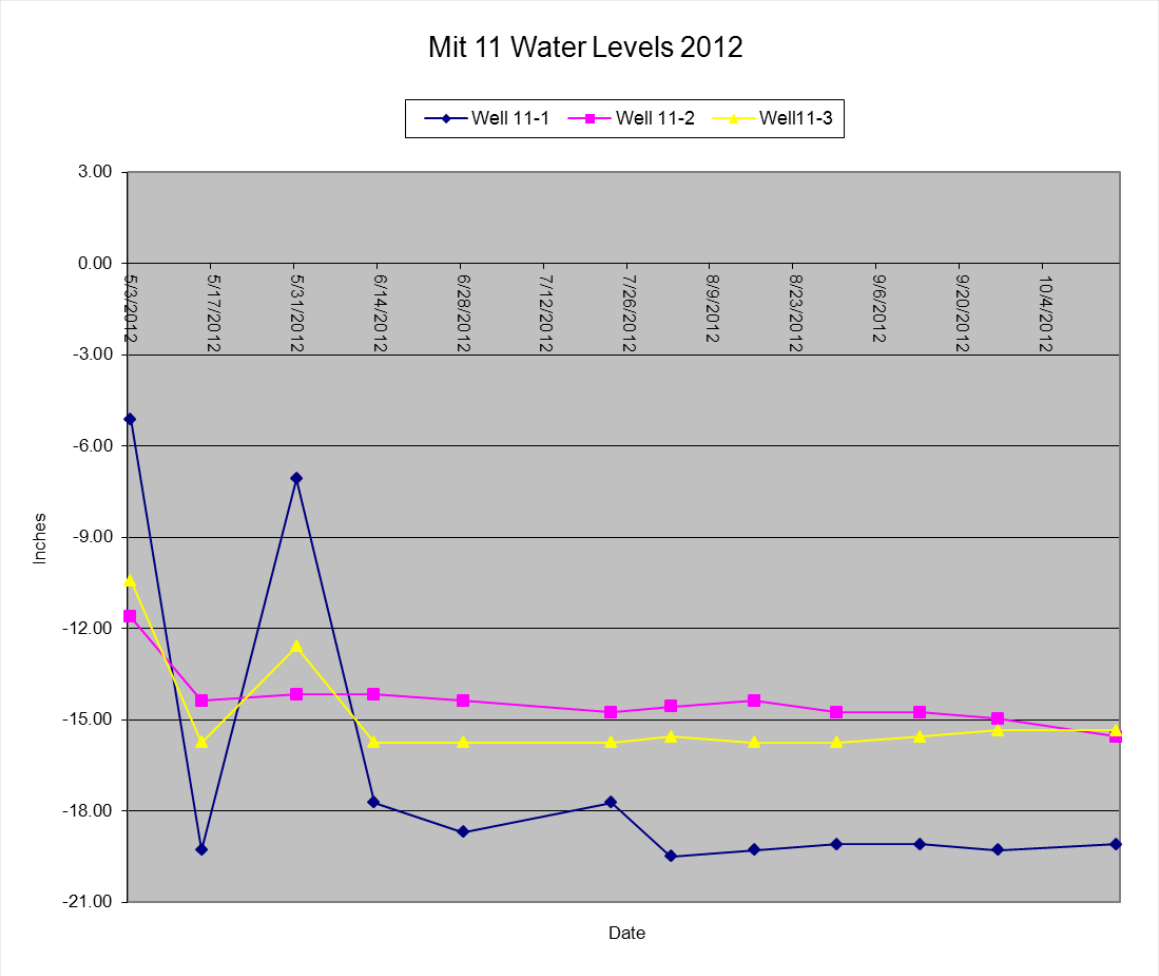
Mitigation Site 10, Plot 3 Dominant Species – September 2012. Plot dominated by native *Sphagnum* moss and *Carex oligosperma*. Native *Carex rostrata* and *Agrostis hyemalis* moderately dominant.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 10 – All Species Present
Species Richness = 67

Agropyron repens
Agrostis gigantea
Agrostis hyemalis
Andromeda glaucophylla
Aster lanceolatus
Beckmannia syzigachne
Betula papyrifera
Betula sp. seedling
Bidens cernua
Calamagrostis canadensis
Callitriche verna
Carex cannescens
Carex deflexa
Carex oligosperma
Carex paupercula
Carex rostrata
Carex sp.
Carex stricta
Carex tenera
Carex trisperma
Chamaedaphne calyculata
Chrysanthemum leucanthemum
Epilobium coloratum
Epilobium leptophyllum
Equisetum arvense
Equisetum fluviatile
Eriophorum angustifolium
Euthamia graminifolia
Glyceria grandis
Hieracium cespitosum
Iris versicolor
Juncus brevicaudatus
Juncus effusus
Juncus tenuis
Kalmia polifolia
Lycopus uniflorus
Lysimachia thyrsiflora
Menyanthes
Phalaris arundinacea
Plantago major
Poa palustris
Polygonum saggitatum
Polytrichum moss
Populus balsaminifera
Populus tremuloides
Potamogeton amplexicaulis
Potentilla palustris
Rumex acetosella
Salix bebbiana
Salix lucida
Salix petiolaris
Salix sp.
Sarracenia purpurea
Scirpus cyperinus
Scirpus validus
Solidago gigantea
Sparganium chlorocarpum
Sparganium glomeratum
Sphagnum moss
Tanacetum vulgare
Triadenum fraseri
Trifolium hybridum
Typha angustifolia
Typha latifolia
Typha spp.
Vaccinium oxycoccus
Viola pallens

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 11 Water Levels: May 3, 2012 – October 16, 2012.

The site **did not meet wetland criteria** of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface at any time during the monitoring period.

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Juncus effusus*	Native	W2	90
	Scirpus cyperinus	Native	W2	40
	Trifolium hybridum	Introduced		10
	Agrostis gigantea	Native		2
	Phalaris arundinacea	Invasive		2
	Scirpus validus	Native		2
	Typha latifolia	Native		2
	Carex tenera	Native		1
	Poa palustris	Native	WT1,W2	1
	Beckmannia syzigachne	Native	WT1,W2	0.1
	Rumex sp.	Introduced		0.1
			TOTAL COVER	150.2

Mitigation Site 11, Plot 1 Dominant Species – July 2012. Plot dominated by native *Juncus effuses* and *Scirpus cyperinus*. Invasive species *Phalaris arundinacea* and introduced species *Trifolium hybridum* and *Rumex* species present.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Phalaris arundinacea*	Invasive		90
	Scirpus cyperinus	Native	W2	10
	Glyceria canadensis	Native		5
	Agrostis gigantea	Native		2
	Chrysanthemum leucanthemum	Introduced		2
	Festuca ovina	Native		2
	Beckmannia syzigachne	Native	WT1,W2	1
	Cirsium vulgare	Introduced		1
	Festuca rubra	Native		1
	Phleum pratense	Introduced		1
	Trifolium hybridum	Introduced		1
	Potentilla norvegica	Native		0.1
			TOTAL COVER	116.1

Mitigation Site 11, Plot 2 Dominant Species – July 2012. Plot dominated by invasive *Phalaris arundinacea*. Introduced *Chrysanthemum leucanthemum*, *Cirsium vulgare*, *Phleum pratense*, and *Trifolium hybridum* present.

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Juncus effusus*	Native	W2	90
	Scirpus cyperinus	Native	W2	40
	Trifolium hybridum	Introduced		10
	Agrostis gigantea	Native		2
	Phalaris arundinacea	Invasive		2
	Scirpus validus	Native		2
	Typha latifolia	Native		2
	Carex tenera	Native		1
	Poa palustris	Native	WT1,W2	1
	Beckmannia syzigachne	Native	WT1,W2	0.1
	Rumex sp.	Native		0.1
			TOTAL COVER	150.2

Mitigation Site 11, Plot 1 Dominant Species – September 2012. Plot dominated by native *Juncus effuses* and *Scirpus cyperinus*. Invasive species *Phalaris arundinacea* and introduced species *Trifolium hybridum* present.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Fresh (Wet) Meadow	*Phalaris arundinacea*	Invasive		80
	Unknown sterile grass	Native		40
	Poa pratense	Introduced		15
	Chrysanthemum leucanthemum	Introduced		10
	Scirpus cyperinus	Native	W2	10
	Phleum pratense	Introduced		5
	Agropyron repens	Introduced		2
	Cirsium vulgare	Introduced		2
	Euthamia graminifolia	Native	W2	2
	Glyceria canadensis	Native		2
	Hieracium aurantiacum	Introduced		2
	Trifolium hybridum	Introduced		1
			TOTAL COVER	171

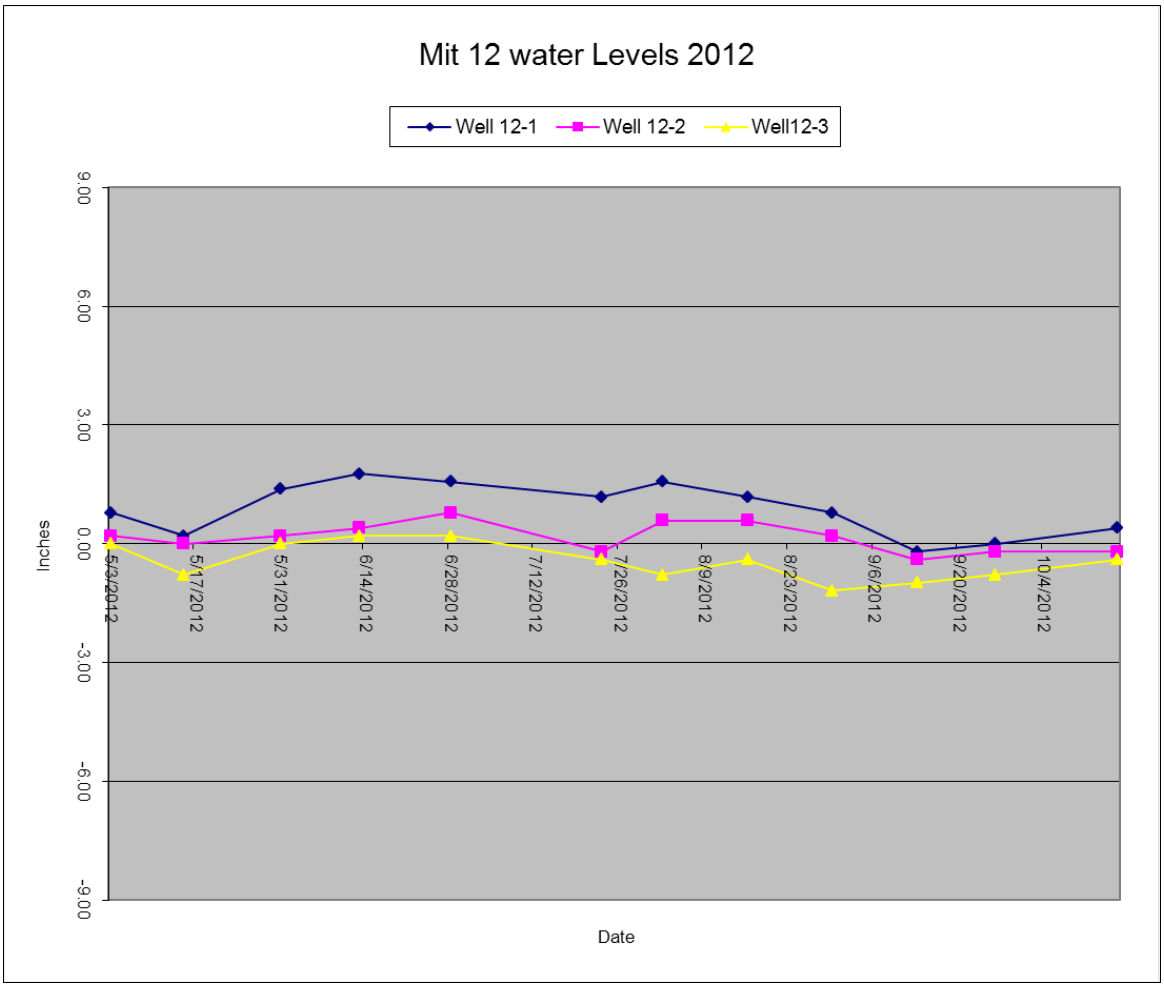
Mitigation Site 11, Plot 2 Dominant Species – September 2012. Plot dominated by invasive *Phalaris arundinacea* and an unknown sterile grass. Introduced *Poa pretense, Chrysanthemum leucanthemum, Phleum pretense, Agropyron repens*, *Cirsium vulgare*, *Hieracium aurantiacum,* and *Trifolium hybridum* present.

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 11 – All Species Present
Species Richness = 40

Achillea millefolium
Agropyron repens
Agrostis gigantea
Alnus rugosa
Aster lanceolatus
Beckmannia syzigachne
Calamagrostis canadensis
Caltha natans
Carex tenera
Chrysanthemum leucanthemum
Cirsium arvense
Cirsium vulgare
Erigeron annuus
Euthamia graminifolia
Festuca ovina
Festuca rubra
Glyceria canadensis
Hieracium aurantiacum
Hypericum canadense
Juncus effusus
Lotus corniculata
Phalaris arundinacea
Phleum pratense
Plantago major
Poa pratense
Potentilla norvegica
Ranunculus acris
Ranunculus pensylvanicus
Rudebeckia hirta
Rumex sp.
Scirpus cyperinus
Scirpus validus
Solidago gigantea
Tanacetum vulgare
Trifolium hybridum
Trifolium pratense
Trifolium repens
Typha latifolia
Unknown sterile grass
Viola pallens

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 12 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Marsh (?)	*Juncus effusus*	Native	W2	90
	Typha angustifolia	Invasive		20
	Aster sp.	Native		15
	Juncus nodosa	Native		10
	Poa palustris	Native	WT1,W2	10
	Polygonum saggitatum	Native		10
	Typha latifolia	Native		10
	Glyceria grandis	Native	W2	5
	Juncus brevicaudatus	Native		5
	Scirpus validus	Native		5
	Lythrum salicare	Invasive		5
	Carex crinita	Native		2
	Equisetum arvense	Native		2
	Onoclea sensibilis	Native		2
	Sagittaria latifolia	Native		0.1
	Scuttelaria lateriflora	Native		0.1
			TOTAL COVER	191.2

Mitigation Site 12, Plot 1 Dominant Species – July 2012. Plot dominated by native *Juncus effusus.* Invasive *Typha angustifolia* and native *Aster* species moderately dominant. Invasive species *Lythrum salicare* present.

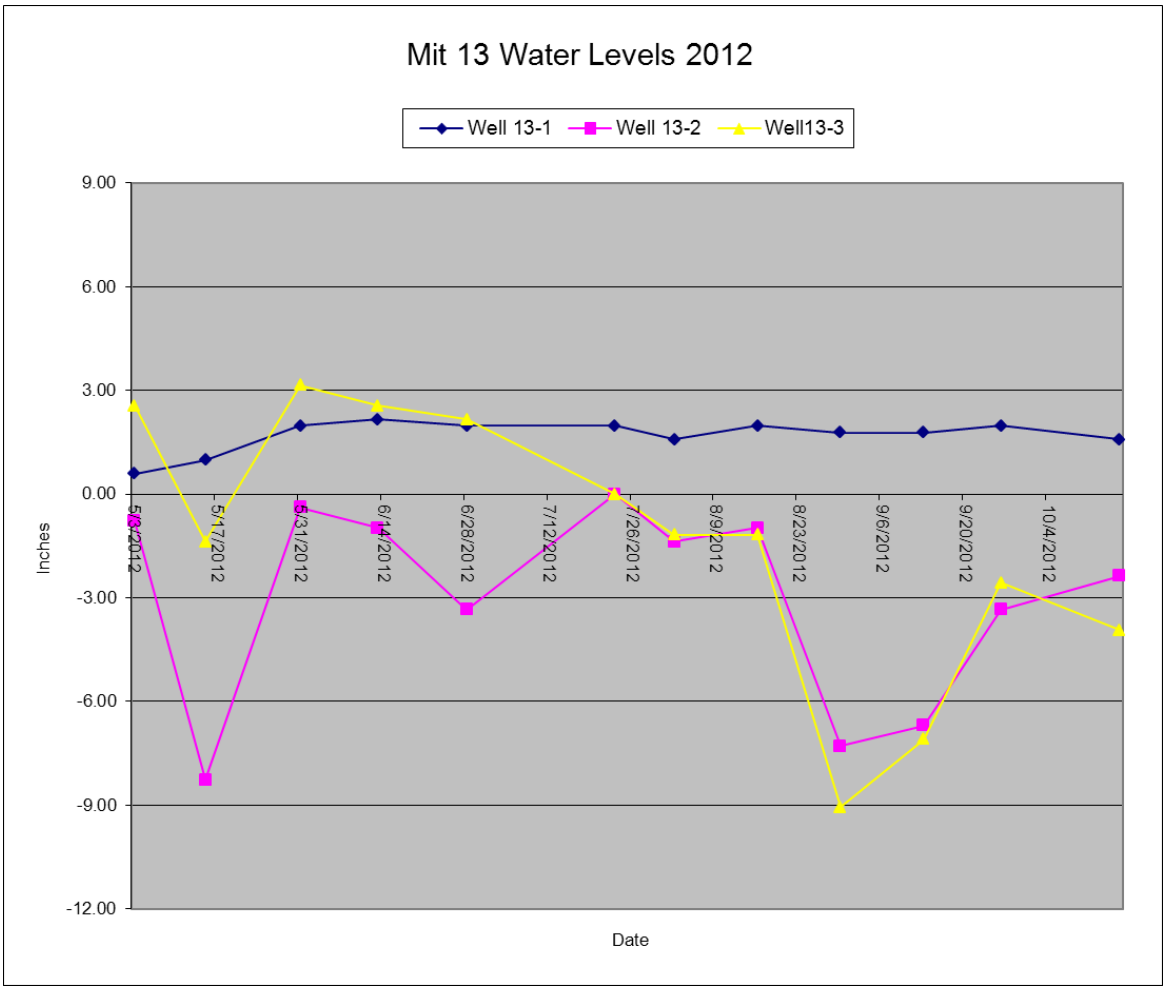
Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Marsh (?)	*Juncus effusus*	Native	W2	90
	Typha latifolia	Native		30
	Glyceria grandis	Native	W2	20
	Typha angustifolia	Invasive		10
	Carex crinita	Native		5
	Glyceria candensis	Native		5
	Lythrum salicare	Invasive		5
	Scirpus validus	Native		5
	Polygonum sagittatum	Native		2
			TOTAL COVER	172

Mitigation Site 12, Plot 1 Dominant Species – September 2012. Plot dominated by native *Juncus effusus*. Native *Typha latifolia* and *Glyceria grandis* moderately dominant. Invasive species *Typha angustifolia* and *Lythrum salicare* present.

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 12 – All Species Present
Species Richness = 35
Alisma plantago-aquatica
Alnus rugosa
Aster sp.
Beckmannia syzigachne
Betula papyrifera
Caltha natans
Caltha sp. seedlings
Carex crinita
Carex sp.
Carex trisperma
Epilobium coloratum
Equisetum arvense
Glyceria canadensis
Glyceria grandis
Glyceria striata
Hieracium aurantiacum
Juncus brevicaudatus
Juncus effusus
Juncus nodosa
Lysimachia terrestris
Lythrum salicare
Onoclea sensibilis
Poa palustris
Polygonum saggitatum
Populus tremuloides
Potentilla norvegica
Potentilla palustris
Rumex acetosella
Saggitaria latifolia
Scirpus microcarpus
Scirpus validus
Scuttelaria lateriflora
Sphagnum
Typha angustifolia
Typha latifolia

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 13 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Juncus effusus*	Native	W2	40
	Scirpus cyperinus	Native	W2	40
	Polytrichum moss	Native		30
	Agrostis hyemalis	Native		10
	Juncus brevicaudatus	Native		10
	Viola pallens	Native		10
	Aster sp.	Native		5
	Carex stipata	Native		5
	Equisetum sylvaticum	Native		5
	Poa palustris	Native	WT1,W2	5
	Carex brunnescens	Native		2
	Carex cannescens	Native		2
	Carex tenera	Native		2
	Equisetum arvense	Native		2
	Euthamia graminifolia	Native	W2	2
	Lysimachia sp.	Native		2
	Lythrum salicare	Invasive		2
	Anaphalis margaritacea	Native		1
	Beckmannia syzigachne	Native	WT1,W2	1
	Betula papyrifera	Native		0.1
	Eupatorium maculatum	Native	W2	0.1
	Eupatorium perfoliatum	Native		0.1
	Populus tremuloides	Native		0.1
	Salix discolor	Native		0.1
	Spiraea alba	Native		0.1
			TOTAL COVER	176.6

Mitigation Site 13, Plot 1 Dominant Species – July 2012. Plot dominated by native *Juncus effusus, Scirpus cyperinus* and *Polytrichum* moss. Invasive *Lythrum salicare* present.

***Mitigation Site 13, Plot 2 – Survey missed July 2012**

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Calamagrostis canadensis*	Native	W2	30
	Typha latifolia	Native		30
	Lythrum salicare	Invasive		20
	Agrostis hyemalis	Native		15
	Juncus effusus	Native	W2	15
	Scirpus cyperinus	Native	W2	15
	Glyceria canadensis	Native		10
	Alnus rugosa	Native		5
	Aster lanceolatus	Native		5
	Carex sp.	Native		5
	Typha hybrid	Invasive		5
	Epilobium leptophyllum	Native		1
			TOTAL COVER	156

Mitigation Site 13, Plot 1 Dominant Species – September 2012. Plot dominated by native *Calamagrostis canadensis* and *Typha latifolia*. Invasive *Lythrum salicare* and native *Agrostis hyemalis*, *Juncus effusus*, and *Scirpus cyperinus* moderately dominant. Invasive *Typha* hybrid present.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Sedge Meadow	*Calamagrostis canadensis*	Native	W2	70
	Scirpus cyperinus	Native	W2	35
	Lythrum salicare	Invasive		15
	Juncus effusus	Native	W2	10
	Agrostis gigantea	Native		5
	Alnus rugosa	Native		5
	Aster lanceolatus	Native		5
	Betula papyrifera	Native		5
	Carex stipata	Native		2
	Lysimachia terrestris	Native		2
	Salix discolor	Native		2
	Agrostis hyemalis	Native		1
	Euthamia graminifolia	Native	W2	1
			TOTAL COVER	158

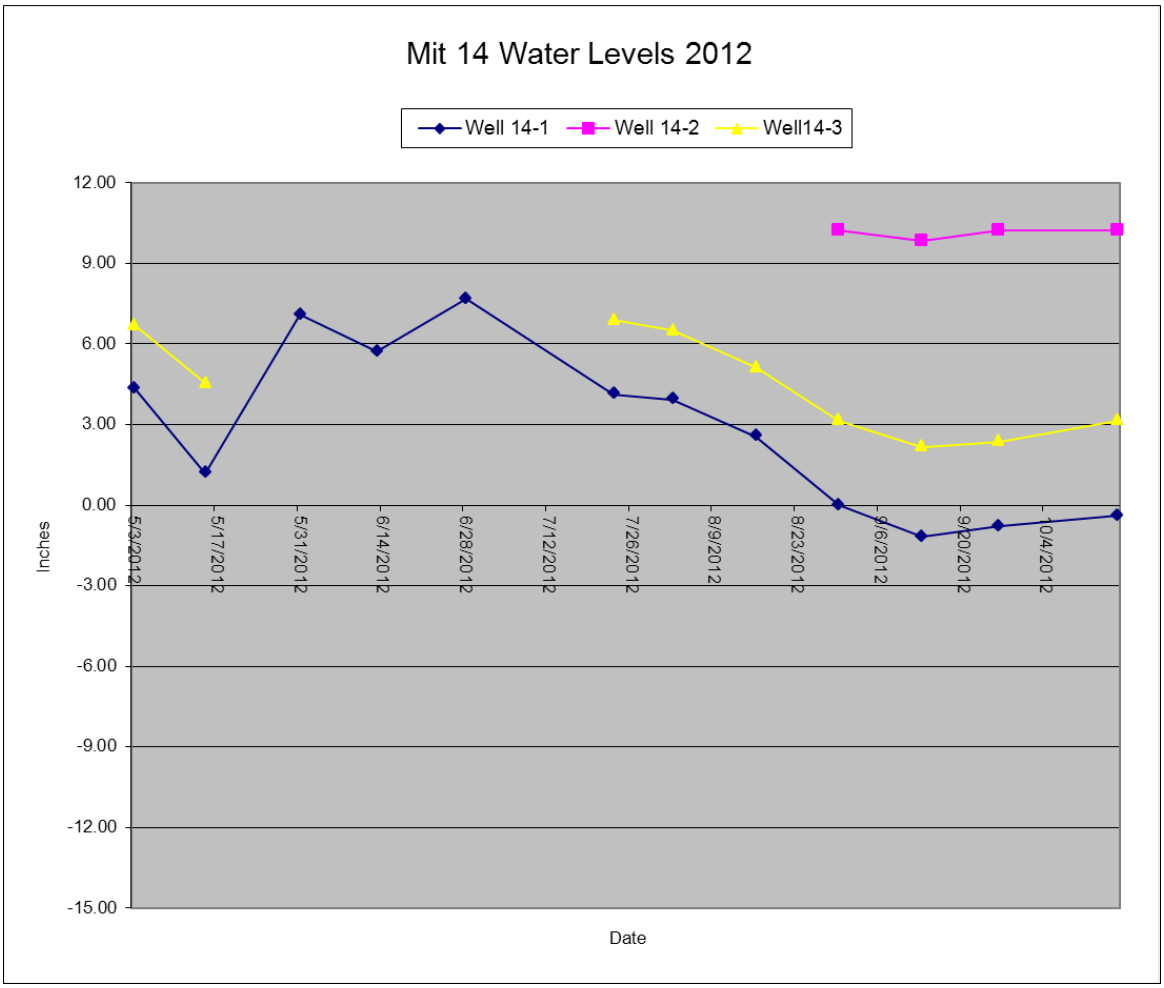
Mitigation Site 13, Plot 2 Dominant Species – September 2012. Plot dominated by native *Calamagrostis canadensis* and *Scirpus cyperinus*. Invasive *Lythrum salicare* moderately dominant.

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 13 – All Species Present
Species Richness = 64

Abies balsamea
Agrostis gigantea
Agrostis hyemalis
Alnus rugosa
Anaphalis margaritacea
Aster lanceolatus
Aster sp.
Beckmannia syzigachne
Betula papyrifera
Calamagrostis canadensis
Calla palustris
Caltha natans
Carex brunnescens
Carex cannescens
Carex interior
Carex lasiocarpa
Carex leptalea
Carex retrorsa
Carex sp.
Carex stipata
Carex tenera
Carex trisperma
Cirsium arvense
Drosera rotundifolia
Eleocharis acicularis
Epilobium leptophyllum
Equisetum arvense
Equisetum sylvaticum
Eupatorium maculatum
Eupatorium perfoliatum
Euthamia graminifolia
Glyceria canadensis
Hieracium aurantiacum
Iris versicolor
Juncus brevicaudatus
Juncus effusus
Lysimachia sp.
Lysimachia terrestris
Lysimachia thyrsiflora
Lythrum salicare
Menyanthes
Phalaris arundinacea
Poa palustris
Polygonum amphibium
Polytrichum mosses
Populus tremuloides
Potamogeton sp.
Potentilla norvegica
Potentilla palustris
Salix discolor
Salix sp. seedlings
Scirpus cyperinus
Scutellaria galericulata
Sparganium chlorocarpum
Sparganium glomeratum
Sphagnum moss
Spiraea alba
Taraxacum officinalis
Trifolium hybridum
Trifolium repens
Typha hybrid
Typha latifolia
Utricularia sp.
Viola pallens

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013



Mitigation Site 14 Water Levels: May 3, 2012 – October 16, 2012.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface. Some wells could not be reached at certain times of year because of high water levels.

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha angustifolia*	Invasive		90
	Typha latifolia	Native		30
	Scirpus cyperinus	Native	W2	20
	Carex cannescens	Native		1
	Calamagrostis canadensis	Native	W2	1
	Poa palustris	Native	WT1,W2	0.1
	Lemna sp.	Native		0.1
	Glyceria canadensis	Native		0.1
	Beckmannia syzigachne	Native	WT1,W2	0.1
			TOTAL COVER	142.4

Mitigation Site 14, Plot 1 Dominant Species – July 2012. Plot dominated by invasive *Typha angustifolia*. Native *Typha latifolia* and *Scirpus cyperinus* moderately dominant.

Eggers & Reed Type	Species	Designation	Seed Mix	% Cover
Shallow Marsh	*Typha angustifolia*	Invasive		90
	Typha latifolia	Native		25
	Grass-like seedlings	Native		5
	Scirpus cyperinus	Native	W2	5
	Carex cannescens	Native		2
			TOTAL COVER	127

Mitigation Site 14, Plot 1 Dominant Species – September 2012. Plot dominated by invasive *Typha angustifolia*. Native *Typha latifolia* moderately dominant.

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 7: Annual Report – FY2013

Mitigation Site 14 – All Species Present
Species Richness = 20
Beckmannia syzigachne
Calamagrostis canadensis
Carex cannescens
Glyceria canadensis
Glyceria striata
Juncus effusus
Lemna sp.
Poa palustris
Populus tremuloides
Pteridium aquilinum
Salix bebbiana
Salix discolor
Salix lucida
Salix petiolaris
Salix pyrifolia
Scirpus atrovirens
Scirpus cyperinus
Sphagnum moss
Typha angustifolia
Typha latifolia

Validation of Wetland Mitigation
In
Abandoned Borrow Areas

Task 8: Data Analysis and Interpretation – FY 2014

Water Level Monitoring
And
Percent Vegetative Cover by Species

2013 Field Season

Completed June 2015

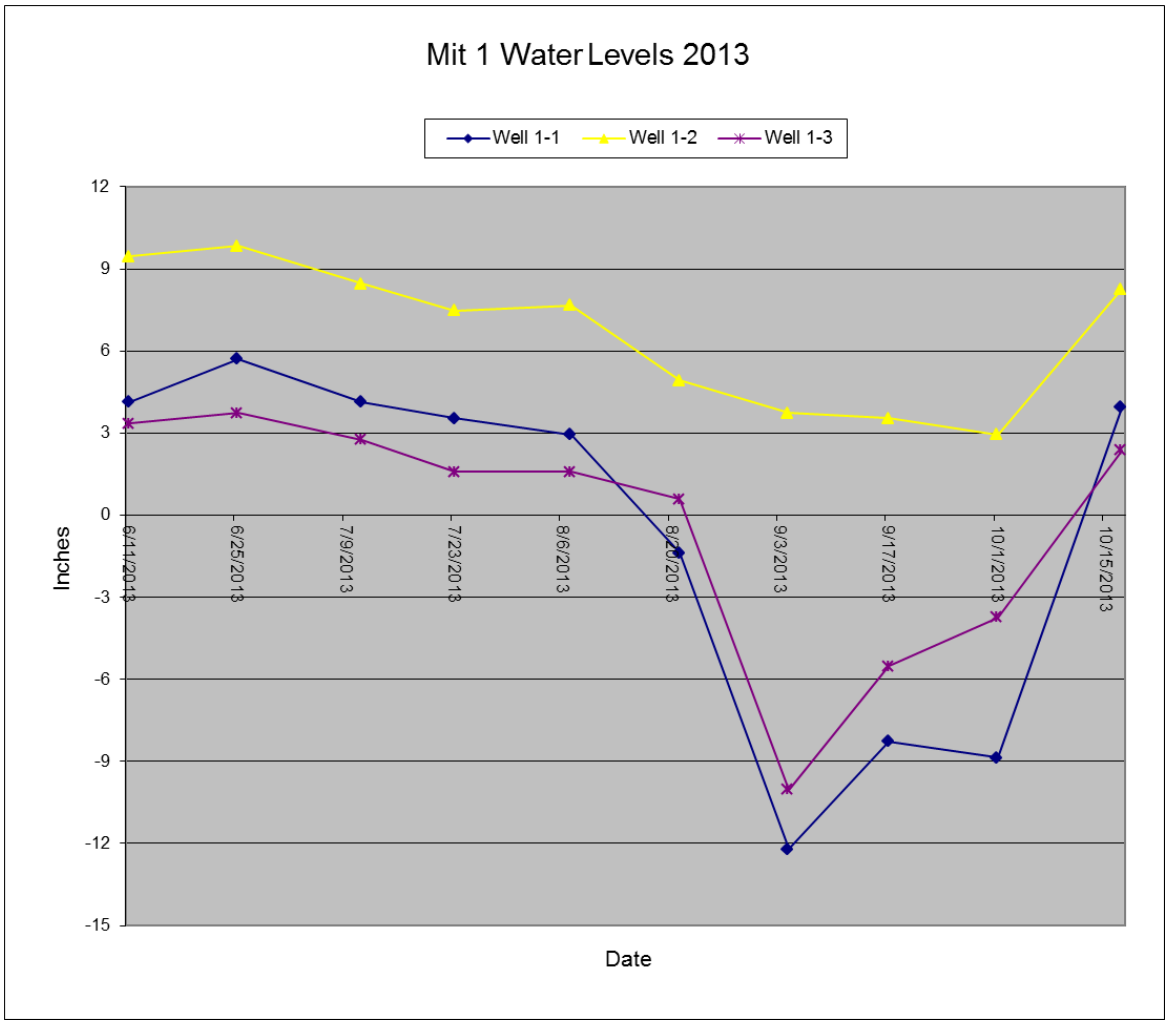
Introduction

This was the third year of the project "Validation of Wetland Mitigation in Abandoned Borrow Areas" which is a continuation of monitoring on the original mitigation sites (3, 4, 5) and on 11 additional mitigation sites (1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 14) along the U.S. Trunk Highway 53 reconstruction corridor. This summary report contains water level and plant survey data collected during the 2013 field season. A new vegetation survey method was adopted in October 2013 to get a better idea of overall site conditions, better quantify plant communities and invasive species infestations, and get a clearer picture of year to year vegetation changes. The new method includes the following procedures:

1) Outline entire mitigation wetland basin and each distinct plant community (according to Wetland Plants and Plant Communities of Minnesota and Wisconsin by Eggers and Reed) within the basin using a GPS.
2) Outline any invasive species infestations.
3) Conduct vegetation survey transects across each plant community using the Step Point Intercept Method to determine percent cover for each plant species.
4) Record all plants observed on the site to create an entire species inventory.
5) Download GPS data onto computer and use ArcGIS® software to determine the area of each plant community.
6) Calculate wetland vegetation quality using the Rapid Floristic Quality Assessment Calculator for each plant community within each mitigation site.
7) Determine which sites have the most potential for meeting regulatory criteria for wetland replacement.
8) Determine areas that may benefit from adaptive management.

Using this method, maps were produced using ArcGIS® software showing transect locations and plant communities for each mitigation site.

Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 1 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Shallow Marsh predominately *Typha angustifolia*.
Power-lines are adjacent to the site.
Standing water most of the year.
Potential to mow and spray cattails and fill with approximately one foot of peat and reseed to try to change the plant community.
Poor potential as a mitigation site without extensive remedial work.

Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 1 - October 2013
Total Basin Area: 0.78 acres

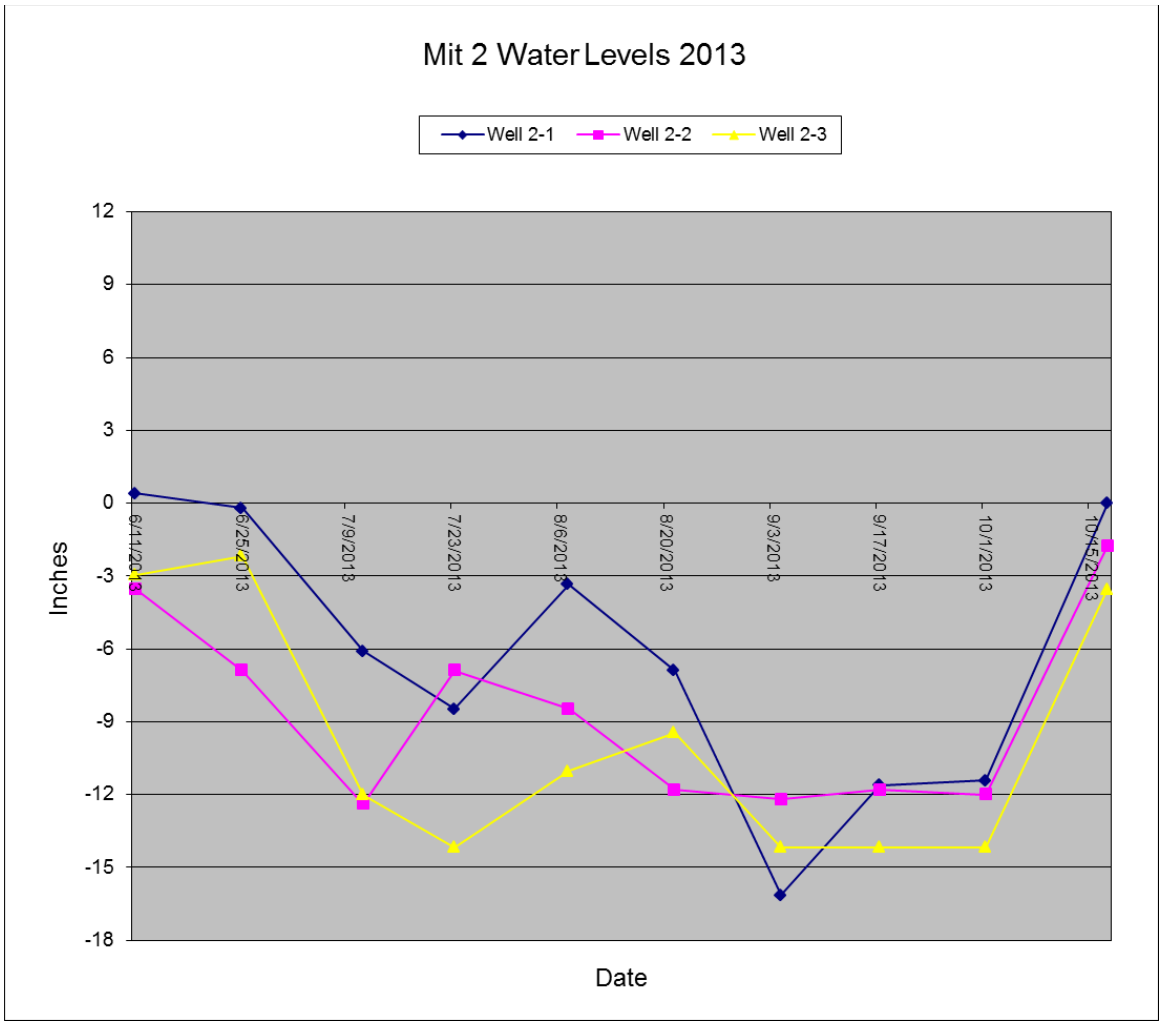
Wetland Type: Shallow Marsh	**Percent**
Area: 0.65 acres	**Cover**
Typha angustifolia	53.6%
Scirpus cyperinus	14.3%
Agrostis gigantea	10.7%
Hieracium aurantiacum	7.1%
Typha latifolia	7.1%
Agrostis scabra	3.6%
Scirpus microcarpus	3.6%
FQA Condition Category	Poor

Wetland Type: Fresh Meadow	
Area: 0.13 acres	
Agrostis gigantea	48.1%
Phleum pratense	11.1%
Elymus repens	7.4%
Lotus corniculatus	7.4%
Agrostis scabra	3.7%
Aster brachyactus	3.7%
Aster lanceolatus	3.7%
Panicum virgatum	3.7%
Poa pratense	3.7%
Salix bebbiana	3.7%
Scirpus cyperinus	3.7%
FQA Condition Category	Fair

Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**
Achillea millefolium	Yes
Agrostis gigantea	No
Agrostis scabra	Yes
Anaphalis margaritacea	Yes
Aster lanceolatus	Yes
Betula papyrifera	Yes
Calamagrostis canadensis	Yes
Carex lupulina	Yes
Carex tenera	Yes
Chrysanthemum leucanthemum	No
Cirsium arvense	No
Elymus repens	No
Erigeron annuus	Yes
Euthamia graminifolia	Yes
Festuca ovina	No
Gnaphalium uliginosum	No
Hieracium aurantiacum	No
Hypericum mutilum	Yes
Juncus effusus	Yes
Juncus tenuis	Yes
Lotus corniculatus	No
Mimulus ringens	Yes
Onoclea sensibilis	Yes
Panicum virgatum	Yes
Phleum pratense	No
Plantago major	No
Populus balsamifera	Yes
Potentilla norvegica	Yes
Salix bebbiana	Yes
Salix discolor	Yes
Salix lucida	Yes
Salix petiolaris	Yes
Salix planifolia	Yes
Scirpus cyperinus	Yes
Scirpus fluviatilis	Yes
Scirpus microcarpus	Yes
Solidago nemoralis	Yes
Typha angustifolia	No
Typha latifolia	Yes
Typha x glauca	No
Species Richness	**40**

Mitigation Site 2
Validation of Wetland
Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 2 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Reed canary grass needs control.
Drier site.
Potentially good tree planting site.
Fair potential as a mitigation site.

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 2 - October 2013
Total Basin Area: 3.53 acres

Wetland Type: Fresh Meadow	**Percent**
Area: 2.08 acres	**Cover**
Phalaris arundinacea	27.1%
Scirpus cyperinus	20.0%
Calamagrostis canadensis	11.4%
Scirpus microcarpus	11.4%
Juncus effusus	10.0%
Typha latifolia	4.3%
Typha angustifolia	2.9%
Agrostis gigantea	1.4%
Aster lanceolatus	1.4%
Carex lacustris	1.4%
Carex utriculata	1.4%
Cirsium arvense	1.4%
Lotus corniculatus	1.4%
Salix pyrifolia	1.4%
Scirpus validus	1.4%
Solidago canadensis	1.4%
FQA Condition Category	Fair

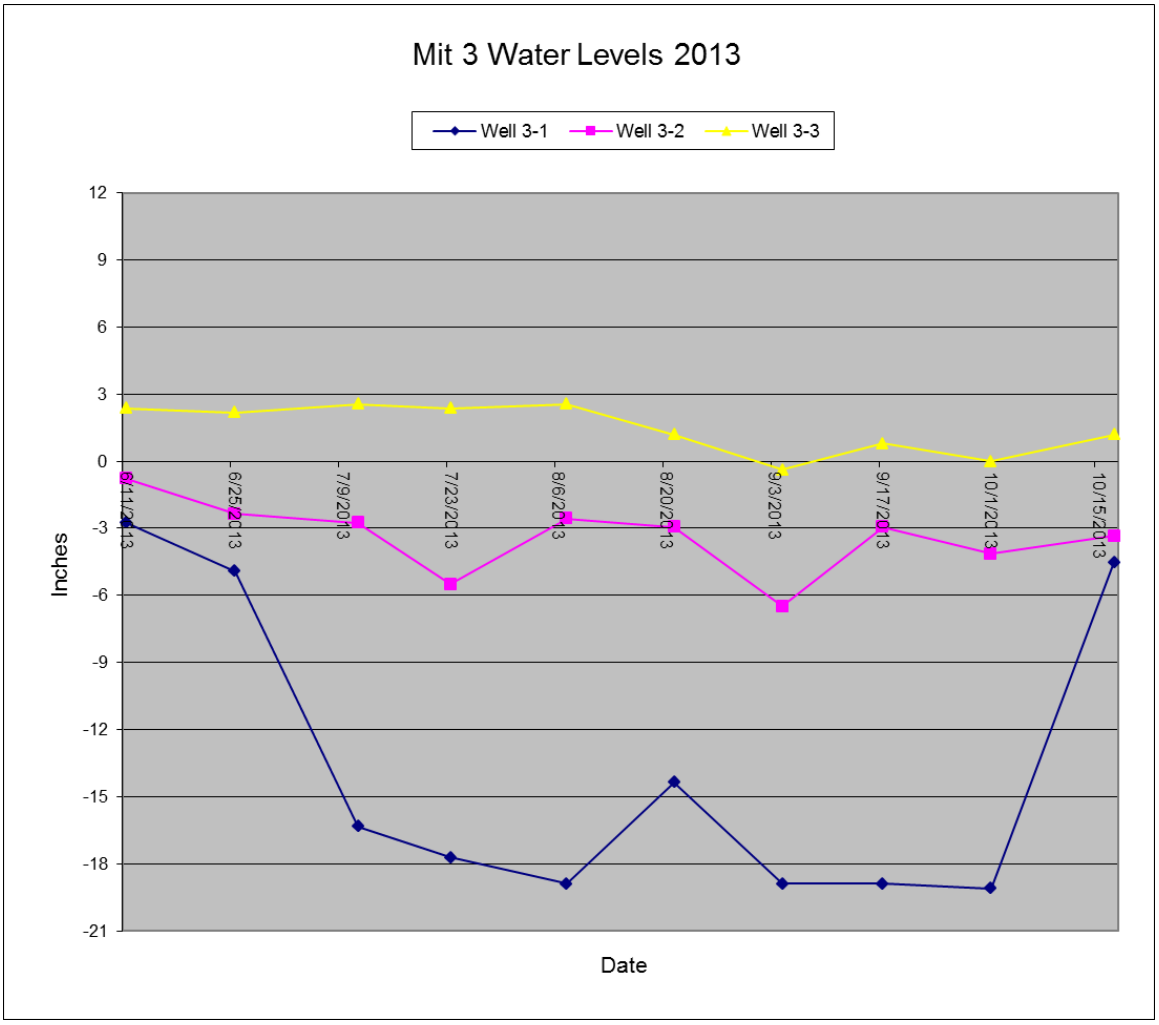
Wetland Type: Alder Thicket	
Area: 0.14 acres	
Phalaris arundinacea	25.0%
Scirpus cyperinus	25.0%
Alnus rugosa	14.3%
Carex lacustris	14.3%
Cirsium arvense	7.1%
Salix petiolaris	7.1%
Juncus effusus	3.6%
Typha latifolia	3.6%
FQA Condition Category	Fair

Wetland Type: Fresh Meadow	
Reed Canary Area: 1.31 acres	
FQA Condition Category	Poor

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**	**Total Species Present October 2013**	**Native**
Achillea millefolium	Yes	*Lotus corniculatus*	No
Agrostis gigantea	No	*Onoclea sensibilis*	Yes
Alnus rugosa	Yes	*Phalaris arundinacea*	No
Anaphalis margaritacea	Yes	*Poa pratense*	No
Aster lanceolatus	Yes	*Populus balsamifera*	Yes
Aster modestus	Yes	*Populus tremuloides*	Yes
Aster puniceus	Yes	*Salix bebbiana*	Yes
Calamagrostis canadensis	Yes	*Salix discolor*	Yes
Carex lacustris	Yes	*Salix petiolaris*	Yes
Carex retrorsa	Yes	*Salix pyrifolia*	Yes
Carex utriculata	Yes	*Scirpus atrovirens*	Yes
Cirsium arvense	No	*Scirpus cyperinus*	Yes
Elymus repens	No	*Scirpus microcarpus*	Yes
Eupatorium maculatum	Yes	*Scirpus validus*	Yes
Euthamia graminifolia	Yes	*Solidago canadensis*	Yes
Fragaria virginiana	Yes	*Solidago gigantea*	Yes
Helenium autumnale	Yes	*Sonchus arvense*	No
Hieracium aurantiacum	No	*Tanacetum vulgare*	No
Hieracium canadense	Yes	*Typha angustifolia*	No
Hypericum mutilum	Yes	*Typha latifolia*	Yes
Juncus effusus	Yes	**Species Richness**	**41**

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 3 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Reed canary grass needs control.
Planted tamarack and black spruce are doing well on drier portions of the site and mounds.
Shallow Marsh predominately *Typha latifolia*.
Good potential as a mitigation site.

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 3 - October 2013
Total Basin Area: 1.04 acres

Wetland Type: Sedge Meadow Area: 0.59 acres	**Percent Cover**
Calamagrostis canadensis	34.6%
Scirpus cyperinus	34.6%
Carex utriculata	15.4%
Juncus effusus	7.7%
Carex lacustris	3.8%
Phalaris arundinacea	3.8%
FQA Condition Category: Fair	

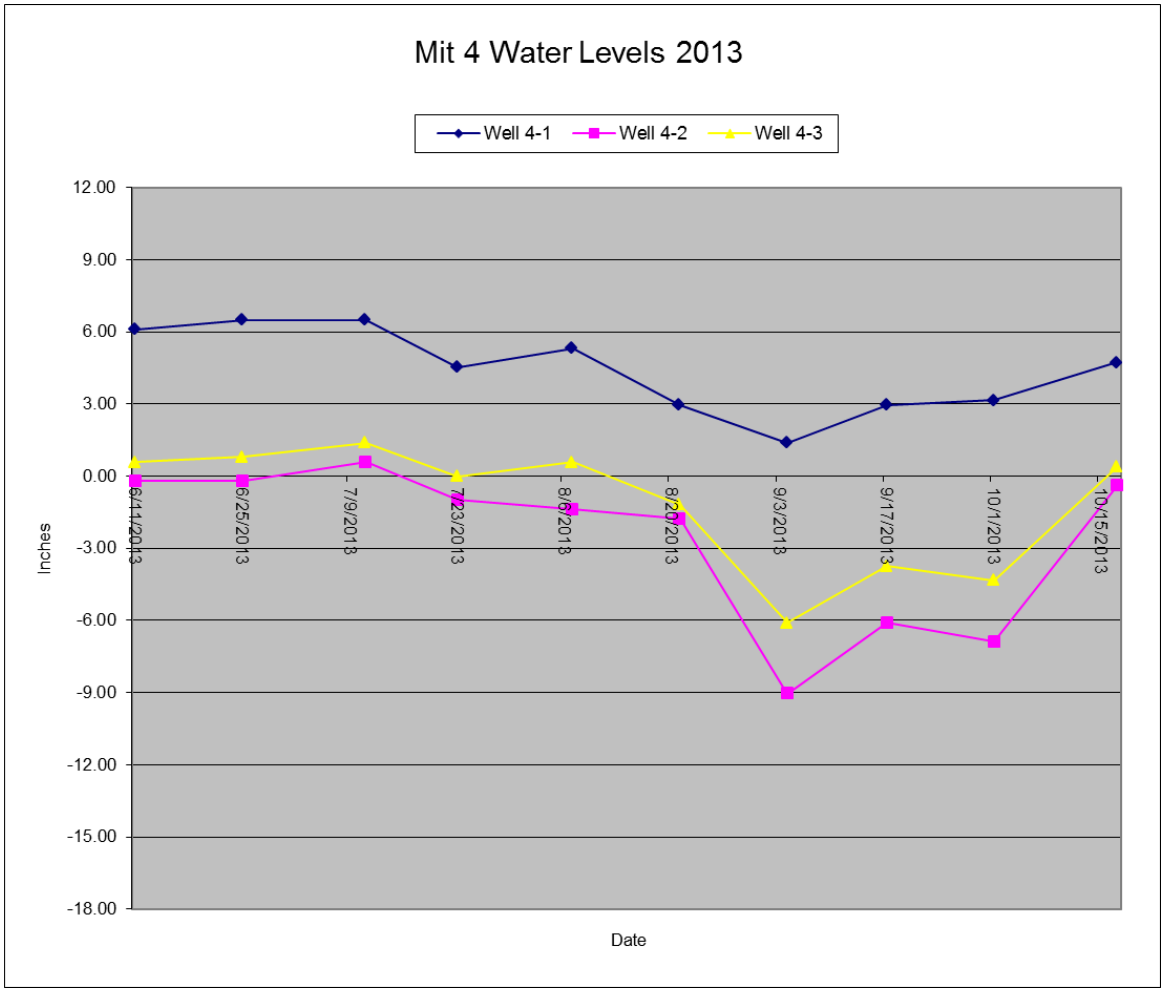
Wetland Type: Shallow Marsh Area: 0.38 acres	
Typha latifolia	41.9%
Scirpus microcarpus	19.4%
Calamagrostis canadensis	9.7%
Scirpus cyperinus	9.7%
Typha angustifolia	9.7%
Carex utriculata	6.5%
Sagittaria latifolia	3.2%
FQA Condition Category: Fair	

Wetland Type: Fresh Meadow Reed Canary Area: 0.17 acres	
FQA Condition Category	Poor

Mitigation Site 3
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**	**Total Species Present October 2013**	**Native**
Abies balsamea	Yes	*Lycopodium clavatum*	Yes
Agrostis gigantea	No	*Myrica gale*	Yes
Agrostis scabra	Yes	*Phalaris arundinacea*	No
Alnus rugosa	Yes	*Picea mariana*	Yes
Aster puniceus	Yes	*Populus balsaminifera*	Yes
Aster umbellatus	Yes	*Populus tremuloides*	Yes
Betula papyrifera	Yes	*Rubus strigosus*	Yes
Calamagrostis canadensis	Yes	*Saggitaria latifolia*	Yes
Carex lacustris	Yes	*Salix petiolaris*	Yes
Carex tenuiflora	Yes	*Salix serissima*	Yes
Carex utriculata	Yes	*Scirpus atrotinctus*	Yes
Cirsium arvense	No	*Scirpus cyperinus*	Yes
Cornus canadense	Yes	*Scirpus microcarpus*	Yes
Droser rotundifolia	Yes	*Solidago gigantea*	Yes
Dryopteris carthusiana	Yes	*Solidago uliginosa*	Yes
Equisetum arvense	Yes	*Sphagnum moss*	Yes
Euthamia graminifolia	Yes	*Thuja occidentalis*	Yes
Glyceria canadensis	Yes	*Typha angustifolia*	No
Glyceria grandis	Yes	*Typha latifolia*	Yes
Juncus effusus	Yes	*Vaccinium angustifolium*	Yes
Latix laricina	Yes	*Viola pallens*	Yes
Lotus corniculata	No	**Species Richness**	**44**
Lycopodium annotinum	Yes		

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 4 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Lythrum salicaria present as occasional scattered stems.
Good *Sphagnum* moss growth on drier areas.
Good potential as a mitigation site.

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

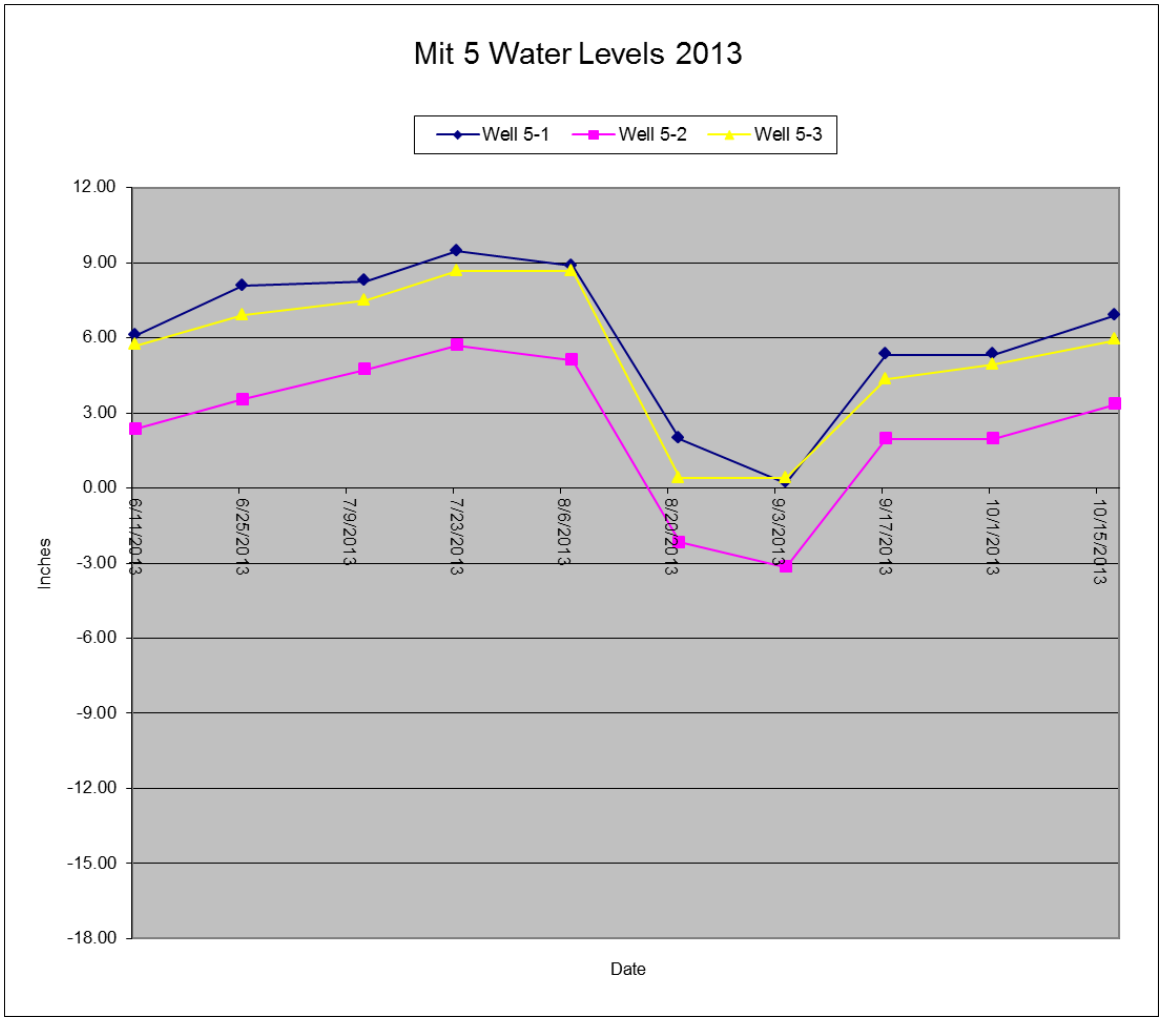
Mitigation 4 - October 2013
Total Basin Area: 1.86 acres

Wetland Type: Sedge Meadow	**Percent**
Area: 1.86 acres	**Cover**
Carex utriculata	35.1%
Scirpus cyperinus	29.8%
Calamagrostis canadensis	15.8%
Carex lacustris	8.8%
Juncus effusus	3.5%
Typha latifolia	3.5%
Carex aquatilis	1.8%
Scirpus microcarpus	1.8%
FQA Condition Category	Fair

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present	
October 2013	**Native**
Aster lanceolatus	Yes
Aster puniceus	Yes
Calamagrostis canadensis	Yes
Carex aquatilis	Yes
Carex lacustris	Yes
Carex utriculata	Yes
Chamaedaphne calyculata	Yes
Epilobium leptophyllum	Yes
Glyceria canadensis	Yes
Juncus effusus	Yes
Larix laricina	Yes
Lythrum salicaria	No
Phalaris arundinacea	No
Picea mariana	Yes
Potentilla palustris	Yes
Salix bebbiana	Yes
Salix petiolaris	Yes
Salix pyrifolia	Yes
Scirpus cyperinus	Yes
Scirpus microcarpus	Yes
Typha angustifolia	No
Typha latifolia	Yes
Utricularia minor	Yes
Species Richness	**23**

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 5 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Site needs continued control of beavers damming the outlet.
Good potential as a mitigation site.

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

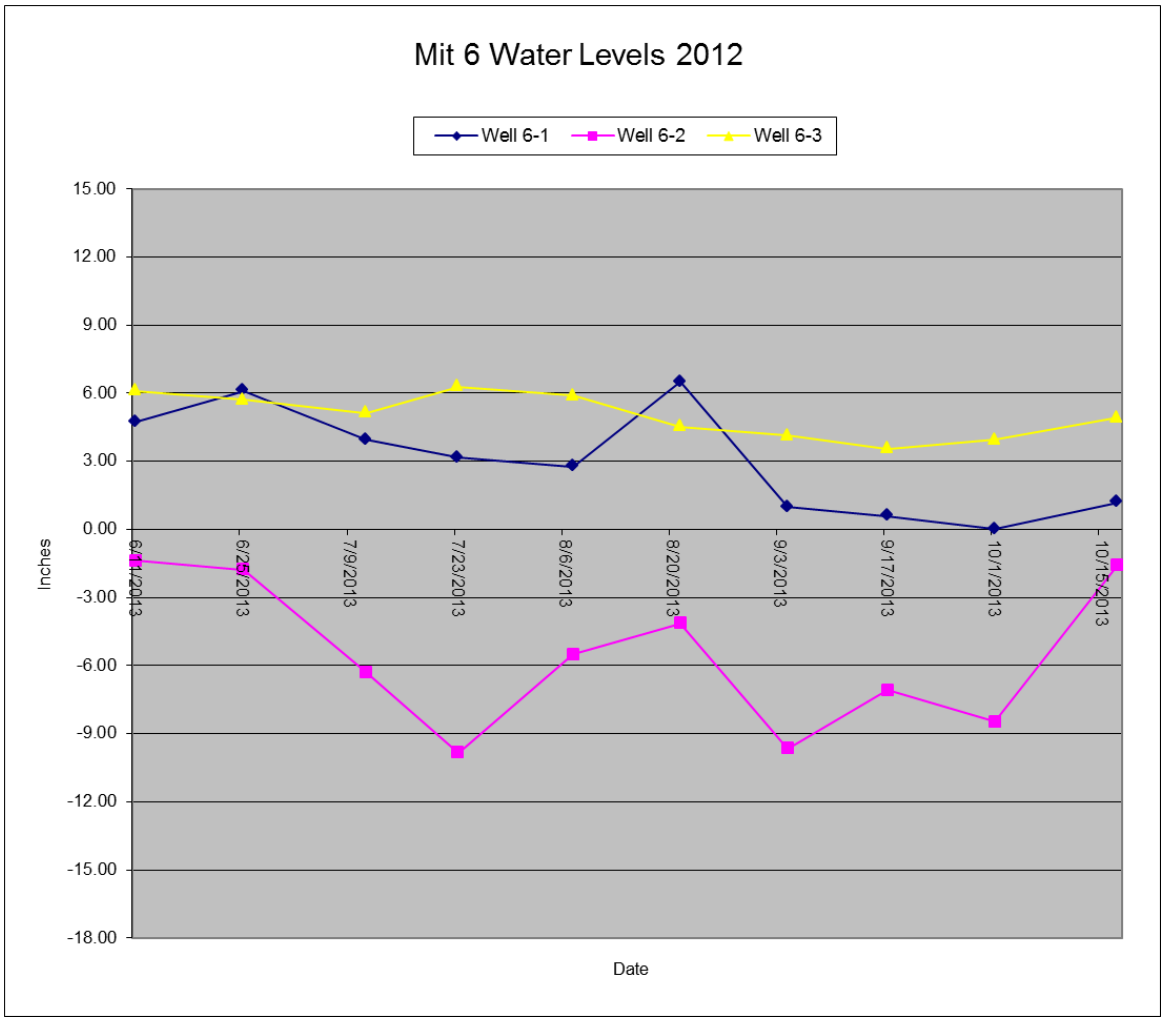
Mitigation 5 - October 2013
Total Basin Area: 1.69 acres

Wetland Type: Sedge Meadow	**Percent**
Area: 1.69 acres	**Cover**
Carex utriculata	32.2%
Scirpus cyperinus	28.8%
Carex lacustris	16.9%
Glyceria canadensis	6.8%
Juncus effusus	5.1%
Calamagrostis canadensis	3.4%
Carex aquatilis	1.7%
Carex canescens	1.7%
Phalaris arundinacea	1.7%
Typha angustifolia	1.7%
FQA Condition Category	Fair

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present	
October 2013	**Native**
Aster puniceus	Yes
Calamagrostis canadensis	Yes
Carex aquatilis	Yes
Carex cannescens	Yes
Carex lacustris	Yes
Carex utriculata	Yes
Glyceria canadensis	Yes
Juncus effusus	Yes
Lemna minor	Yes
Phalaris arundinacea	Yes
Polygonum amphibium	Yes
Salix petiolaris	Yes
Scirpus cyperinus	Yes
Typha angustifolia	No
Typha latifolia	Yes
Species Richness	**15**

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 6 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Sedge meadow appears to be outcompeting shallow marsh in drier areas with encroachment of native sedges.
Good potential as a mitigation site.
Maybe partial credit for sedge meadow areas.

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 6 - October 2013
Total Basin Area: 5.77 acres

Wetland Type: Shallow Marsh	**Percent**
Area: 3.64 acres	**Cover**
Carex lacustris	24.3%
Typha X glauca	24.3%
Typha angustifolia	18.9%
Typha latifolia	8.1%
Carex utriculata	5.4%
Equisetum scirpoides	5.4%
Agrostis scabra	2.7%
Calamagrostis canadensis	2.7%
Eleocharis palustris	2.7%
Juncus effusus	2.7%
Potamogeton obtusifolius	2.7%

FQA Condition Category: Fair

Wetland Type: Sedge Meadow	
Area: 2.05 acres	
Carex utriculata	44.4%
Carex lacustris	33.3%
Scirpus cyperinus	11.1%
Lotus corniculatus	2.8%
Phalaris arundinacea	2.8%
Salix bebbiana	2.8%
Scirpus microcarpus	2.8%

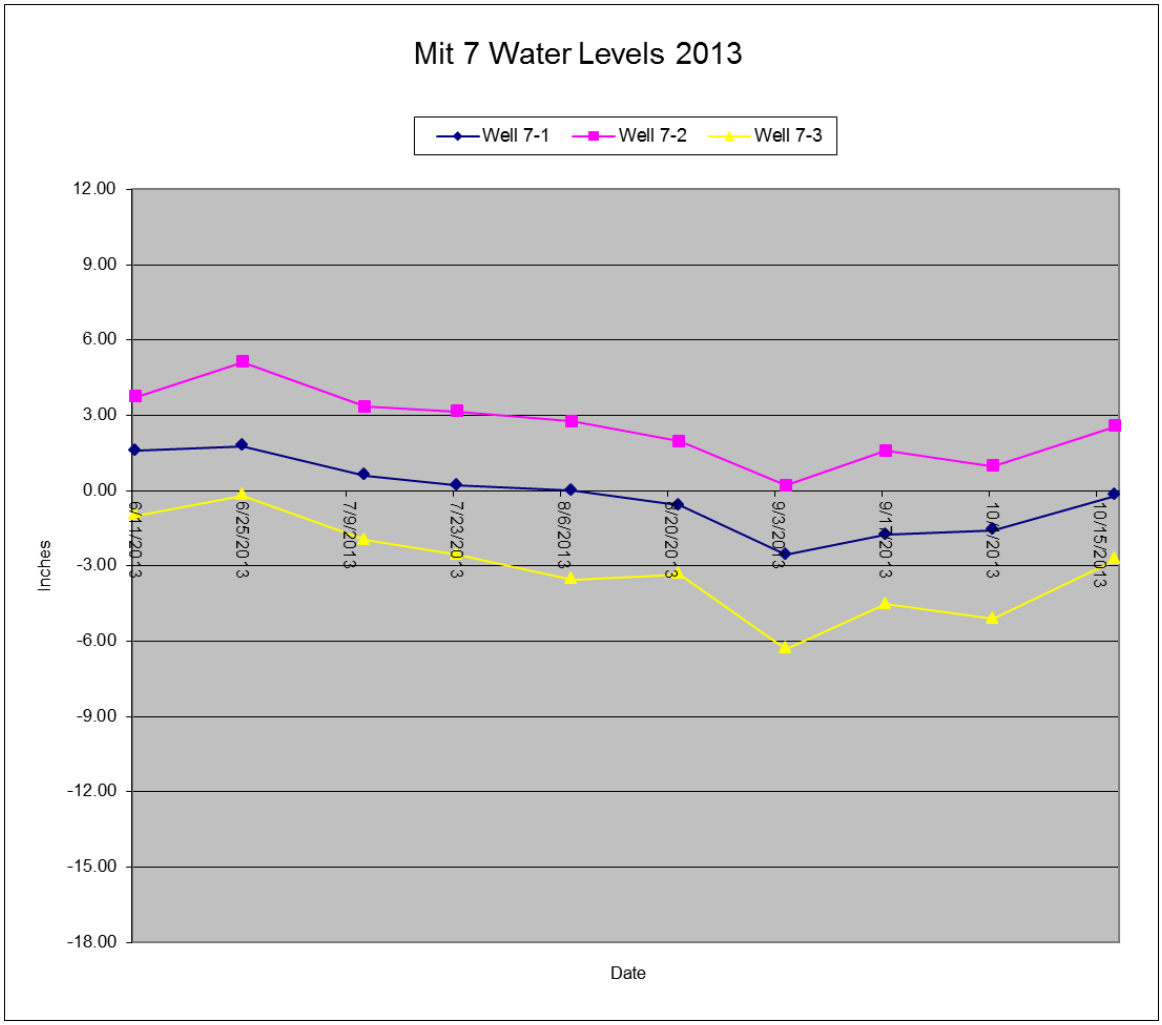
FQA Condition Category: Fair

Wetland Type: Fresh Meadow
Area: 0.08 acres

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**	**Total Species Present October 2013**	**Native**
Agrostis scabra	Yes	*Juncus effusus*	Yes
Alisma plantago-aquatica	Yes	*Juncus pelocarpus*	Yes
Anaphalis margaritacea	Yes	*Lemna minor*	Yes
Aster lanceolatus	Yes	*Lotus corniculatus*	No
Aster puniceus	Yes	*Phalaris arundinacea*	No
Betula papyrifera	Yes	*Populus balsamifera*	Yes
Calamagrostis canadensis	Yes	*Populus tremuloides*	Yes
Caltha natans	Yes	*Potamogeton epihydrus*	Yes
Carex lacustris	Yes	*Potamogeton obtusifolius*	Yes
Carex utriculata	Yes	*Potamogeton richardsonii*	Yes
Chamaedaphne calyculata	Yes	*Rubus strigosus*	Yes
Cirsium arvense	No	*Salix bebbiana*	Yes
Cirsium vulgare	No	*Salix discolor*	Yes
Eleocharis palustris	Yes	*Salix eriocephala*	Yes
Epilobium leptophyllum	Yes	*Salix interior*	Yes
Equisetum fluviatile	Yes	*Salix petiolaris*	Yes
Equisetum scirpoides	Yes	*Scirpus cyperinus*	Yes
Eupatorium maculatum	Yes	*Scirpus microcarpus*	Yes
Glyceria canadensis	Yes	*Solidago gigantea*	Yes
Glyceria grandis	Yes	*Typha angustifolia*	No
Glyceria striata	Yes	*Typha latifolia*	Yes
Hieracium aurantiacum	No	*Typha X glauca*	No
Hypericum majus	Yes	*Utricularia macrorhiza*	Yes
Juncus brevicaudatus	Yes	**Species Richness**	**47**

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 7 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Near power-lines.
Poor potential as a mitigation site without significant remedial action to control cattails.

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 7 - October 2013
Total Basin Area: 1.44 acres

Wetland Type: Shallow Marsh	**Percent**
Area: 1.09 acres	**Cover**
Typha angustifolia	44.8%
Scirpus cyperinus	27.6%
Typha X glauca	10.3%
Scirpus microcarpus	6.9%
Carex utriculata	3.4%
Carex vulpinoidea	3.4%
Phalaris arundinacea	3.4%

FQA Condition Category: Poor

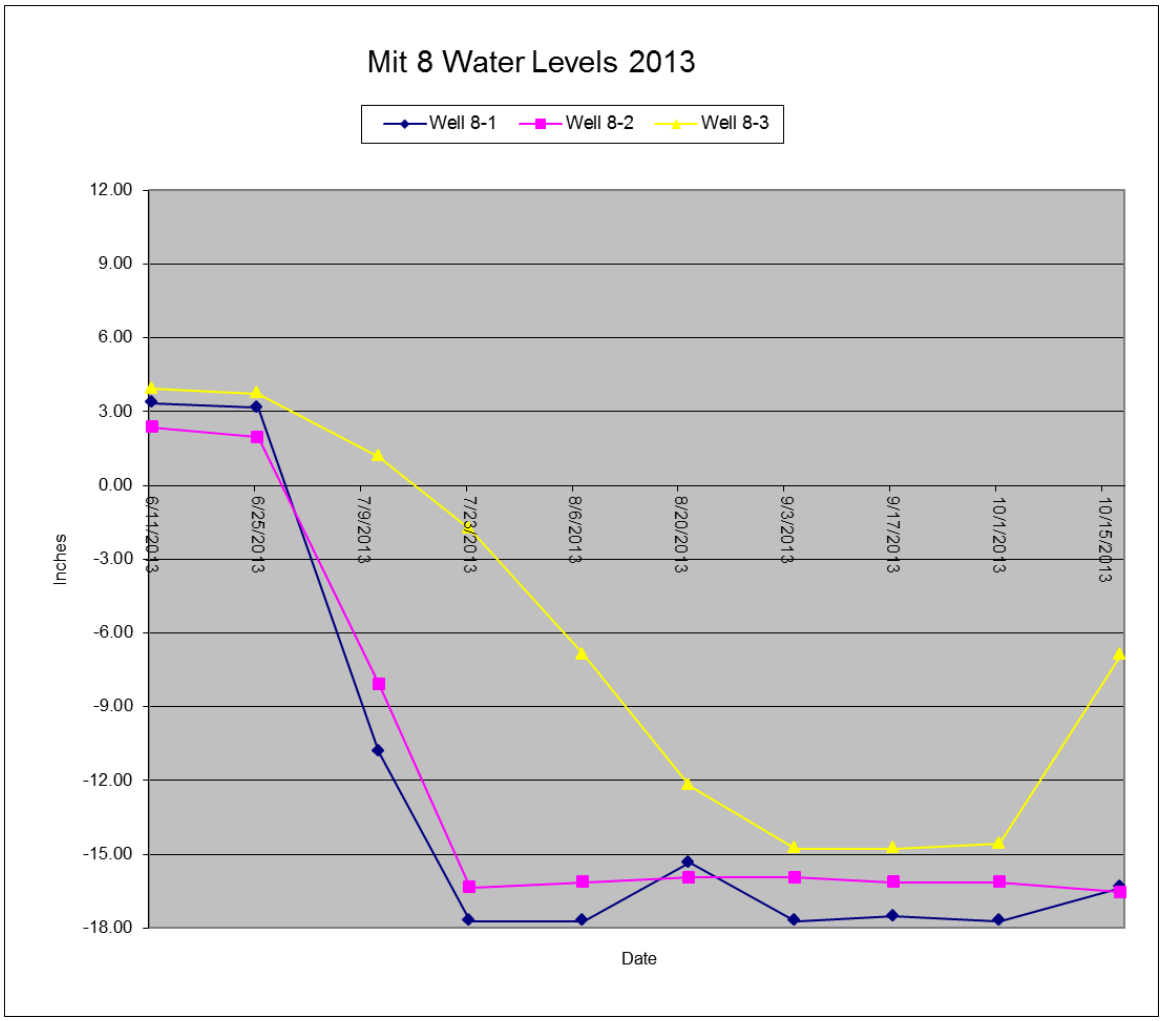
Wetland Type: Fresh Meadow	
Area: 0.35 acres	
Carex tenera	20.7%
Juncus effusus	20.7%
Agrostis gigantea	13.8%
Calamagrostis canadensis	13.8%
Scirpus cyperinus	13.8%
Phalaris arundinacea	6.9%
Aster lanceolatus	3.4%
Glyceria grandis	3.4%
Scirpus microcarpus	3.4%

FQA Condition Category: Fair

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present	
October 2013	**Native**
Achillea millefolium	Yes
Agrostis gigantea	No
Aster lanceolatus	Yes
Aster puniceus	Yes
Calamagrostis canadensis	Yes
Carex tenera	Yes
Carex utriculata	Yes
Carex vulpinoidea	Yes
Epilobium leptophyllum	Yes
Geum macrophyllum	Yes
Glyceria canadensis	Yes
Glyceria grandis	Yes
Juncus effusus	Yes
Juncus vaseyi	Yes
Phalaris arundinacea	Yes
Phalaris arundinacea	No
Phleum pratense	No
Pycanthemum virginianum	Yes
Salix bebbiana	Yes
Salix petiolaris	Yes
Scirpus cyperinus	Yes
Scirpus cyperinus	Yes
Scirpus microcarpus	Yes
Scirpus microcarpus	Yes
Solidago gigantea	Yes
Typha angustifolia	No
Typha X glauca	No
Verberna hastata	Yes
Species Richness	**28**

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 8 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
It appears native sedges are overtaking scattered cattail stands.
Drier site.
Good tree planting site.
Good potential as a relatively large mitigation site.
Will require some reed canary grass control.

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Good

Mitigation 8 - October 2013
Total Basin Area: 19.68 acres

Wetland Type: Fresh Meadow	**Percent**
Area: 18.23 acres	**Cover**
Scirpus cyperinus	28.4%
Calamagrostis canadensis	26.9%
Carex lacustris	19.4%
Lotus corniculatus	4.5%
Carex utriculata	3.0%
Poa palustris	3.0%
Scirpus microcarpus	3.0%
Agrostis gigantea	1.5%
Agrostis scabra	1.5%
Alnus rugosa	1.5%
Aster lanceolatus	1.5%
Festuca sp.	1.5%
Juncus effusus	1.5%
Phalaris arundinacea	1.5%
Populus balsamifera	1.5%

FQA Condition Category: Fair

Mitigation Site 8

Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Wetland Type: Shallow Marsh
Area: 0.37 acres

Carex lacustris	40.0%
Scirpus cyperinus	13.3%
Scirpus microcarpus	13.3%
Typha angustifolia	13.3%
Phalaris arundinacea	6.7%
Typha latifolia	6.7%
Typha X glauca	6.7%

FQA Condition Category: Fair

Wetland Type: Sedge Meadow
Area: 0.66 acres

Carex utriculata	76.7%
Carex lacustris	10.0%
Alnus rugosa	3.3%
Aster lanceolatus	3.3%
Rubus strigosus	3.3%
Scirpus cyperinus	3.3%

FQA Condition Category: Exceptional

Wetland Type: Shrub Carr (Willows)
Area: 0.42 acres

Carex lacustris	42.9%
Salix petiolaris	28.6%
Populus balsamifera	14.3%
Salix bebbiana	14.3%

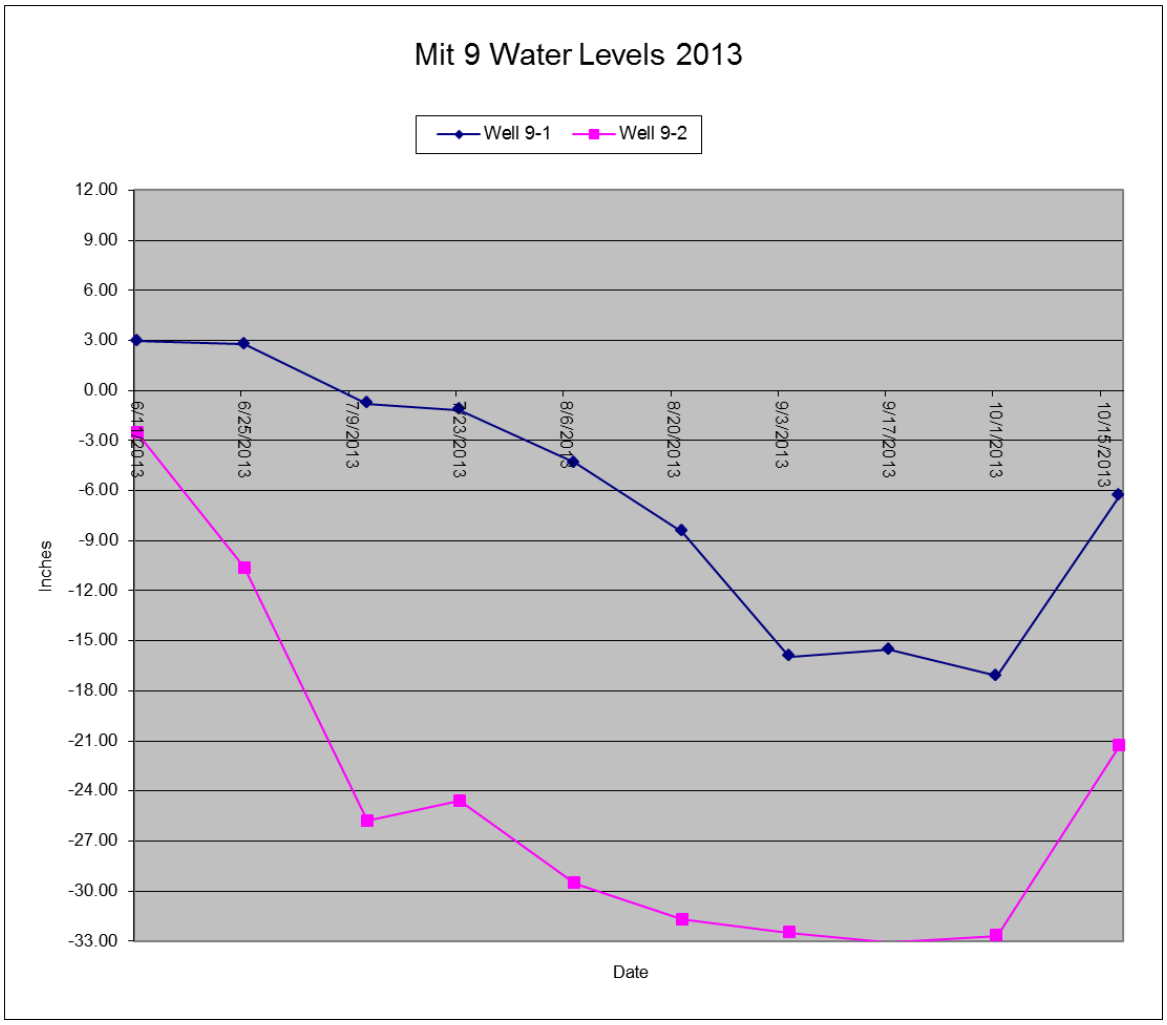
FQA Condition Category: Exceptional

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**
Agrostis gigantea	No
Agrostis scabra	Yes
Alisma plantago-aquatica	Yes
Alnus rugosa	Yes
Anaphalis margaritacea	Yes
Aster lanceolatus	Yes
Aster puniceus	Yes
Aster umbellatus	Yes
Beckmannia syzigachne	Yes
Betula papyrifera	Yes
Calamagrostis canadensis	Yes
Carex intumescens	Yes
Carex lacustris	Yes
Carex retrorsa	Yes
Carex stipata	Yes
Carex tenera	Yes
Carex utriculata	Yes
Cirsium arvense	No
Cirsium vulgare	No
Eleocharis intermedia	Yes
Eleocharis palustris	Yes
Epilobium leptophyllum	Yes
Equisetum sylvaticum	Yes
Eupatorium maculatum	Yes
Eupatorium perfoliatum	Yes
Euthamia graminifolia	Yes
Festuca sp.	X
Geum macrophyllum	Yes
Glyceria canadensis	Yes
Hippuris vulgaris	Yes
Juncus effusus	Yes

Total Species Present October 2013	**Native**
Lotus corniculatus	No
Phalaris arundinacea	No
Pinus banksiana	Yes
Pinus resinosa	Yes
Poa palustris	Yes
Poa palustris	Yes
Populus balsamifera	Yes
Populus tremuloides	Yes
Potamogeton epihydrus	Yes
Potamogeton obtusifolius	Yes
Potamogeton robbinsii	Yes
Rubus strigosus	Yes
Sagittaria latifolia	Yes
Salix bebbiana	Yes
Salix discolor	Yes
Salix eriocephala	Yes
Salix petiolaris	Yes
Salix pyrifolia	Yes
Scirpus cyperinus	Yes
Scirpus microcarpus	Yes
Solidago canadensis	Yes
Solidago gigantea	Yes
Solidago uliginosa	Yes
Spiraea alba	Yes
Tanacetum vulgare	No
Typha angustifolia	No
Typha latifolia	Yes
Typha X glauca	No
Verbena hastata	Yes
Species Richness	**60**

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 9 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Power-lines across portions of the site.
Mixture of uplands, ponds, shallow marsh and fresh meadow.
Good potential as a mitigation site in fresh meadow areas away from the power-lines.
May qualify for partial credit.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Exceptional

Mitigation 9 - October 2013
Total Basin Area: 17.12 acres

Wetland Type: Shallow Marsh	**Percent**
Area: 1.14 acres	**Cover**
Scirpus cyperinus	25.0%
Glyceria canadensis	23.9%
Typha latifolia	17.0%
Calamagrostis canadensis	11.4%
Typha angustifolia	11.4%
Scirpus atrovirens	3.4%
Iris versicolor	1.1%
Juncus alpinoarticulatus	1.1%
Phalaris arundinacea	1.1%
Salix bebbiana	1.1%
Salix discolor	1.1%
Sphagnum moss	1.1%
Viola pallens	1.1%

FQA Condition Category: Fair

Wetland Type: Fresh Meadow	
Area: 15.85	
Glyceria canadensis	40.0%
Calamagrostis canadensis	12.0%
Euthamia graminifolia	12.0%
Carex utriculata	8.0%
Salix bebbiana	8.0%
Aster lanceolatus	4.0%
Carex tenera	4.0%
Solidago gigantea	4.0%
Tanacetum vulgare	4.0%
Typha latifolia	4.0%

FQA Condition Category: Exceptional

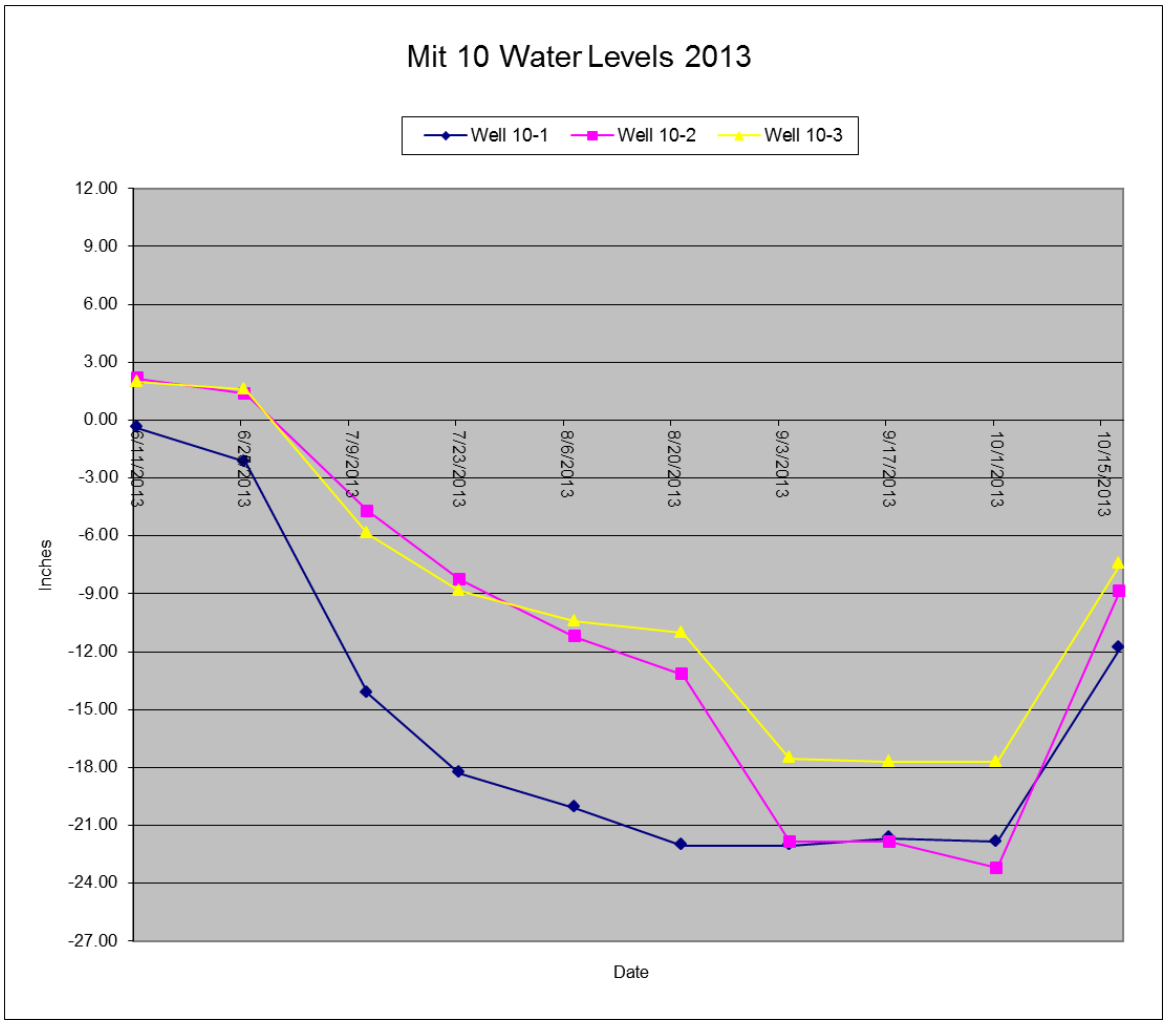
Wetland Type: Pond
Area: 0.13 acres

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**
Agrostis gigantea	No
Agrostis scabra	Yes
Alnus rugosa	Yes
Anaphalis margaritacea	Yes
Aster lanceolatus	Yes
Aster puniceus	Yes
Aster umbellatus	Yes
Betula papyrifera	Yes
Betula pumila	Yes
Bidens cernua	Yes
Calamagrostis canadensis	Yes
Carex canescens	Yes
Carex lacustris	Yes
Carex oligosperma	Yes
Carex stipata	Yes
Carex tenera	Yes
Carex utriculata	Yes
Chamaedaphne calyculata	Yes
Chrysanthemum leucanthemum	No
Epilobium leptophyllum	Yes
Equisetum arvense	Yes
Eriophorum angustifolium	Yes
Euthamia graminifolia	Yes
Fragaria virginiana	Yes
Geum allepicum	Yes
Glyceria canadensis	Yes
Iris versicolor	Yes
Juncus alpinoarticulatus	Yes
Juncus effusus	Yes
Juncus filiformis	Yes
Juncus tenuis	Yes
Lotus corniculatus	No

Total Species Present October 2013	**Native**
Lycopus uniflorus	Yes
Onoclea sensibilis	Yes
Phalaris arundinacea	No
Pinus resinosa	Yes
Poa palustris	Yes
Polytrichum moss	Yes
Populus balsamifera	Yes
Populus tremuloides	Yes
Potentilla norvegica	Yes
Ranunculus pensylvanicus	Yes
Rubus strigosus	Yes
Rumex crispus	No
Salix bebbiana	Yes
Salix discolor	Yes
Salix lucida	Yes
Salix pedicellaris	Yes
Salix petiolaris	Yes
Salix pyrifolia	Yes
Scirpus atrotinctus	Yes
Scirpus atrovirens	Yes
Scirpus cyperinus	Yes
Scirpus cyperinus	Yes
Scirpus sp.	X
Solidago gigantea	Yes
Sphagnum moss	Yes
Tanacetum vulgare	No
Typha angustifolia	No
Typha latifolia	Yes
Verbena hastata	Yes
Viola pallens	Yes
Species Richness	**62**

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 10 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Power-lines cross a portion of the site.
Site had significant *Sphagnum* establishment but was flooded out in 2014 with no known cause for the rise in water table.
Good potential as a mitigation site with water level management on areas away from the power-lines.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Good

Mitigation 10 - October 2013
Total Basin Area: 7.16 acres

Wetland Type: Fresh Meadow/Shrub Carr	**Percent**
Area: 1.46 acres	**Cover**
Scirpus cyperinus	53.3%
Calamagrostis canadensis	13.3%
Salix petiolaris	13.3%
Agrostis scabra	6.7%
Carex utriculata	6.7%
Populus balsamifera	6.7%

FQA Condition Category: Fair

Wetland Type: Bog	
Area: 1.93 acres	
Chamaedaphne calyculata	26.5%
Scirpus cyperinus	24.5%
Carex utriculata	14.3%
Carex oligosperma	8.2%
Calamagrostis canadensis	6.1%
Sphagnum moss	6.1%
Rubus strigosus	4.1%
Andromeda glaucophylla	2.0%
Carex aquatilis	2.0%
Salix petiolaris	2.0%
Tanacetum vulgare	2.0%
Typha latifolia	2.0%

FQA Condition Category: Fair

Mitigation Site 10

Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Wetland Type: Shallow Marsh
Area: 0.76 acres

Scirpus cyperinus	45.7%
Typha latifolia	25.7%
Calamagrostis canadensis	5.7%
Sphagnum moss	5.7%
Typha angustifolia	5.7%
Carex canescens	2.9%
Carex lacustris	2.9%
Carex utriculata	2.9%
Lotus corniculatus	2.9%

FQA Condition Category: Fair
Wetland Type: Sedge Meadow
Area: 2.95

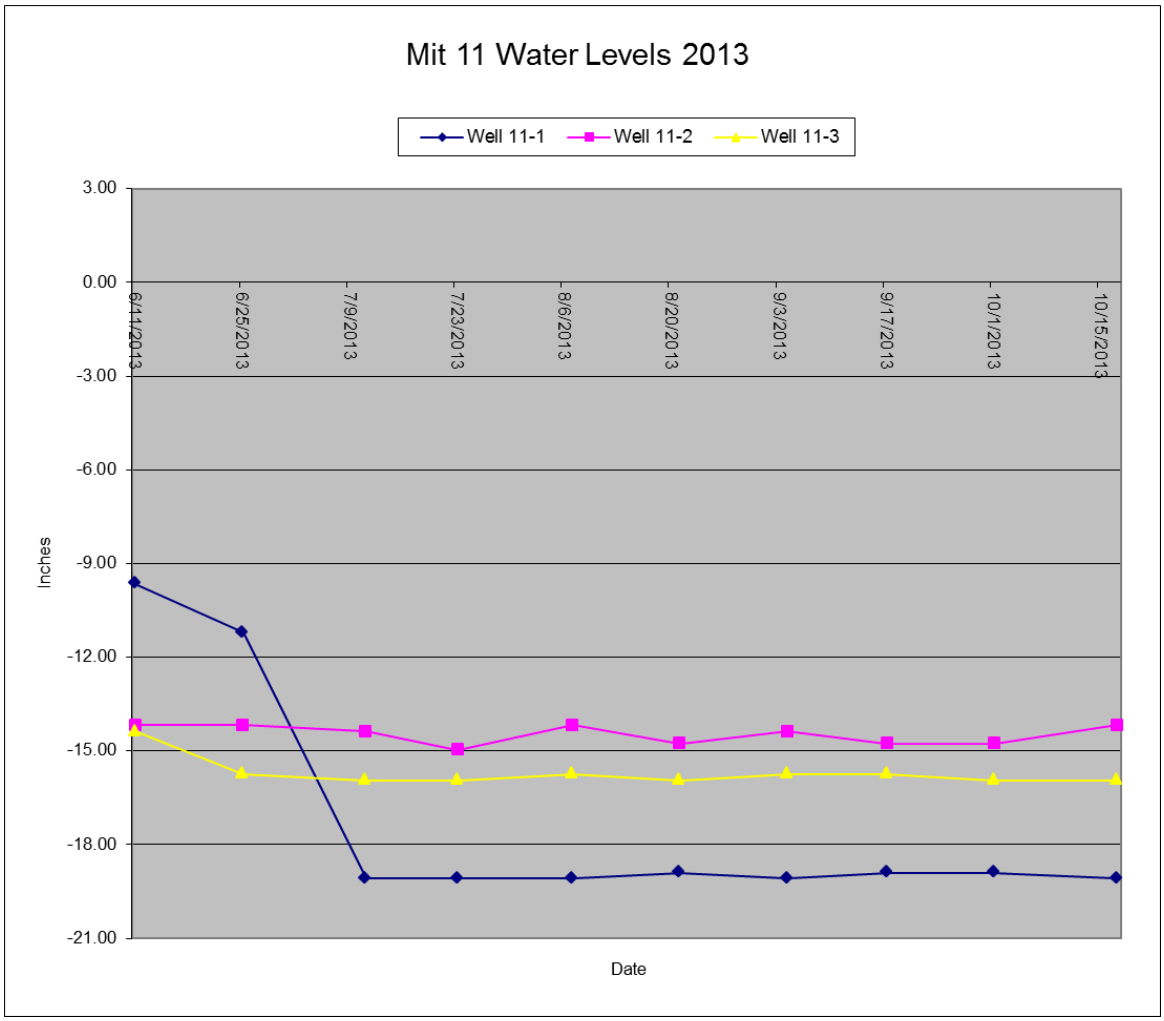
Wetland Type: Pond
Area: 0.06

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**	
Achillea millefolium	Yes	
Agrostis scabra	Yes	
Alnus rugosa	Yes	
Alnus viridis ssp. crispa	Yes	
Andromeda glaucophylla	Yes	
Betula papyrifera	Yes	
Betula pumila	Yes	
Calamagrostis canadensis	Yes	
Caltha natans	Yes	Rare
Carex aquatilis	Yes	
Carex canescens	Yes	
Carex lacustris	Yes	
Carex lasiocarpa	Yes	
Carex oligosperma	Yes	
Carex sp.	X	
Carex tenera	Yes	
Carex utriculata	Yes	
Chamaedaphne calyculata	Yes	
Cirsium arvense	No	
Dryopteris cristata	Yes	
Iris versicolor	Yes	
Juncus effusus	Yes	
Kalmia polifolia	Yes	

Total Species Present October 2013	**Native**
Larix laricina	Yes
Lotus corniculatus	No
Lysimachia thyrsiflora	Yes
Pinus strobus	Yes
Populus balsamifera	Yes
Populus tremuloides	Yes
Potentilla norvegica	Yes
Rubus strigosus	Yes
Salix bebbiana	Yes
Salix discolor	Yes
Salix humilus	Yes
Salix pedicellaris	Yes
Salix petiolaris	Yes
Salix pyrifolia	Yes
Scirpus cyperinus	Yes
Solidago gigantea	Yes
Sphagnum moss	Yes
Tanacetum vulgare	No
Trifolium hybridum	No
Typha angustifolia	No
Typha latifolia	Yes
Species Richness	**44**

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 11 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
This site meets wetland hydrology criteria but not by much.
Failure to meet wetland hydrology criteria may prevent its use as a mitigation site.
Poor potential as a mitigation site due to low water table and extensive reed canary grass infestation.

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 11 - October 2013
Total Basin Area: 2.8 acres

Wetland Type: Fresh Meadow	**Percent**
Area: 1.03 acres	**Cover**
Scirpus cyperinus	39.0%
Alnus rugosa	15.3%
Phalaris arundinacea	15.3%
Agrostis gigantea	11.9%
Calamagrostis canadensis	6.8%
Euthamia graminifolia	3.4%
Chrysanthemum leucanthemum	1.7%
Juncus effusus	1.7%
Phleum pratense	1.7%
Poa pratense	1.7%
Scirpus microcarpus	1.7%

FQA Condition Category: Fair

Wetland Type: Reed Canary	
Area: 1.67 acres	
Phalaris arundinacea	58.5%
Calamagrostis canadensis	7.3%
Scirpus cyperinus	7.3%
Agrostis gigantea	4.9%
Chrysanthemum leucanthemum	4.9%
Euthamia graminifolia	4.9%
Poa pratense	4.9%
Elymus repens	2.4%
Juncus effusus	2.4%
Solidago gigantea	2.4%

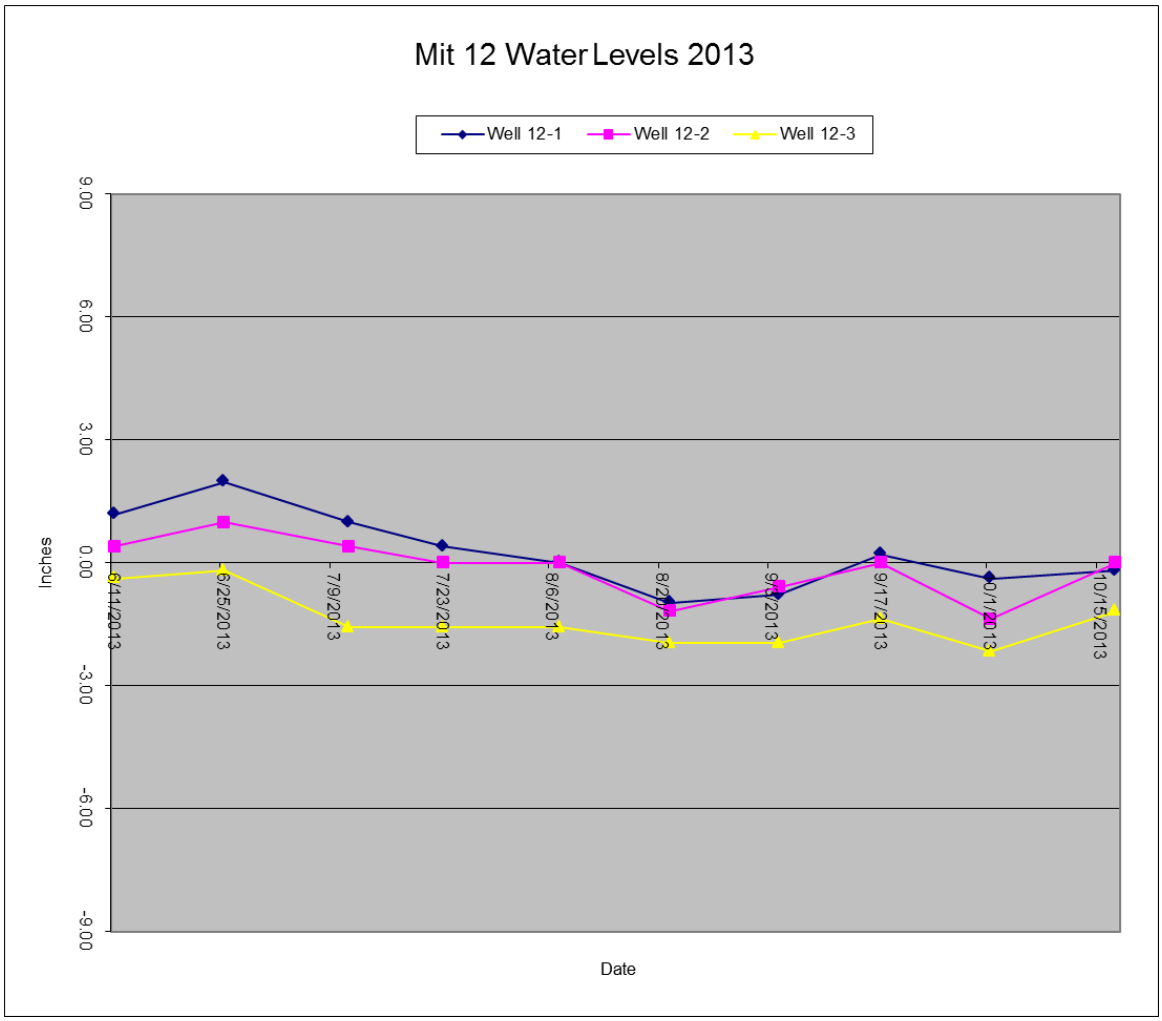
FQA Condition Category: Poor

Wetland Type: Shrub Carr (Alder Thicket)
Area: 0.14 acres

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present	
October 2013	**Native**
Achillea millefolium	Yes
Agrostis gigantea	No
Alnus rugosa	Yes
Anaphalis margaritacea	Yes
Aster lanceolatus	Yes
Aster modestus	Yes
Bromus inermis	No
Calamagrostis canadensis	Yes
Carex lacustris	Yes
Chrysanthemum leucanthemum	No
Cirsium arvense	No
Cirsium vulgare	No
Elymus repens	No
Euthamia graminifolia	Yes
Glyceria canadensis	Yes
Glyceria grandis	Yes
Iris versicolor	Yes
Juncus effusus	Yes
Phalaris arundinacea	No
Phleum pratense	No
Poa pratense	No
Poa pratense	No
Ribes hirtellum	Yes
Rubus strigosus	Yes
Rudbeckia hirta	Yes
Rumex crispus	No
Salix bebbiana	Yes
Scirpus cyperinus	Yes
Scirpus microcarpus	Yes
Solidago gigantea	Yes
Spiraea alba	Yes
Tanacetum vulgare	No
Trifolium hybridum	No
Species Richness	**33**

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 12 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Purple loosestrife and narrow-leaf cattail common.
Power-lines run directly over the site.
Poor potential as a mitigation site.

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 12 - October 2013
Total Basin Area: 0.66 acres

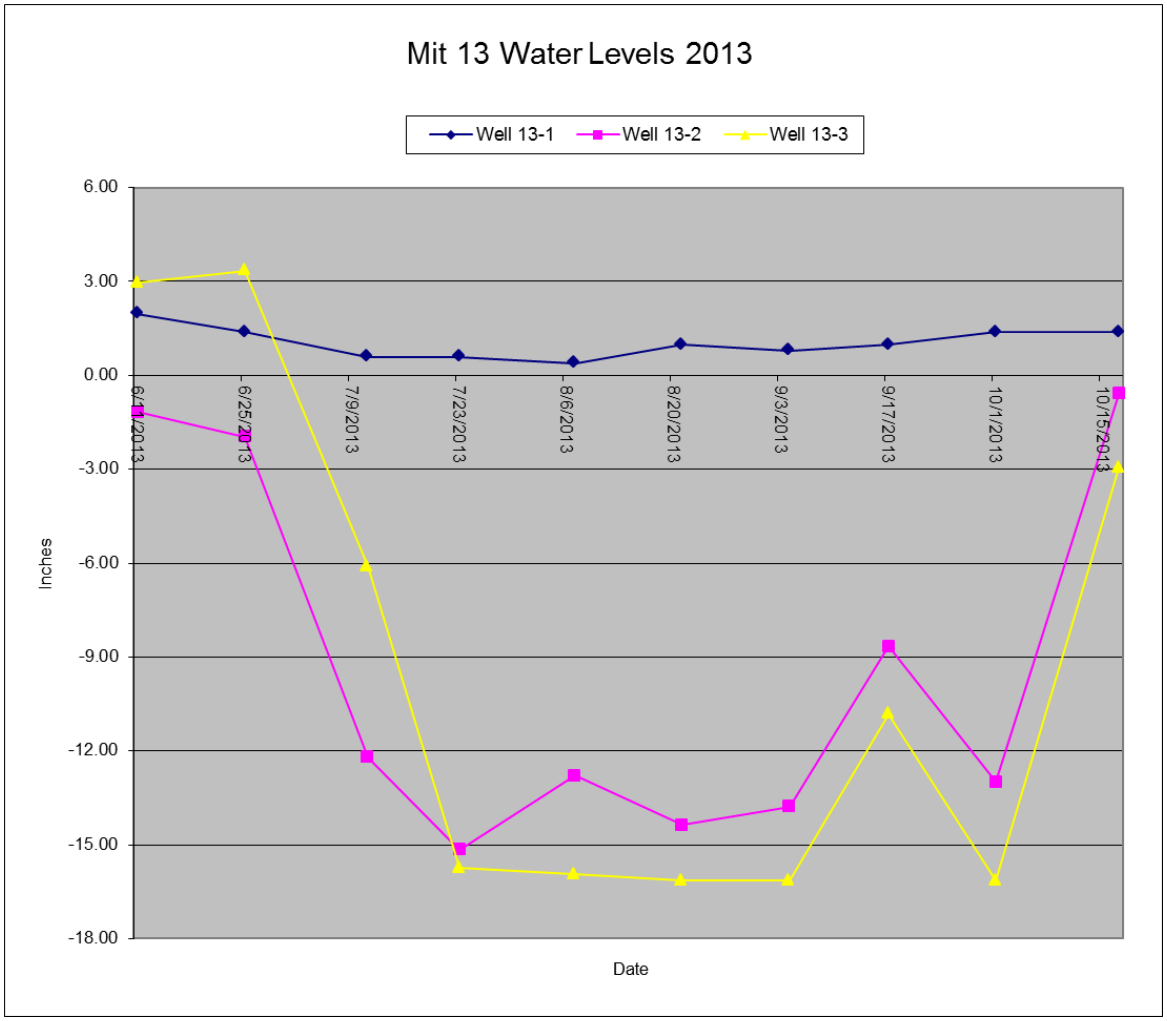
Wetland Type: Shallow Marsh	**Percent**
Area: 0.66 acres	**Cover**
Typha X glauca	24.4%
Typha angustifolia	22.0%
Juncus effusus	17.1%
Carex utriculata	9.8%
Lythrum salicaria	7.3%
Aster puniceus	2.4%
Carex canescens	2.4%
Juncus nodosus	2.4%
Salix bebbiana	2.4%
Salix pyrifolia	2.4%
Scirpus atrovirens	2.4%
Scirpus cyperinus	2.4%
Scirpus validus	2.4%

FQA Condition Category: Fair

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present	
October 2013	**Native**
Aster puniceus	Yes
Carex canescens	Yes
Carex utriculata	Yes
Juncus effusus	Yes
Juncus nodosus	Yes
Lythrum salicaria	No
Salix bebbiana	Yes
Salix pyrifolia	Yes
Scirpus atrovirens	Yes
Scirpus cyperinus	Yes
Scirpus validus	Yes
Typha angustifolia	No
Typha X glauca	No
Aster lanceolatus	Yes
Beckmannia syzigachne	Yes
Calamagrostis canadensis	Yes
Carex comosa	Yes
Carex hystericina	Yes
Carex lacustris	Yes
Equisetum arvense	Yes
Eupatorium maculatum	Yes
Eupatorium perfoliatum	Yes
Galium tinctorium	Yes
Juncus canadensis	Yes
Leersia oryzoides	Yes
Lysimachia thyrsiflora	Yes
Mimulus ringens	Yes
Onoclea sensibilis	Yes
Phalaris arundinacea	No
Phragmites australis	Yes
Polygonum sagittatum	Yes
Salix petiolaris	Yes
Sphagnum	Yes
Verbena hastata	Yes
Species Richness	**34**

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 13 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Purple loosestrife common in the shallow marsh area.
Power-line runs directly over the site.
Poor potential as a mitigation site.

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 13 - October 2013
Total Basin Area: 3.20 acres

Wetland Type: Shallow Marsh	**Percent**
Area: 0.39 acres	**Cover**
Typha angustifolia	28.0%
Scirpus cyperinus	16.0%
Typha latifolia	16.0%
Typha X glauca	12.0%
Juncus effusus	8.0%
Aster modestus	4.0%
Lythrum salicaria	4.0%
Scirpus microcarpus	4.0%
Sparganium chlorocarpum	4.0%
Sphagnum moss	4.0%

FQA Condition Category: Poor

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Wetland Type: Fresh Meadow
Area: 2.76 acres

Calamagrostis canadensis	30.8%
Scirpus cyperinus	18.8%
Juncus effusus	9.4%
Phalaris arundinacea	5.1%
Agrostis gigantea	3.4%
Agrostis scabra	3.4%
Carex utriculata	3.4%
Scirpus microcarpus	3.4%
Carex canescens	2.6%
Carex leptalea	2.6%
Equisetum arvense	2.6%
Salix discolor	2.6%
Bare	1.7%
Glyceria canadensis	1.7%
Sphagnum moss	1.7%
Typha angustifolia	1.7%
Aster puniceus	0.9%
Carex comosa	0.9%
Epilobium coloratum	0.9%
Juncus tenuis	0.9%
Lythrum salicaria	0.9%
Typha latifolia	0.9%

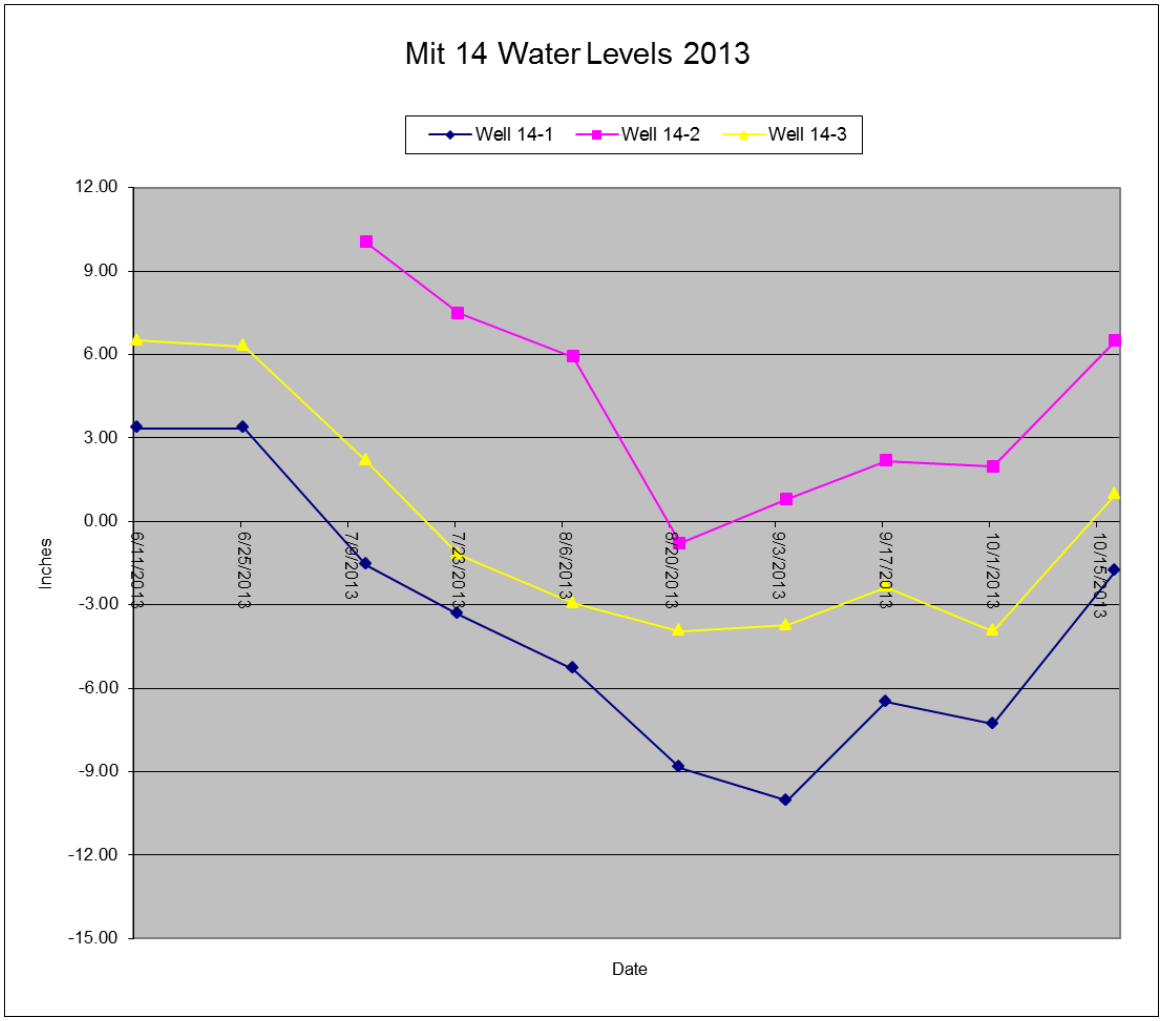
FQA Condition Category: Fair
Bare Soil
Area: 0.05 acres

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present October 2013	**Native**	
Agrostis gigantea	No	
Agrostis scabra	Yes	
Alisma plantago-aquatica	Yes	
Alnus rugosa	Yes	
Aster lanceolatus	Yes	
Aster modestus	Yes	
Aster puniceus	Yes	
Betula papyrifera	Yes	
Calamagrostis canadensis	Yes	
Caltha natans	Yes	Rare
Carex canescens	Yes	
Carex comosa	Yes	
Carex cristatella	Yes	
Carex disperma	Yes	
Carex gynandra	Yes	
Carex lasiocarpa	Yes	
Carex leptalea	Yes	
Carex paupercula	Yes	
Carex tenera	Yes	
Carex utriculata	Yes	
Chamaedaphne calyculata	Yes	
Chrysanthemum leucanthemum	No	
Drosera rotundifolia	Yes	
Eleocharis palustris	Yes	
Epilobium coloratum	Yes	
Epilobium leptophyllum	Yes	
Equisetum arvense	Yes	
Eupatorium maculatum	Yes	
Euthamia graminifolia	Yes	
Glyceria canadensis	Yes	

Total Species Present October 2013	**Native**
Juncus canadensis	Yes
Juncus effusus	Yes
Juncus nodosus	Yes
Juncus tenuis	Yes
Lotus corniculatus	No
Lysimachia thyrsiflora	Yes
Lythrum salicaria	No
Menyanthes trifoliata	Yes
Phalaris arundinacea	No
Poa palustris	Yes
Potentilla palustris	Yes
Salix discolor	Yes
Salix lucida	Yes
Salix pedicellaris	Yes
Salix pyrifolia	Yes
Scirpus cyperinus	Yes
Scirpus microcarpus	Yes
Scirpus validus	Yes
Sparganium chlorocarpum	Yes
Sphagnum moss	Yes
Spiraea alba	Yes
Stachys hispida	Yes
Thelypteris palustris	Yes
Typha angustifolia	No
Typha latifolia	Yes
Typha X glauca	No
Utricularia intermedia	Yes
Utricularia minor	Yes
Viola pallens	Yes
Species Richness	**59**

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014



Mitigation Site 14 Water Levels: June 11, 2013 – October 17, 2013.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Comments
Shallow marsh predominantly narrow-leaf cattail.
Standing water for most of the year.
Poor potential as a mitigation site without extensive remedial work.

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Overall FQA Condition Category: Fair

Mitigation 14 - October 2013
Total Basin Area: 0.66

Wetland Type: Fresh Meadow	**Percent**
Area: 0.12 acres	**Cover**
Scirpus cyperinus	61.5%
Agrostis scabra	11.5%
Typha angustifolia	7.7%
Calamagrostis canadensis	3.8%
Carex tenera	3.8%
Juncus brevicaudatus	3.8%
Juncus effusus	3.8%
Typha latifolia	3.8%

FQA Condition Category: Fair

Wetland Type: Shallow Marsh	
Area: 0.54 acres	
Typha X glauca	38.9%
Typha angustifolia	27.8%
Glyceria canadensis	11.1%
Scirpus cyperinus	11.1%
Salix bebbiana	5.6%
Typha latifolia	5.6%

FQA Condition Category: Fair

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Task 8: Annual Report – FY2014

Total Species Present	
October 2013	**Native**
Agrostis scabra	Yes
Alisma plantago-aquatica	Yes
Alnus rugosa	Yes
Betula papyrifera	Yes
Calamagrostis canadensis	Yes
Carex canescens	Yes
Drosera rotundifolia	Yes
Glyceria canadensis	Yes
Juncus effusus	Yes
Larix laricina	Yes
Lythrum salicaria	No
Phragmites australis	Yes
Picea mariana	Yes
Populus tremuloides	Yes
Salix bebbiana	Yes
Salix discolor	Yes
Salix eriocephala	Yes
Salix pyrifolia	Yes
Scirpus cyperinus	Yes
Sphagnum	Yes
Typha angustifolia	No
Typha latifolia	Yes
Typha X glauca	No
Species Richness	**23**

Validation of Wetland Mitigation
In
Abandoned Borrow Areas

Data Analysis and Interpretation – FY 2015

Water Level Monitoring
And
Percent Vegetative Cover by Species

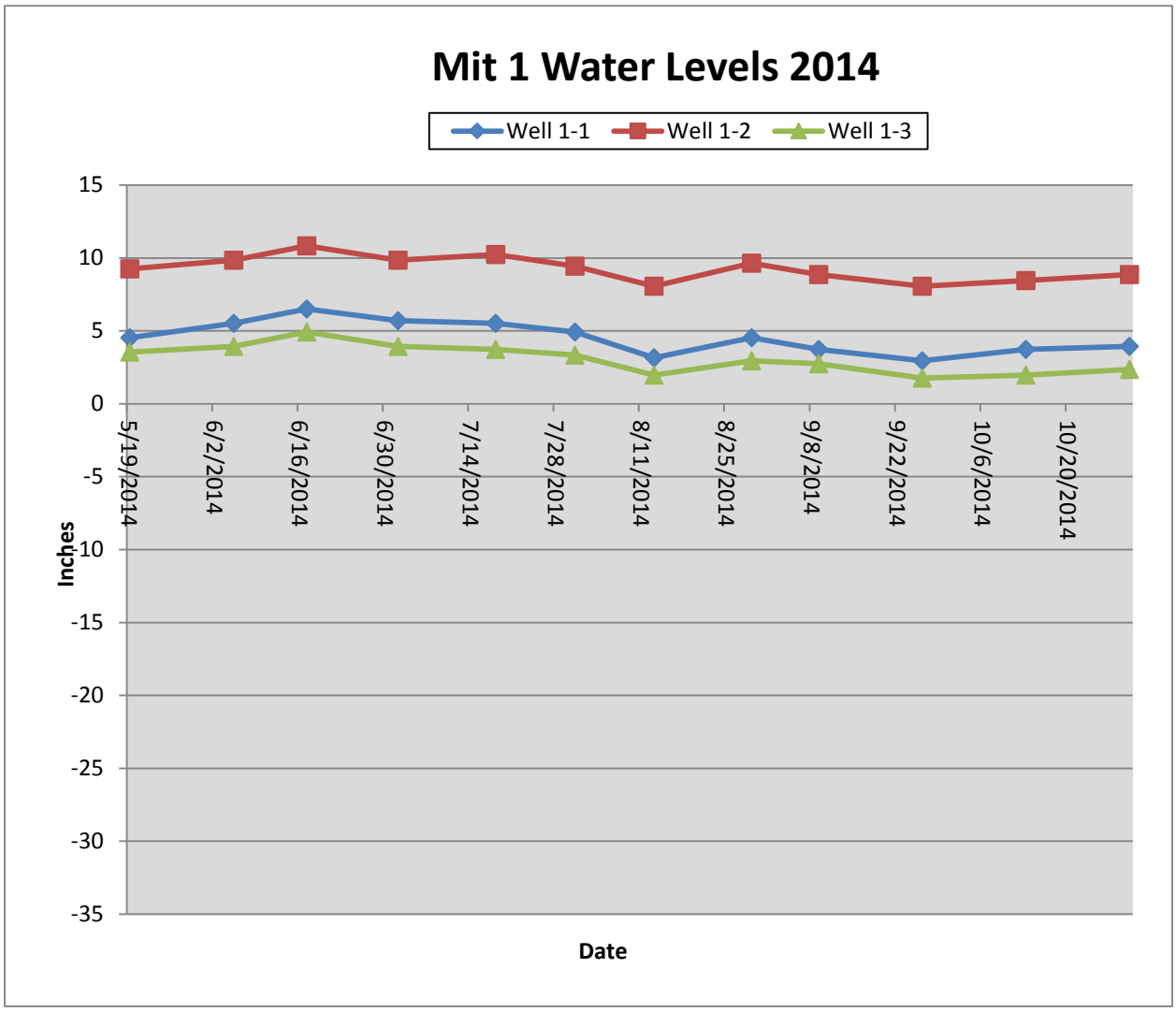
2014 Field Season

Completed June 2015

Introduction

This was the fourth year of the project "Validation of Wetland Mitigation in Abandoned Borrow Areas," which is a continuation of monitoring on the original mitigation sites (3, 4, 5), and on 11 additional mitigation sites (1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 14) along the U.S. Trunk Highway 53 reconstruction corridor. This summary report contains water level and plant survey data collected during the 2014 field season. The new vegetation survey method adopted in October 2013 was again used during this field season. Using this method, maps were produced using ArcGIS® software showing transect locations and plant communities for each mitigation site.

Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 1 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 1

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Poor

Mitigation 1 - October 2014
Total Basin Area: 0.83 acres

Wetland Type: Shallow Marsh Area: 0.73acres	**Percent Cover**
Typha angustifolia	93%
Scirpus cyperinus	4%
Scirpus microcarpus	4%

FQA Condition Category: Poor

Wetland Type: Wet Meadow Area:0.10	
Agrostis gigantea	48%
Carex tenera	7%
Juncus effusus	7%
Lotus corniculatus	7%
Panicum virigatum	7%
Scirpus cyperinus	7%
Typha angustifolia	7%
Juncus tenuis	3%
Phalaris arundinacea	3%
Trifolium hybridum	3%

FQA Condition Category: Poor

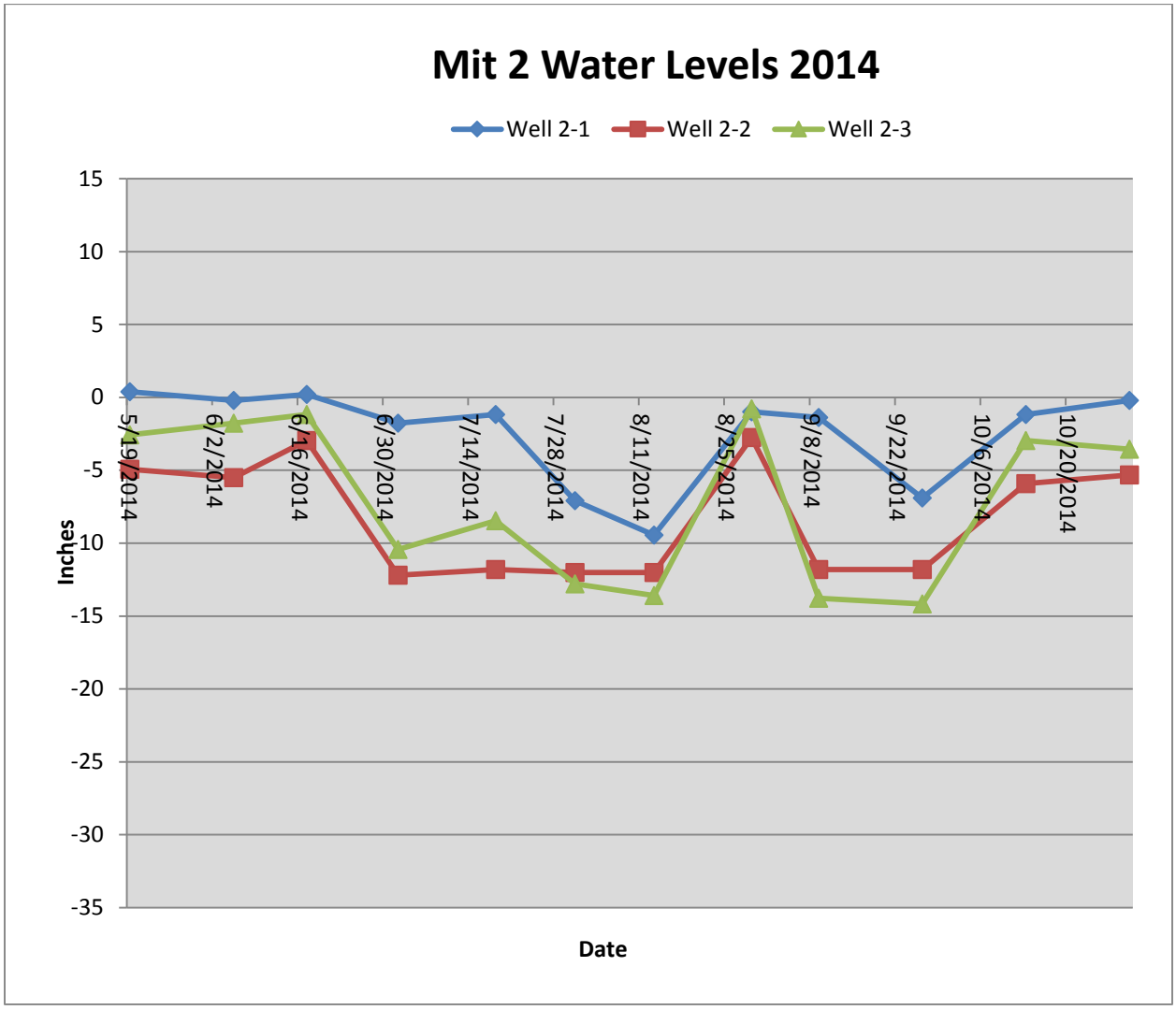
Mitigation Site 1
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	Native
Achillea millifolium	Yes
Agrostis gigantea	Yes
Agrostis scabra	Yes
Alisma plantago-aquatica	Yes
Alnus rugosa	Yes
Anaphalis margaritacea	Yes
Aster brachyactus	Adventive
Aster lanceolatus	Yes
Aster lanceolatus var. hirsuticaulis	Yes
Aster lateriflorus	Yes
Aster puniceus	Yes
Aster sp.	X
Aster umbellatus	Yes
Betula papyrifera	Yes
Calamagrostis canadensis	Yes
Carex crinita	Yes
Carex lupulina	Yes
Carex scoparia	Yes
Carex tenera	Yes
Carex vulpinoidea	Yes
Chrysanthemum leucanthemum	No
Cirsium arvense	No
Cirsium vulgare	No
Echinocloa crus-galli	No
Elymus (Agropyron) repens	No
Equisetum arvense	Yes
Erigeron annuus	Yes
Eupatorium maculatum	Yes
Euthamia graminifolia	Yes
Festuca ovina	No
Fragaria virginiana	Yes
Glyceria grandis	Yes
Gnaphalium uliginosum	No
Hieracium aurantiacum	No
Juncus brevicaudatus	Yes
Juncus effusus	Yes
Juncus nodosa	Yes

Total Species Present October 2014	Native
Juncus tenuis	Yes
Larix laricina	Yes
Lotus corniculatus	No
Lythrum salicaria	No
Medicago sativa	No
Mimulus ringens	Yes
Oenothera biennis	Yes
Onoclea sensibilis	Yes
Panicum virgatum	Yes
Phalaris arundinacea	No
Phleum pratense	No
Plantago major	No
Poa palustris	Yes
Poa pratense	No
Polygonum saggitatum	Yes
Populus balsamifera	Yes
Potentilla norvegica	Yes
Sagittaria latifolia	Yes
Salix bebbiana	Yes
Salix discolor	Yes
Salix interior	Yes
Salix lucida	Yes
Salix petiolaris	Yes
Scirpus cyperinus	Yes
Scirpus fluviatilis	Yes
Scirpus microcarpus	Yes
Scirpus pallidus	Yes
Scirpus validus	Yes
Scutellaria lateriflorus	Yes
Seteria sp.	X
Solidago gigantea	Yes
Solidago nemoralis	Yes
Sonchus arvensis	No
Tanacetum vulgare	No
Trifolium arvense	No
Trifolium hybridum	No

Total Species Present October 2014	**Native**	**Total Species Present October 2014**	**Native**
Typha angustifolia	No	*Typha x glauca*	No
Typha latifolia	Yes	**Species Richness**	**76**

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 2 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 2
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 2 - October 2014
Total Basin Area: 3.32 acres

Wetland Type: Wet Meadow	**Percent**
Area: 1.15 acres	**Cover**
Phalaris arundinacea	34%
Scirpus microcarpus	16%
Carex lacustris	10%
Juncus effusus	10%
Scirpus cyperinus	8%
Calamagrostis canadensis	3%
Cirsium arvense	3%
Carex utriculata	2%
(bare soil- ATV damage)	1%
Agrostis gigantea	1%
Carex retrorsa	1%
Lotus corniculatus	1%
Panicum virgatum	1%
Poa palustris	1%
Scirpus validus	1%
Solidago canadensis	1%
Sphagnum moss	1%
Typha angustifolia	1%
Typha latifolia	1%

FQA Condition Category: Fair

Wetland Type: Alder Thicket	
Area: 0.13acres	
Carex lacustris	33%
Calamagrostis canadensis	22%
Scirpus cyperinus	22%
Phalaris arundinacea	17%
Alnus rugosa	6%

FQA Condition Category: Fair

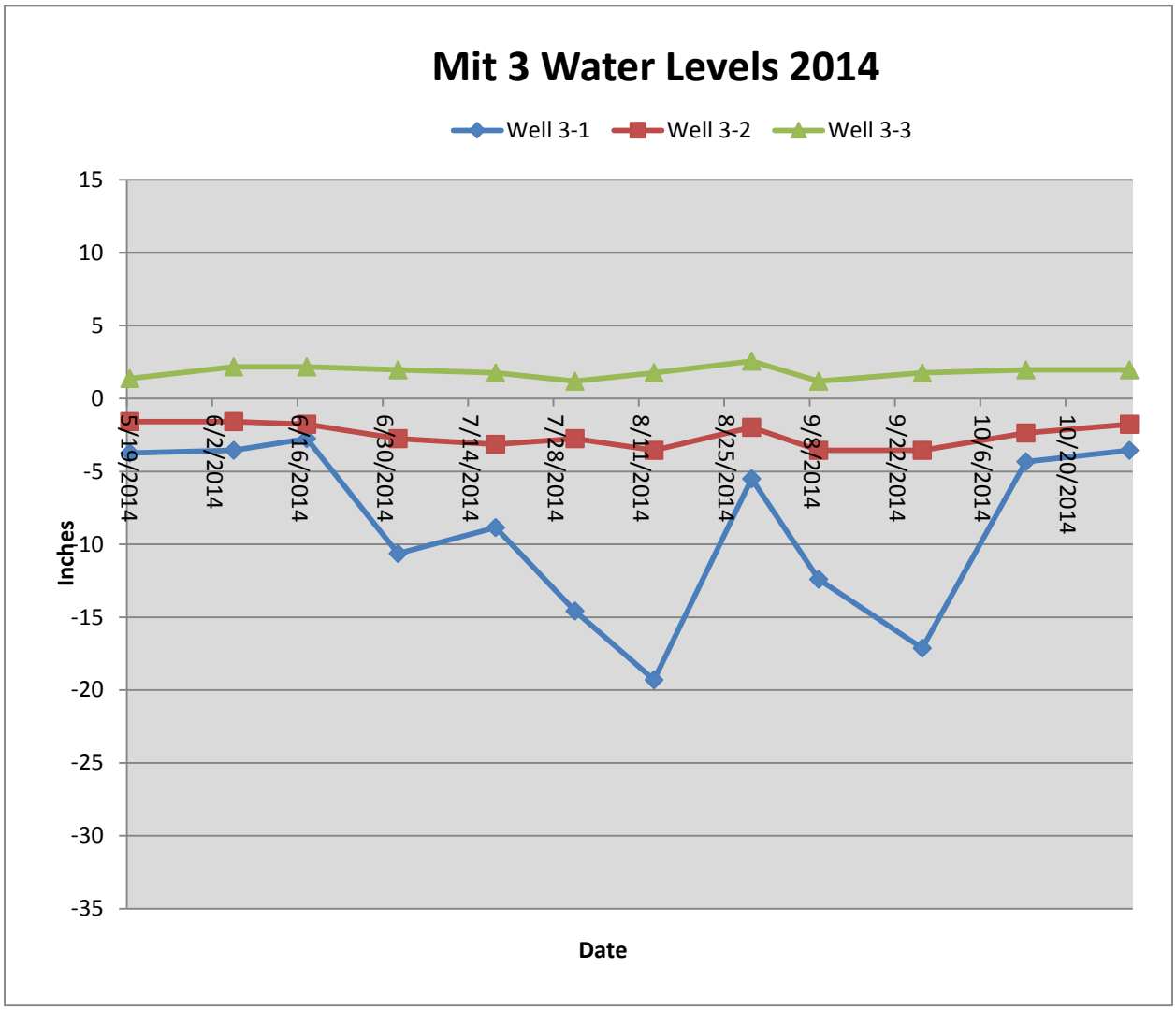
Wetland Type: Reed Canary Stand
Reed Canary Area: 2.04 acres
FQA Condition Category: Poor

Mitigation Site 2

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	**Native**	**Total Species Present October 2014**	**Native**
Achillea millifolium	Yes	*Lotus corniculatus*	No
Agrostis gigantea	Yes	*Mentha arvensis*	Yes
Alisma plantago-aquatica	Yes	*Onoclea sensibilis*	Yes
Alnus rugosa	Yes	*Panicum virgatum*	Yes
Anaphalis margaritacea	Yes	*Phalaris arundinacea*	No
Aster lanceolatus	Yes	*Poa palustris*	Yes
Aster modestus	Yes	*Poa pratense*	No
Aster puniceus	Yes	*Populus balsamifera*	Yes
Aster sp.	X	*Populus tremuloides*	Yes
Aster umbellatus	Yes	*Potentilla norvegica*	Yes
Beckmannia syzigachne	Yes	*Pycnanthemum virginianum*	Yes
Betula papyrifera	Yes	*Ranunculus pensylvanicus*	Yes
Bromus ciliatus	Yes	*Rubus pubescens*	Yes
Calamagrostis canadensis	Yes	*Rubus strigosus*	Yes
Carex lacustris	Yes	*Salix bebbiana*	Yes
Carex retrorsa	Yes	*Salix discolor*	Yes
Carex sp.	X	*Salix lucida*	Yes
Carex stipata	Yes	*Salix petiolaris*	Yes
Carex tenera	Yes	*Salix planifolia*	Yes
Carex utriculata	Yes	*Salix pyrifolia*	Yes
Chrysanthemum leucanthemum	No	*Scirpus atrovirens*	Yes
Cirsium arvense	No	*Scirpus cyperinus*	Yes
Cirsium vulgare	No	*Scirpus fluviatilis*	Yes
Dryopteris cristata	Yes	*Scirpus microcarpus*	Yes
Elymus repens	No	*Scirpus validus*	Yes
Epilobium leptophyllum	Yes	*Solidago canadensis*	Yes
Eupatorium maculatum	Yes	*Solidago gigantea*	Yes
Euthamia graminifolia	Yes	*Sonchus arvensis*	No
Fragaria virginiana	Yes	*Spiraea alba*	Yes
Glyceria grandis	Yes	*Stellaria longifolia*	Yes
Helenium autumnale	Yes	*Tanacetum vulgare*	No
Hieracium aurantiacum	No	*Taraxacum officinale*	No
Hypericum mutilum	Yes	*Trifolium hybridum*	No
Juncus effusus	Yes	*Typha angustifolia*	No
Lactuca biennis	Yes	*Typha latifolia*	Yes
Larix laricina	Yes	**Species Richness**	**71**

Mitigation Site 3



Mitigation Site 3 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 3

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 3 - October 2014
Total Basin Area: 1.04 acres

Wetland Type: Sedge Meadow	**Percent**
Area: 0.59 acres	**Cover**
Scirpus cyperinus	53%
Calamagrostis canadensis	30%
Phalaris arundincea	7%
Carex utriculata	3%
Juncus effusus	3%
Populus tremuloides	3%

FQA Condition Category: Fair

Wetland Type: Shallow Marsh	
Area: 0.39 acres	
Carex utriculata	30%
Typha latifolia	23%
Scirpus cyperinus	13%
Typha angustifolia	13%
Glyceria canadensis	10%
Calamagrostis candadensis	7%
Scirpus microcarpus	3%

FQA Condition Category: Good

Wetland Type: Reed Canary Stand	
Reed Canary Area: 0.16 acres	
Phalaris arundincea	100%

FQA Condition Category: Poor

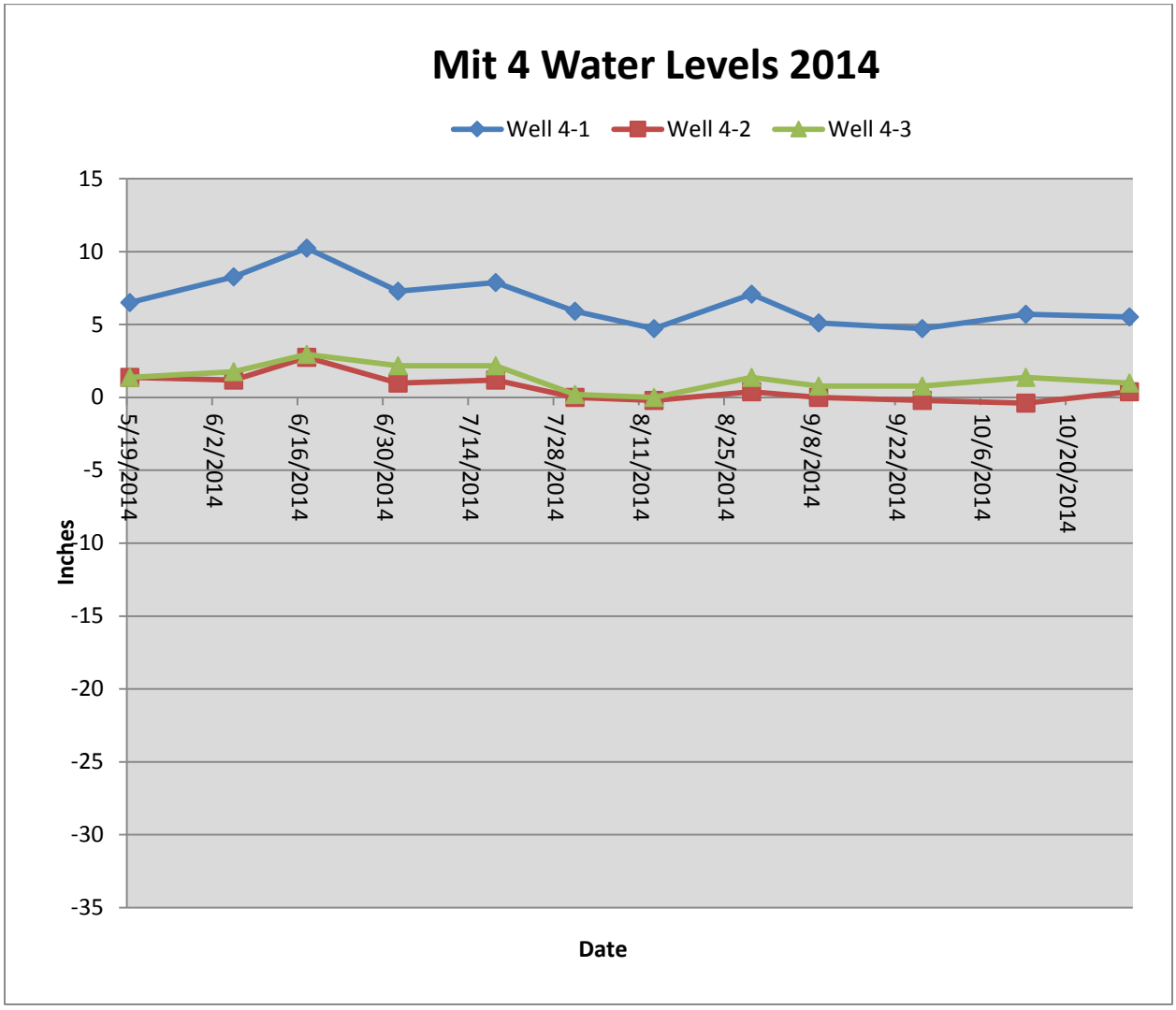
Mitigation Site 3

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present

October 2014	Native	October 2014	Native
Achillea millefolium	Yes	*Juncus effusus*	Yes
Agrostis gigantea	No	*Larix laricina*	Yes
Agrostis hyemalis	Yes	*Leersia oryzoides*	Yes
Alisma plantago-aquatica	Yes	*Lycopodium annotinum*	Yes
Alnus rugosa	Yes	*Mimulus ringens*	Yes
Aster lanceolatus	Yes	*Phalaris arundinacea*	No
Aster modestus	Yes	*Picea mariana*	Yes
Aster puniceus	Yes	*Poa palustris*	Yes
Aster sp.	X	*Polygonum saggitatum*	Yes
Betula papyrifera	Yes	*Polygonum sp.*	X
Bidens cernua	Yes	*Populus tremuloides*	Yes
Bidens frondosa	Yes	*Potentilla palustris*	Yes
Calamagrostis canadensis	Yes	*Rubus strigosus*	Yes
Carex comosa	Yes	*Saggitaria latifolia*	Yes
Carex intumescens	Yes	*Salix bebbiana*	Yes
Carex lacustris	Yes	*Salix discolor*	Yes
Carex retrorsa	Yes	*Salix petiolaris*	Yes
Carex scoparia	Yes	*Salix sp. seedling*	X
Carex atherodes	Yes	*Scirpus atrovirens*	Yes
Carex stipata	Yes	*Scirpus cyperinus*	Yes
Carex tenera	Yes	*Scirpus fluviatilis*	Yes
Carex utriculata	Yes	*Scirpus microcarpus*	Yes
Cerastium fontanum	Yes	*Scirpus sp. (sterile)*	X
Cyperaceae sp. (Carex?)	X	*Scirpus validus*	Yes
Cyperaceae sp. (Scirpus?)	X	*Solidago canadensis*	Yes
Dicot seedlings	X	*Solidago gigantea*	Yes
Drosera rotundifolia	Yes	*Sparganium chlorocarpum*	Yes
Elymus sp.	X	*Thuja occidentalis*	Yes
Epilobium ciliatum	Yes	*Trifolium hybridum*	No
Epilobium sp.	X	*Trifolium pratense*	No
Equisetum arvense	Yes	*Typha angustifolia*	No
Eupatorium perfoliatum	Yes	*Typha latifolia*	Yes
Eupatorium sp. seedling	X	*Typha sp. seedlings*	X
Galium tinctorium	Yes	*Viola sp.*	X
Glyceria canadensis	Yes	**Species Richness**	**72**
Glyceria grandis	Yes		
Glyceria striata	Yes		
Hieracium aurantiacum	No		

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 4 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Exceptional

Mitigation 4 - October 2014
Total Basin Area: 1.86 acres

Wetland Type: Sedge Meadow	**Percent**
Area: 1.86 acres	**Cover**
Carex utriculata	53.4%
Carex lacustris	13.8%
Scirpus microcarpus	13.8%
Calamagrostis canadensis	6.9%
Scirpus cyperinus	6.9%
Eleocharis palustris	1.7%
Juncus effusus	1.7%
Typha latifolia	1.7%

FQA Condition Category: Exceptional

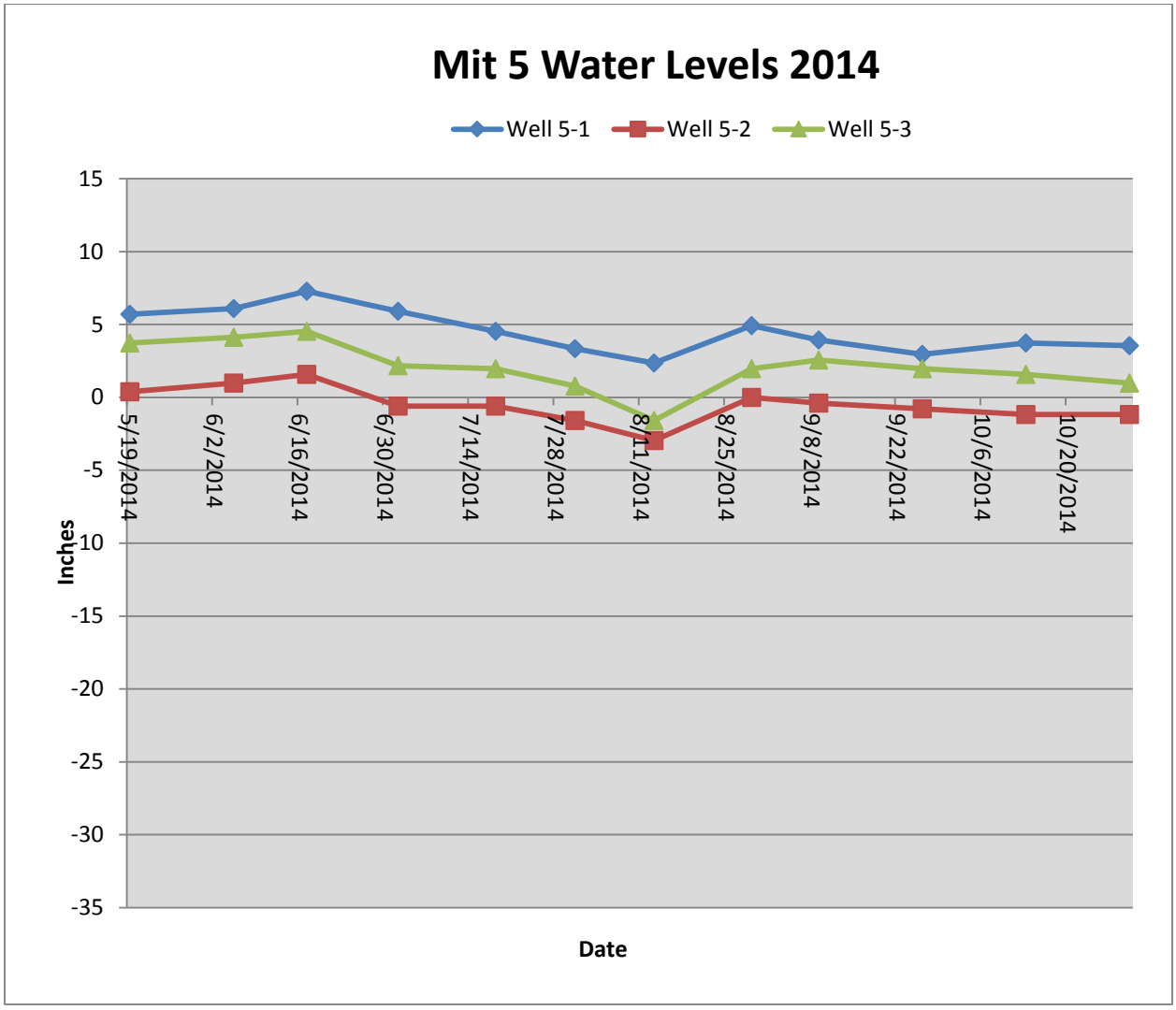
Mitigation Site 4
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	Native
Achillea millefolium	Yes
Agrostis gigantea	No
Agrostis scabra	Yes
Alisma plantago-aquatica	Yes
Anaphalis margaritacea	Yes
Aster lanceolatus	Yes
Aster lanceolatus var. hirsuticaulis	Yes
Aster modestus	Yes
Aster puniceus	Yes
Aster umbellatus	Yes
Beckmannia syzigachne	Yes
Betula papyrifera	Yes
Betula pumila	Yes
Bidens cernua	Yes
Bidens frondosa	Yes
Calamagrostis canadensis	Yes
Callitriche verna	Yes
Campanula aparinoides	Yes
Cardamine pensylvanica	Yes
Carex aquatilis	Yes
Carex cannescens	Yes
Carex lacustris	Yes
Carex lasiocarpa	Yes
Carex retrorsa	Yes
Carex scoparia	Yes
Carex sp.	X
Carex stipata	Yes
Carex tenera	Yes
Carex utriculata	Yes
Chamaedaphne calyculata	Yes
Chelone glabra	Yes
Dicot seedlings	X
Dryopteris cristata	Yes
Eleocharis obtusa	Yes
Eleocharis palustris	Yes
Epilobium ciliatum	Yes

Total Species Present October 2014	Native
Epilobium coloratum	Yes
Epilobium leptophyllum	Yes
Eupatorium maculatum	Yes
Euthamia graminifolia	Yes
Galium tinctorium	Yes
Glyceria canadensis	Yes
Glyceria grandis	Yes
Glyceria septentrionalis	Yes
Hypericum canadense	Yes
Impatiens capensis	Yes
Iris versicolor	Yes
Juncus brevicaudatus	Yes
Juncus effusus	Yes
Juncus filiformis	Yes
Juncus nodosus	Yes
Larix laricina	Yes
Leersia oryzoides	Yes
Lemna minor	Yes
Lysimachia thyrsiflora	Yes
Lythrum salicaria	No
Mentha arvensis	Yes
Onoclea sensibilis	Yes
Phalaris arundinacea	No
Poa palustris	Yes
Polygonum amphibium	Yes
Polygonum hydropiper	Yes
Polygonum pensylvanicum	Yes
Polygonum saggitatum	Yes
Polytrichum moss	Yes
Populus tremuloides	Yes
Potentilla norvegica	Yes
Potentilla palustris	Yes
Rumex orbiculatus	Yes
Saggitaria latifolia	Yes
Salix bebbiana	Yes
Salix eriocephala	Yes
Salix petiolaris	Yes

Total Species Present October 2014	Native	Total Species Present October 2014	Native
Salix sp. seedling	X	*Triadenum fraseri*	Yes
Scirpus cyperinus	Yes	*Typha angustifolia*	No
Scirpus microcarpus	Yes	*Typha latifolia*	Yes
Scutellaria galericulata	Yes	*Typha x glauca*	No
Sium suave	Yes	*Utricullaria intermedia*	Yes
Solidago gigantea	Yes	*Utricullaria minor*	Yes
Sphagnum moss	Yes	*Veronica scuttelaria*	Yes
Thelypteris palustris	Yes	*Viola pallens*	Yes
Torreyochloa pallida	Yes	**Species Richness**	**90**

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 5 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 5
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Exceptional

Mitigation 5 - October 2014
Total Basin Area: 1.87 acres

Wetland Type: Sedge Meadow	**Percent**
Area: 1.87 acres	**Cover**
Carex utriculata	38%
Scirpus cyperinus	23%
Carex lacustris	15%
Calamagrostis canadensis	13%
Glyceria canadensis	6%
Typha latifolia	6%

FQA Condition Category: Exceptional

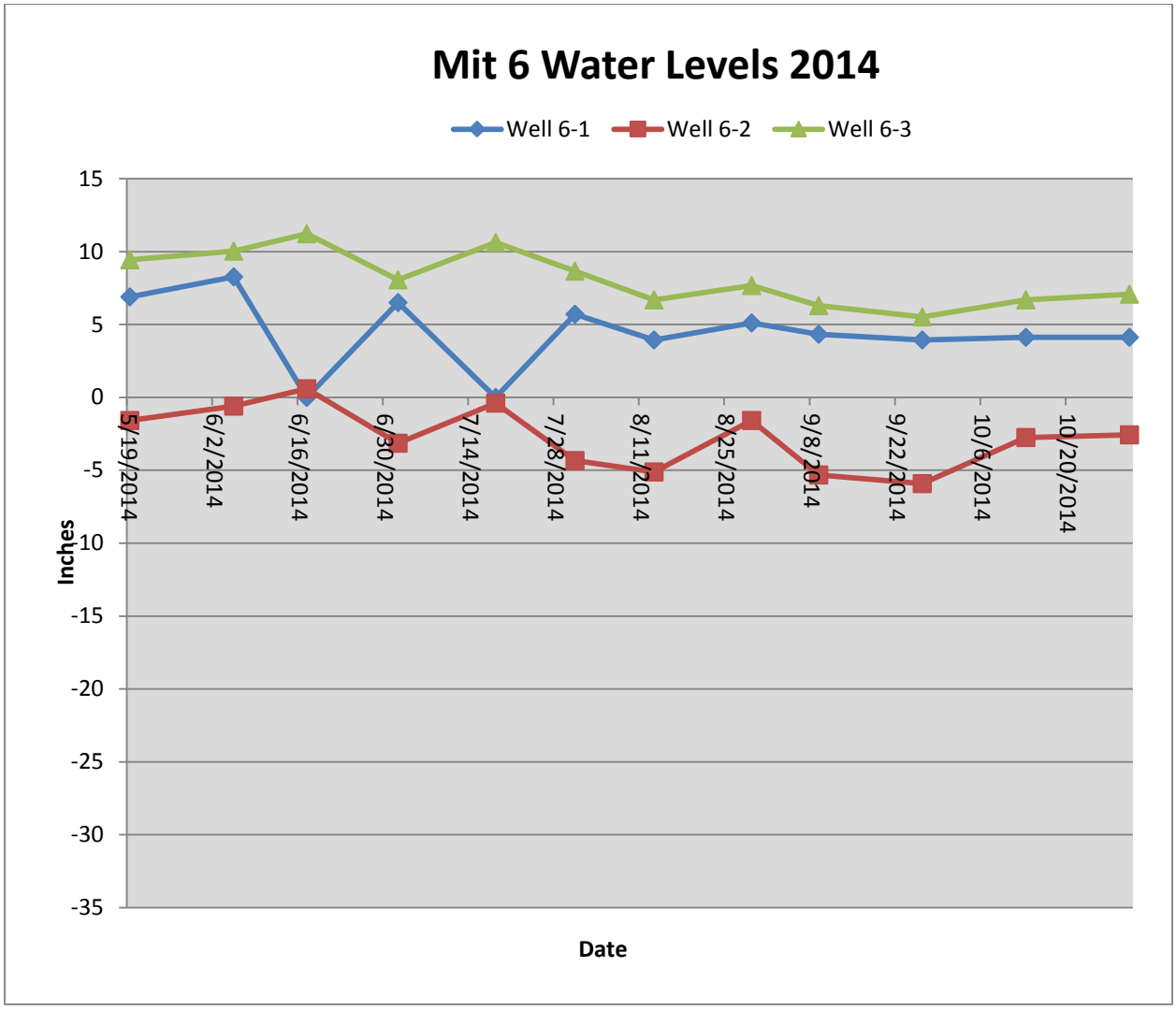
Mitigation Site 5

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present

October 2014	Native	October 2014	Native
Alisma plantago-aquatica	Yes	*Lysimachia thyrsiflora*	Yes
Alnus rugosa	Yes	*Phalaris arundinacea*	No
Aster lanceolatus	Yes	*Polygonum amphibium*	Yes
Bidens cernua	Yes	*Polygonum hydropiper*	Yes
Bidens connata	Yes	*Polygonum pensylvanicum*	Yes
Bidens frondosa	Yes	*Polygonum saggitatum*	Yes
Calamagrostis canadensis	Yes	*Ranunculus pensylvanicus*	Yes
Callitriche verna	Yes	*Rumex orbiculatus*	Yes
Caltha palustris	Yes	*Saggitaria latifolia*	Yes
Carex aquatilis	Yes	*Salix bebbiana*	Yes
Carex aquatilis	Yes	*Salix discolor*	Yes
Carex cannescens	Yes	*Salix interior*	Yes
Carex lacustris	Yes	*Salix petiolaris*	Yes
Carex retrorsa	Yes	*Salix planifolia*	Yes
Carex stipata	Yes	*Salix pyrifolia*	Yes
Carex stricta	Yes	*Salix sp.*	X
Carex tenera	Yes	*Scirpus atrovirens*	Yes
Carex utriculata	Yes	*Scirpus cyperinus*	Yes
Cicuta bulbifera	Yes	*Scirpus microcarpus*	Yes
Cyperaceae seedlings	X	*Scirpus validus*	Yes
Eleocharis obtusa	Yes	*Sium suave*	Yes
Eleocharis palustris	Yes	*Sparganium chlorocarpum*	Yes
Epilobium letptophyllum	Yes	*Spiraea alba*	Yes
Eupatorium maculatum	Yes	*Torreyochloa pallida*	Yes
Galium tinctorium	Yes	*Typha angustifolia*	No
Glyceria canadensis	Yes	*Typha latifolia*	Yes
Glyceria grandis	Yes	*Utricullaria intermedia*	Yes
Grass seedlings	X	*Utricullaria minor*	Yes
Juncus effusus	Yes	*Viola pallens*	Yes
Leersia oryzoides	Yes	**Species Richness**	**59**

Mitigation Site 6
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 6 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 6

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Good

Mitigation 6 - October 2014
Total Basin Area: 6.07 acres

Wetland Type: Shallow Marsh	**Percent**
Area: 3.10acres	**Cover**
Typha angustifolia	34%
Carex lacustris	18%
Carex utriculata	16%
Typha x glauca	11%
Agrostis gigantea	2%
Equisetum fluviatile	2%
Juncus brevicaudatus	2%
Juncus vaseyi	2%
Lemna minor	2%
Medicago sativa	2%
Phalaris arundinacea	2%
Scirpus cyperinus	2%
Typha latifolia	2%

FQA Condition Category: Fair

Wetland Type: Sedge Meadow	
Area: 2.87 acres	
Carex utriculata	38%
Carex lacustris	16%
Calamagrostis canadensis	11%
Scirpus microcarpus	11%
Anaphalis margaritacea	3%
Cirsium arvense	3%
Hieracium aurantiacum	3%
Juncus effusus	3%
Lotus corniculatus	3%
Phalaris arundinacea	3%
Salix eriocephala	3%
Scirpus cyperinus	3%
Typha angustifolia	3%

FQA Condition Category: Good

Wetland Type: Wet Meadow
Area: 0.10 acres, no data

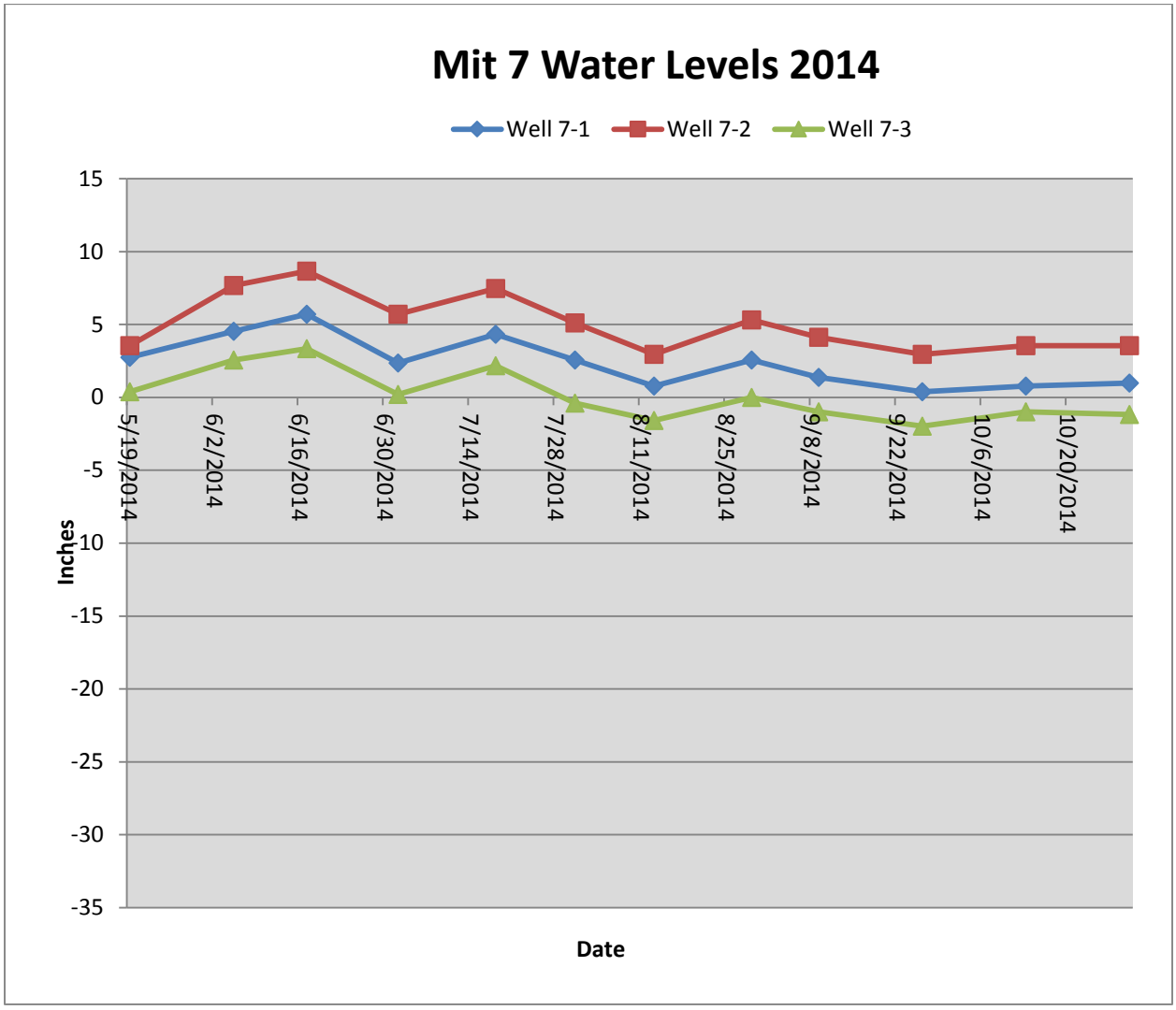
Mitigation Site 6

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present

October 2014	Native	October 2014	Native
Agrostis gigantea	Yes	*Lotus corniculatus*	No
Agrostis scabra	Yes	*Lythrum salicaria*	No
Alisma plantago-aquatica	Yes	*Medicago sativa*	No
Alnus rugosa	Yes	*Onoclea sensibilis*	Yes
Anaphalis margaritacea	Yes	*Phalaris arundinacea*	No
Barbarea vulgaris	No	*Pinus strobus*	Yes
Betula papyrifera	Yes	*Populus tremuloides*	Yes
Bidens frondosa	Yes	*Potamogeton obtusifolius*	Yes
Calamagrostis canadensis	Yes	*Potentilla palustris*	Yes
Carex aquatilis	Yes	*Rubus strigosus*	Yes
Carex cannescens	Yes	*Rumex crispus*	No
Carex lacustris	Yes	*Salix bebbiana*	Yes
Carex retrorsa	Yes	*Salix discolor*	Yes
Carex scoparia	Yes	*Salix lucida*	Yes
Carex sp.	X	*Salix petiolaris*	Yes
Carex stipata	Yes	*Salix planifolia*	Yes
Carex utriculata	Yes	*Salix serissima*	Yes
Chamaedaphne calyculata	Yes	*Scirpus atrocinctus*	Yes
Cicuta bulbifera	Yes	*Scirpus cyperinus*	Yes
Eleocharis palustris	Yes	*Scirpus microcarpus*	Yes
Equisetum fluviatile	Yes	*Sium suave*	Yes
Equisetum scirpoides	Yes	*Sparganium chlorocarpum*	Yes
Eupatorium maculatum	Yes	*Trifolium hybridum*	No
Galium tinctorium	Yes	*Typha angustifolia*	No
Glyceria canadensis	Yes	*Typha latifolia*	Yes
Glyceria grandis	Yes	*Typha X glauca*	No
Hieracium aurantiacum	No	*Utricullaria minor*	Yes
Juncus brevicaudatus	Yes	*Utricullaria vulgaris (macrorhiza)*	Yes
Juncus effusus	Yes	*Viola sp.*	X
Juncus tenuis	Yes	**Species Richness**	**61**
Juncus vaseyi	Yes		
Lemna minor	Yes		

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 7 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 7
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 7 - October 2014
Total Basin Area: 1.5 acres

Wetland Type: Shallow Marsh	**Percent**
Area: 1.1 acres	**Cover**
Scirpus cyperinus	52%
Typha angustifolia	20%
Scirpus microcarpus	16%
Salix bebbiana	4%
Typha latifolia	4%
Typha x glauca	4%

FQA Condition Category: Fair

Wetland Type: Wet Meadow	
Area: 0.4 acres	
Scirpus cyperinus	26%
Calamagrostis canadensis	19%
Juncus effusus	11%
Scirpus microcarpus	11%
Agrostis gigantea	7%
Carex tenera	7%
Phalaris arundinacea	7%
Salix sp.	7%
Glyceria grandis	4%

FQA Condition Category: Fair

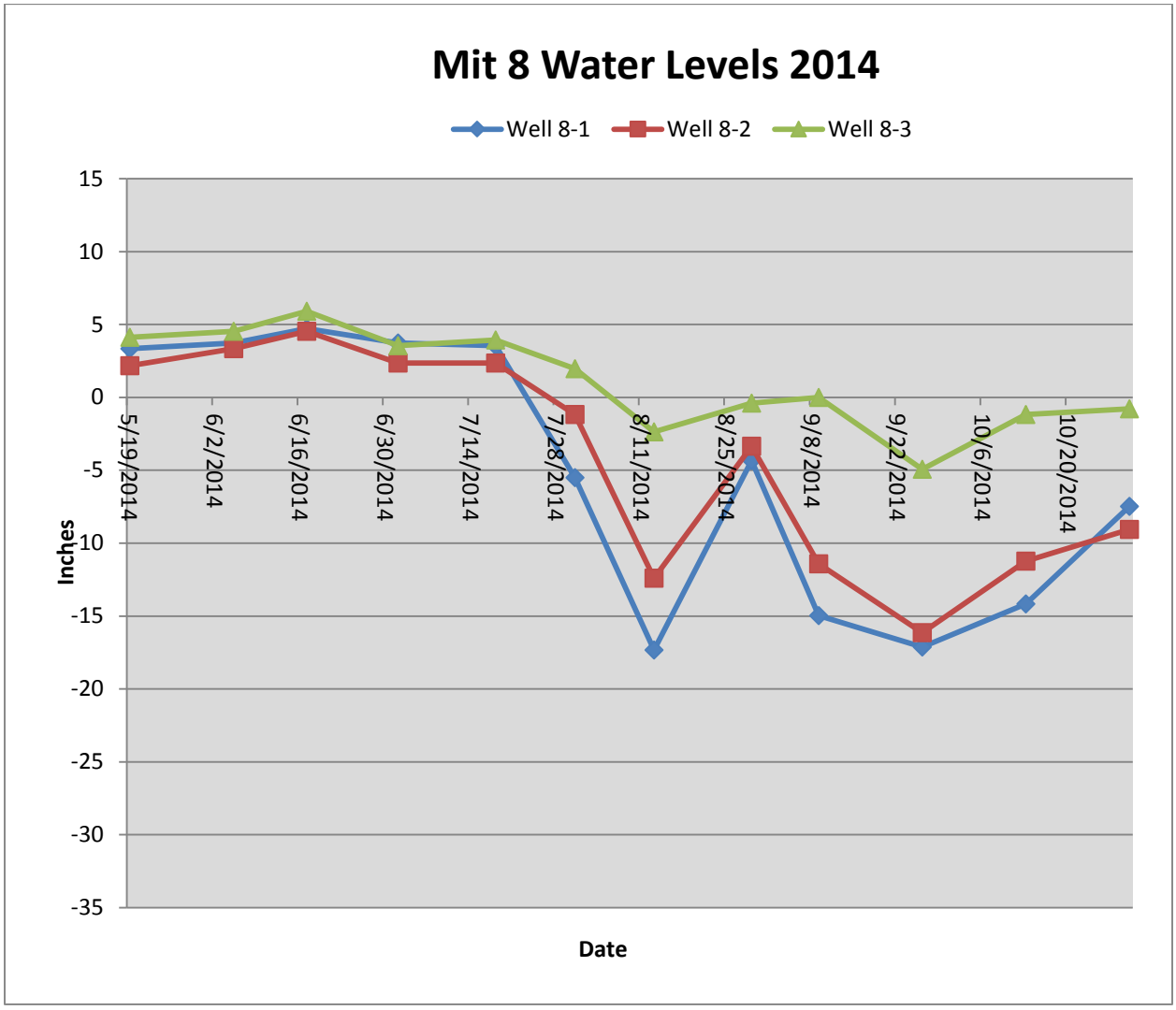
Mitigation Site 7

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present

October 2014	Native	October 2014	Native
Agrostis gigantea	*No*	*Larix laricina*	*Yes*
Alisma plantago-aquatica	*Yes*	*Phalaris arundinacea*	*No*
Alnus rugosa	*Yes*	*Poa palustris*	*Yes*
Aster lanceolatus	*Yes*	*Populus tremuloides*	*Yes*
Aster modestus	*Yes*	*Ranunculus acris*	*No*
Beckmannia syzigachne	*Yes*	*Rumex orbiculatus*	*Yes*
Calamagrostis canadensis	*Yes*	*Salix bebbiana*	*Yes*
Carex intumescens	*Yes*	*Salix eriocephala*	*Yes*
Carex scoparia	*Yes*	*Salix petiolaris*	*Yes*
Carex stipata	*Yes*	*Salix serissima*	*Yes*
Carex tenera	*Yes*	*Scirpus atrovirens*	*Yes*
Carex utriculata	*Yes*	*Scirpus cyperinus*	*Yes*
Carex vulpinoidea	*Yes*	*Scirpus microcarpus*	*Yes*
Chrysanthemum leucanthemum	*No*	*Scirpus validus*	*Yes*
Epilobium coloratum	*Yes*	*Solidago canadensis*	*Yes*
Epilobium leptophyllum	*Yes*	*Solidago uliginosa*	*Yes*
Equisetum sylvaticum	*Yes*	*Tanacetum vulgare*	*No*
Glyceria canadensis	*Yes*	*Trifolium repens*	*No*
Glyceria grandis	*Yes*	*Typha angustifolia*	*No*
Juncus effusus	*Yes*	*Typha latifolia*	*Yes*
Juncus filiformis	*Yes*	*Typha X glauca*	*No*
Juncus tenuis	*Yes*	**Species Richness**	**44**
Juncus vaseyi	*Yes*		

Mitigation Site 8
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 8 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 8

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 8 - October 2014
Total Basin Area: 19.83 acres

Wetland Type: Wet Meadow	**Percent**
Area: 14.35 acres	**Cover**
Calamagrostis canadensis	32%
Scirpus cyperinus	25%
Carex lacustris	16%
Carex utriculata	9%
Agrostis gigantea	5%
Cirsium arvense	4%
Phalaris arundinacea	4%
Carex stipata	2%
Lotus corniculatus	2%
Scirpus microcarpus	2%

FQA Condition Category: Fair

Wetland Type: Shallow Marsh	
Area: 1.54 acres	
Carex lacustris	23%
Scirpus cyperinus	19%
Scirpus microcarpus	15%
(bare soil, ATV damage)	12%
Calamagrostis canadensis	12%
Typha latifolia	12%
Carex utriculata	4%
Typha angustifolia	4%

FQA Condition Category: Fair

Mitigation Site 8

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Wetland Type: Sedge Meadow
Area: 1.60 acres

Carex utriculata	48%
Carex lacustris	17%
Scirpus cyperinus	13%
Calamagrostis canadensis	9%
Alnus rugosa	4%
Aster lanceolatus	4%
Rubus strigosus	4%

FQA Condition Category: Exceptional

Wetland Type: Shrub Carr (Willows)
Area: 1.49 acres

Carex lacustris	67%
Salix discolor	33%

FQA Condition Category: Fair

Wetland Type: Reed Canary Stand
Area: 0.64 acres

Phalaris arundinacea	100%

FQA Condition Category: Poor

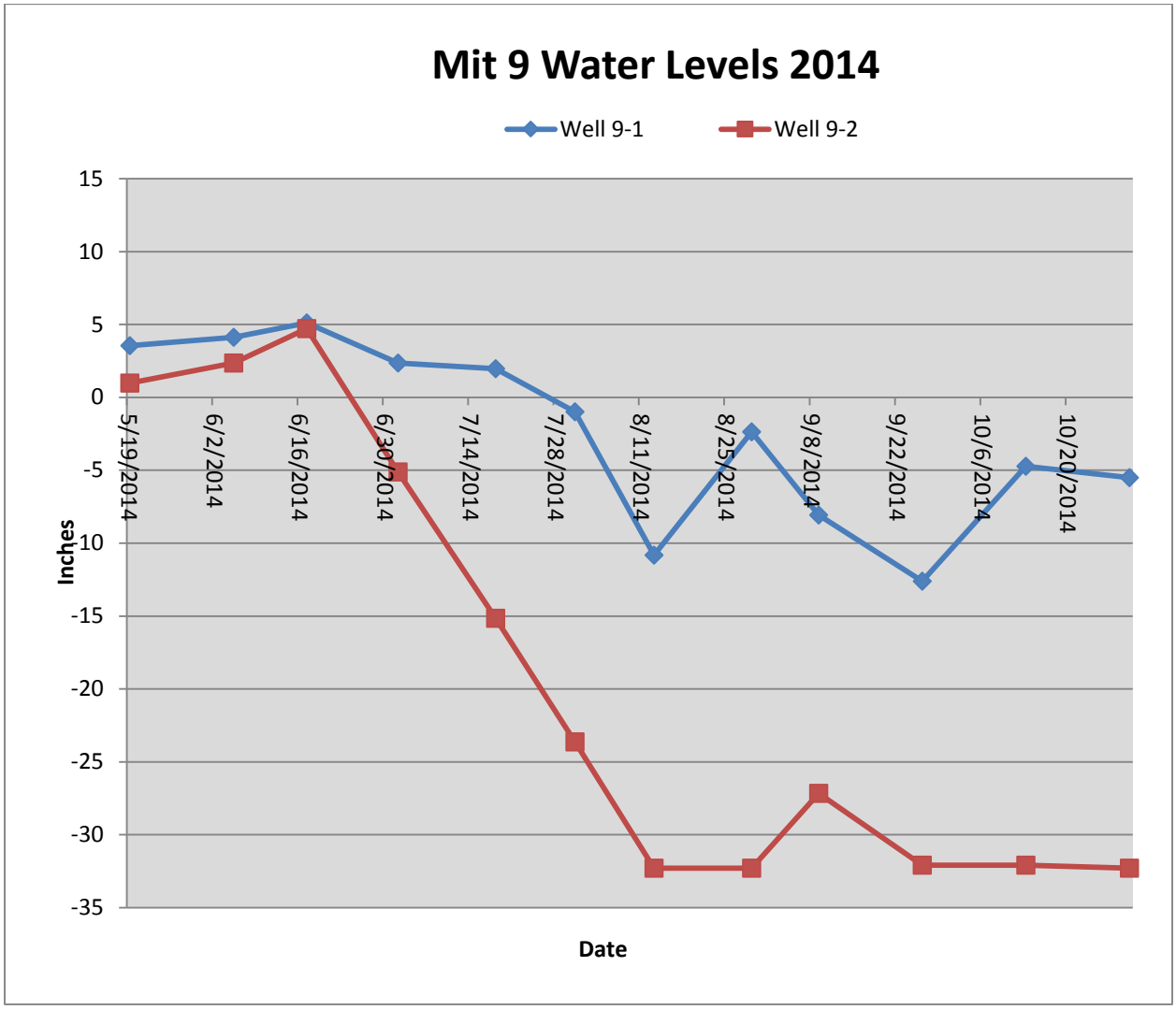
Mitigation Site 8

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present

October 2014	Native	October 2014	Native
Agrostis gigantea	No	*Solidago canadensis*	Yes
Alnus rugosa	Yes	*Solidago gigantea*	Yes
Anaphalis margaritacea	Yes	*Typha angustifolia*	No
Aster lanceolatus	Yes	*Typha latifolia*	Yes
Aster macrophyllus	Yes	*Typha X glauca*	No
Aster puniceus	Yes	*Carex lupulina*	Yes
Aster sp.	X	*Helenium autumnale*	Yes
Betula papyrifera	Yes	*Hippuris vulgaris*	Yes
Calamagrostis canadensis	Yes	*Rumex orbiculatus*	Yes
Carex cannescens	Yes	*Eupatorium perfoliatum*	Yes
Carex lacustris	Yes	*Equisetum arvense*	Yes
Carex stipata	Yes	*Dryopteris cristata*	Yes
Carex utriculata	Yes	*Equisetum sylvaticum*	Yes
Eupatorium maculatum	Yes	*Solidago uliginosa*	Yes
Festuca sp.	X	*Carex intumescens*	Yes
Glyceria grandis	Yes	*Pinus resinosa*	Yes
Juncus effusus	Yes	*Pinus banksiana*	Yes
Lotus corniculatus	No	*Juncus vaseyi*	Yes
Phalaris arundinacea	No	*Verbena hastata*	Yes
Poa palustris	Yes	*Salix planifolia*	Yes
Populus balsamifera	Yes	*Panicum virgatum*	Yes
Populus tremuloides	Yes	*Geum allepicum*	Yes
Rubus strigosus	Yes	*Carex hystericina*	Yes
Salix bebbiana	Yes	*Juncus tenuis*	Yes
Salix discolor	Yes	*Solidago nemoralis*	Yes
Salix eriocephala	Yes	*Fragaria virginiana*	Yes
Salix petiolaris	Yes	*Onoclea sensibilis*	Yes
Salix pyrifolia	Yes	*Chrysanthemum leucanthemum*	No
Scirpus cyperinus	Yes	*Hieracium aurantiacum*	No
Scirpus microcarpus	Yes	**Species Richness**	**60**
Scirpus validus	Yes		

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 9 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Good

Mitigation 9 - October 2014
Total Basin Area: 9.24 acres

Wetland Type: Wet Meadow
Area: 5.74 acres

Scirpus cyperinus	36%
Calamagrostis canadensis	30%
Glyceria canadensis	14%
Typha latifolia	7%
Agropyron repens	2%
Carex cannescens	2%
Phalaris arundinacea	2%
Rubus strigosus	2%
Salix petiolaris	2%
Sphagnum moss	2%

FQA Condition Category: Fair

Wetland Type: Shallow Marsh
Area: 2.01 acres

Typha angustifolia	30%
Scirpus cyperinus	23%
Typha latifolia	10%
Carex utricullata	8%
Polytrichum moss	5%
Salix petiolaris	5%
Sphagnum moss	5%
Calamagrostis canadensis	3%
Carex oligosperma	3%
Glyceria canadensis	3%
Juncus alpinoarticulatus	3%
Juncus brevicaudatus	3%
Viola pallens	3%

FQA Condition Category: Fair

Mitigation Site 8

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Wetland Type: Sedge Meadow	**Percent**
Area: 1.21 acres	**Cover**
Scirpus cyperinus	45%
Glyceria canadensis	41%
Betula pumila	5%
Iris versicolor	5%
Typha latifolia	5%

FQA Condition Category: Exceptional

Wetland Type: Bog	
Area: 0.12 acres	
Glyceria canadensis	67%
Scirpus cyperinus	33%

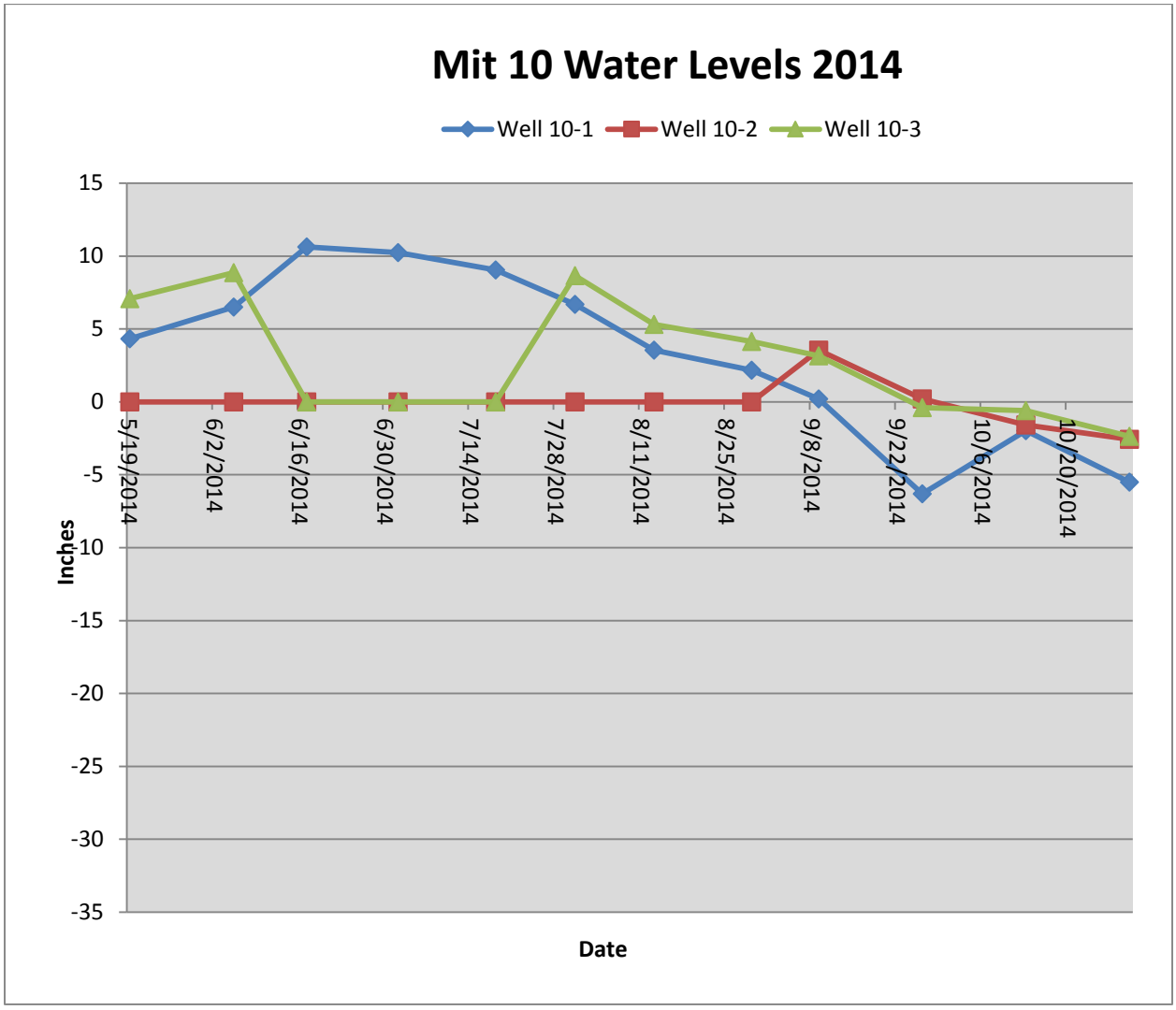
FQA Condition Category: Fair

Mitigation Site 9
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	Native	Total Species Present October 2014	Native
Achillea millefolium	Yes	*Fragaria virginiana*	Yes
Agrostis gigantea	No	*Glyceria canadensis*	Yes
Agrostis scabra	Yes	*Glyceria grandis*	Yes
Alnus rugosa	Yes	*Hieracium aurantiacum*	No
Anaphalis margaritacea	Yes	*Hypericum pyramidatum*	Yes
Aster lanceolatus	Yes	*Iris versicolor*	Yes
Aster macrophyllus	Yes	*Lotus corniculatus*	No
Betula papyrifera	Yes	*Lycopus uniflorus*	Yes
Betula pumila	Yes	*Lysimachia sp.*	X
Bidens cernua	Yes	*Oenothera parviflora*	Yes
Bidens frondosa	Yes	*Phleum pratense*	No
Bromus inermis	No	*Pinus resinosa*	Yes
Calamagrostis canadensis	Yes	*Pinus strobus*	Yes
Calla palustris	Yes	*Plantago major*	No
Campanula aparinoides	Yes	*Poa palustris*	Yes
Carex cannescens	Yes	*Polygonum pensylvanicum*	Yes
Carex comosa	Yes	*Polytrichum moss*	Yes
Carex disperma	Yes	*Potentilla palustris*	Yes
Carex interior	Yes	*Rubus strigosus*	Yes
Carex leptalea	Yes	*Salix bebbiana*	Yes
Carex magellanicum	Yes	*Salix discolor*	Yes
Carex sp. (1)	X	*Salix interior*	Yes
Carex sp. (2)	X	*Salix pedicellaris*	Yes
Carex tenera	Yes	*Salix petiolaris*	Yes
Carex utriculata	Yes	*Salix pyrifolia*	Yes
Chamaedaphne calyculata	Yes	*Scirpus cyperinus*	Yes
Cirsium arvense	No	*Solidago gigantea*	Yes
Cirsium muticum	Yes	*Solidago nemoralis*	Yes
Dryopteris cristata	Yes	*Solidago uliginosa*	Yes
Epilobium ciliatum	Yes	*Sonchus sp.*	No
Equisetum arvense	Yes	*Sphagnum moss*	Yes
Equisetum hyemale	Yes	*Tanacetum vulgare*	No
Eriophorum angustifolium	Yes	*Typha angustifolia*	No
Eupatorium maculatum	Yes	*Typha latifolia*	Yes
Euthamia graminifolia	Yes	*Utricullaria intermedia*	Yes
Festuca ovina	No	*Verbena hastata*	Yes
Festuca rubra	No	*Viola cucullata*	Yes

Viola pallens	Yes
Species Richness	**75**

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 10 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Good

Mitigation 10 - October 2014
Total Basin Area: 7.48 acres

Wetland Type: Shrub Carr **Area: 0.92 acres**	**Percent Cover**
Scirpus cyperinus	50%
Salix bebbiana	14%
Agrostis scabra	7%
Calamagrostis canadensis	7%
Carex utriculata	7%
Juncus effusus	7%
Salix petiolaris	7%

FQA Condition Category: Fair

Wetland Type: Bog **Area: 0.74 acres**	
Scirpus cyperinus	31%
Chamaedaphne calyculata	20%
Carex utriculata	17%
Carex oligosperma	11%
Carex aquatilis	3%
Carex lasiocarpa	3%
Glyceria canadensis	3%
Salix bebbiana	3%
Salix discolor	3%
Sphagnum moss	3%
Typha latifolia	3%

FQA Condition Category: Fair

Mitigation Site 8

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Wetland Type: Shallow Marsh
Area: 1.15 acres

Scirpus cyperinus	35%
Typha latifolia	29%
Carex lacustris	12%
Calamagrostis canadensis	6%
Carex lasiocarpa	6%
Carex utriculata	6%
Salix discolor	6%

FQA Condition Category: Fair

Wetland Type: Wet Meadow
Area: 4.59 acres

Carex utriculata	41%
Carex lacustris	9%
Carex lasiocarpa	9%
Glyceria canadensis	9%
Typha x glauca	9%
Betula papyrifera	5%
Calamagrostis canadensis	5%
Carex oligosperma	5%
Typha angustifolia	5%
Typha latifolia	5%

FQA Condition Category: Good

Mitigation Site 10
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

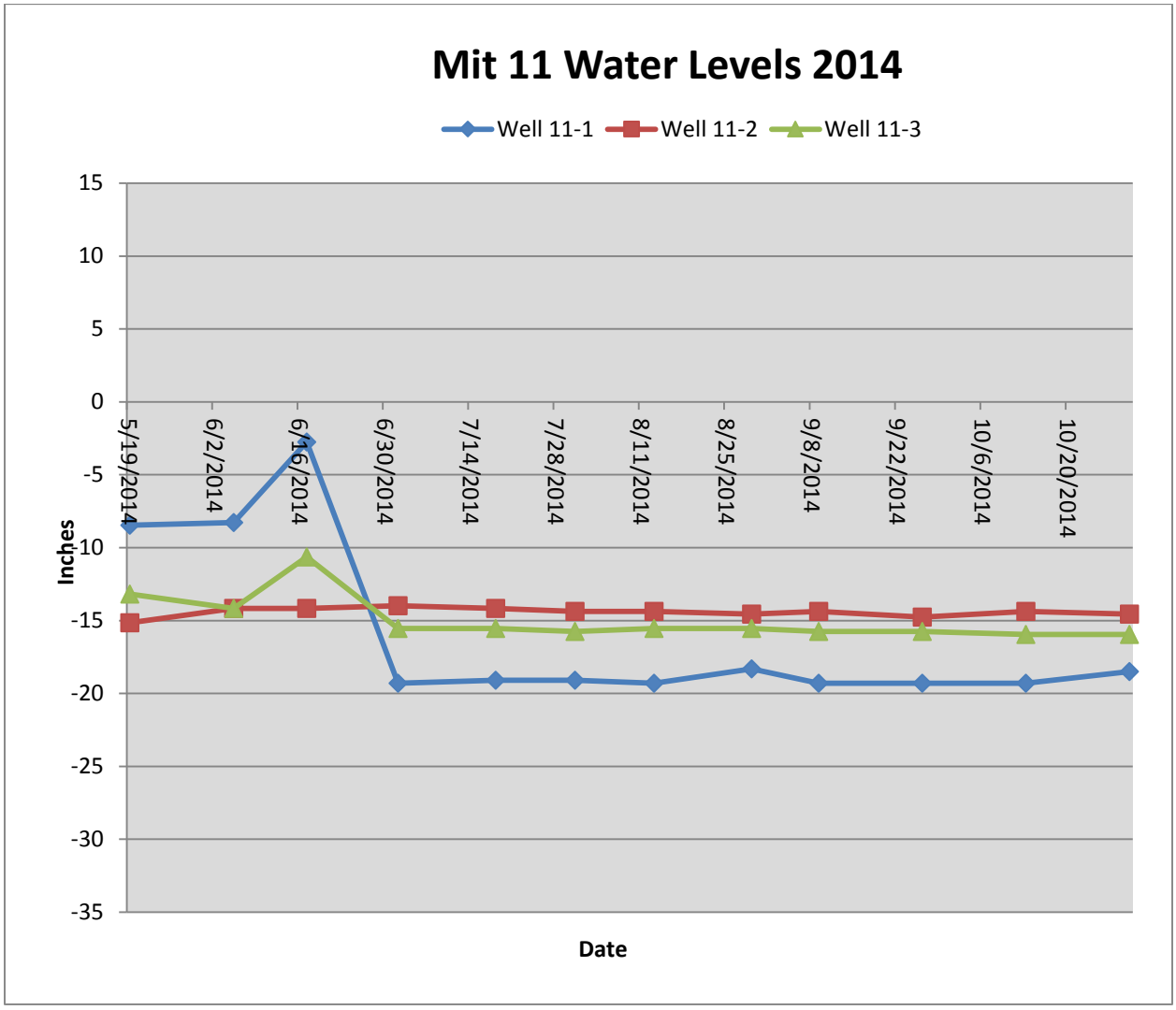
Total Species Present October 2014	Native
Agrostis gigantea	No
Agrostis scabra	Yes
Andromeda polifolia var. glaucophylla	Yes
Beckmannia syzigachne	Yes
Betula papyrifera	Yes
Betula sp. seedling	X
Bidens cernua	Yes
Calamagrostis canadensis	Yes
Callitriche verna	Yes
Carex aquatilis	Yes
Carex cannescens	Yes
Carex lacustris	Yes
Carex lasiocarpa	Yes
Carex oligosperma	Yes
Carex sp.	X
Carex sp. (Ovales)	X
Carex stricta	Yes
Carex trisperma	Yes
Carex utriculata	Yes
Chamaedaphne calyculata	Yes
Chrysanthemum leucanthemum	No
Cyperaceae seedlings	X
Dicot seedlings	X
Elymus (Agropyron) repens	No
Epilobium coloratum	Yes
Epilobium leptophyllum	Yes
Equisetum arvense	Yes
Equisetum fluviatile	Yes
Eriophorum angustifolium	Yes
Glyceria grandis	Yes
Grass seedlings (Agrostis?)	X
Hieracium cespitosum	No
Iris versicolor	Yes
Juncus brevicaudatus	Yes
Juncus effusus	Yes
Kalmia polifolia	Yes

Total Species Present October 2014	Native
Lotus corniculatus	No
Lycopus uniflorus	Yes
Lysimachia thyrsiflora	Yes
Menyanthes trifoliata	Yes
Oenothera biennis	Yes
Phalaris arundinacea	No
Pinus banksiana	Yes
Plantago major	No
Poa palustris	Yes
Polygonum saggitatum	Yes
Polytrichum moss	Yes
Populus balsamifera	Yes
Populus tremuloides	Yes
Potamogeton amplexicaulis?	Yes
Potentilla norvegica	Yes
Potentilla palustris	Yes
Rubus strigosus	Yes
Rumex acetosella	No
Salix bebbiana	Yes
Salix eriocephala	Yes
Salix lucida	Yes
Salix pedicellaris	Yes
Salix petiolaris	Yes
Salix pyrifolia	Yes
Sarracenia purpurea	Yes
Scirpus cyperinus	Yes
Scirpus microcarpus	Yes
Scirpus validus	Yes
Solidago gigantea	Yes
Sparganium chlorocarpum	Yes
Sparganium glomeratum	Yes
Sphagnum moss	Yes
Tanacetum vulgare	No
Triadenum fraseri	Yes
Trifolium hybridum	No
Typha angustifolia	No
Typha latifolia	Yes

Total Species Present October 2014	Native
Vaccinium oxycoccus	Yes
Viola pallens	Yes

Total Species Present October 2014	Native
Species Richness	**75**

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 11 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 11

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 11 - October 2014
Total Basin Area: 3.02 acres

Wetland Type: Wet Meadow	**Percent**
Area: 1.23 acres	**Cover**
Scirpus cyperinus	44%
Carex lacustris	14%
Phalaris arundinacea	14%
Aster lanceolatus	7%
Calamagrostis canadensis	7%
Agropyron repens	2%
Agrostis gigantea	2%
Alnus rugosa	2%
Euthamia graminifolia	2%
Juncus effusus	2%
Poa pratense	2%

FQA Condition Category: Fair

Wetland Type: Reed Canary	
Area: 1.9 acres	
Phalaris arundinacea	78%
Calamagrostis canadensis	12%
Agrostis gigantea	2%
Bromus inermis	2%
Juncus effusus	2%
Poa pratense	2%

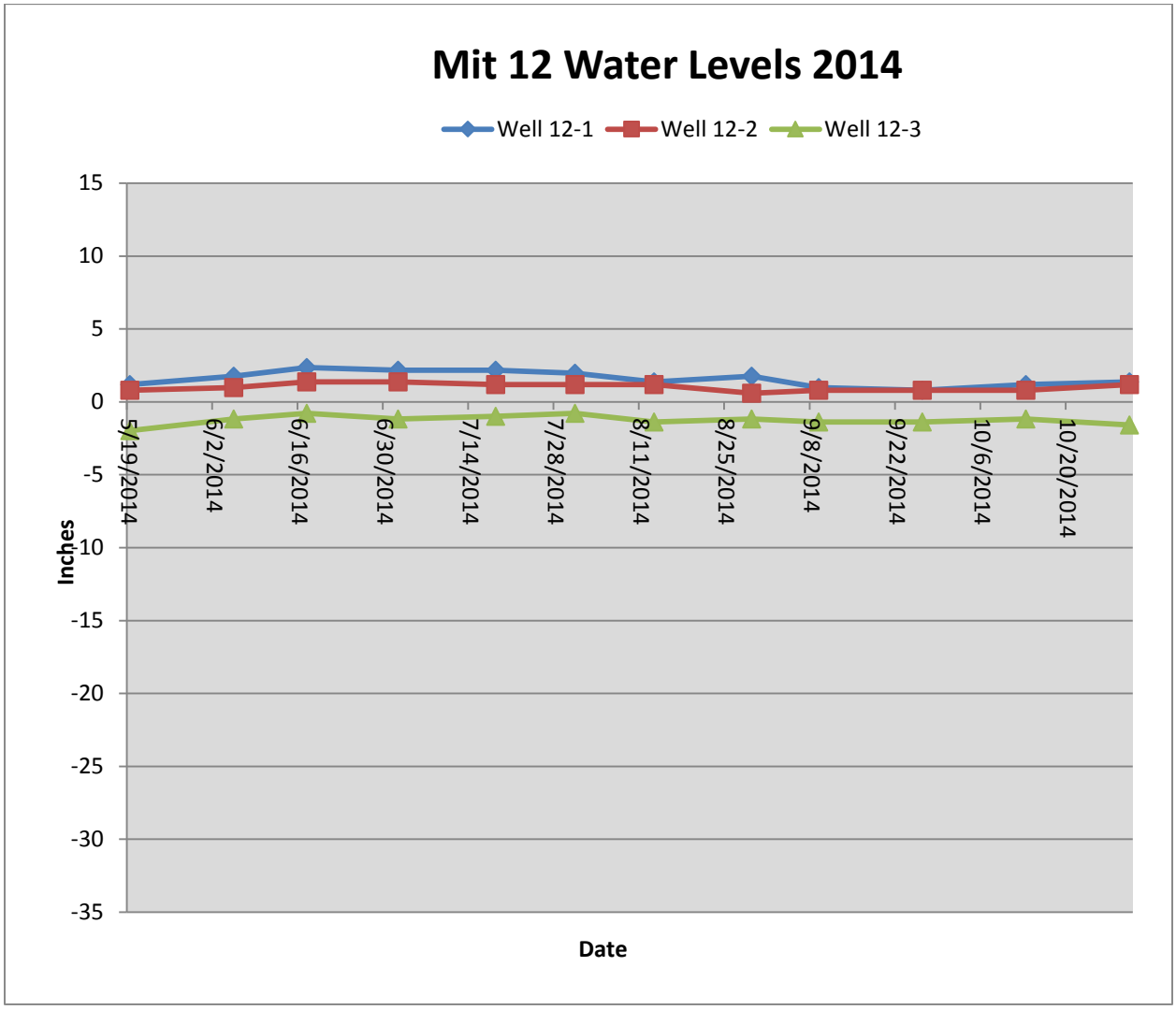
FQA Condition Category: Poor

Wetland Type: Shrub Carr (Alder Thicket)
Area: 0.20acres, no data

Mitigation Site 11
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	Native	Total Species Present October 2014	Native
Achillea millefolium	Yes	*Phleum pratense*	No
Agrostis gigantea	No	*Plantago major*	No
Alnus rugosa	Yes	*Poa palustris*	Yes
Aster lanceolatus	Yes	*Poa pratense*	No
Beckmannia syzigachne	Yes	*Potentilla norvegica*	Yes
Calamagrostis canadensis	Yes	*Ranunculus acris*	No
Caltha natans	Yes	*Ranunculus pensylvanicus*	Yes
Carex cannescens	Yes	*Ribes hirtellum*	Yes
Carex sp.	X	*Rubus strigosus*	Yes
Carex stipata	Yes	*Rudebeckia hirta*	Yes
Carex tenera	Yes	*Scirpus cyperinus*	Yes
Chrysanthemum leucanthemum	No	*Scirpus microcarpus*	Yes
Cirsium arvense	No	*Scirpus validus*	Yes
Elymus (Agropyron) repens	No	*Solidago gigantea*	Yes
Erigeron annuus	Yes	*Spiraea alba*	Yes
Euthamia graminifolia	Yes	*Tanacetum vulgare*	No
Glyceria canadensis	Yes	*Trifolium hybridum*	No
Hieracium aurantiacum	No	*Trifolium pratense*	No
Hypericum canadense	Yes	*Trifolium repens*	No
Hypericum pyramidatum	Yes	*Typha latifolia*	Yes
Juncus effusus	Yes	*Urtica dioica*	Yes
Lotus corniculatus	No	*Viola pallens*	Yes
Phalaris arundinacea	No	**Species Richness**	**45**

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 12 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 12 - October 2014
Total Basin Area: 0.62 acres

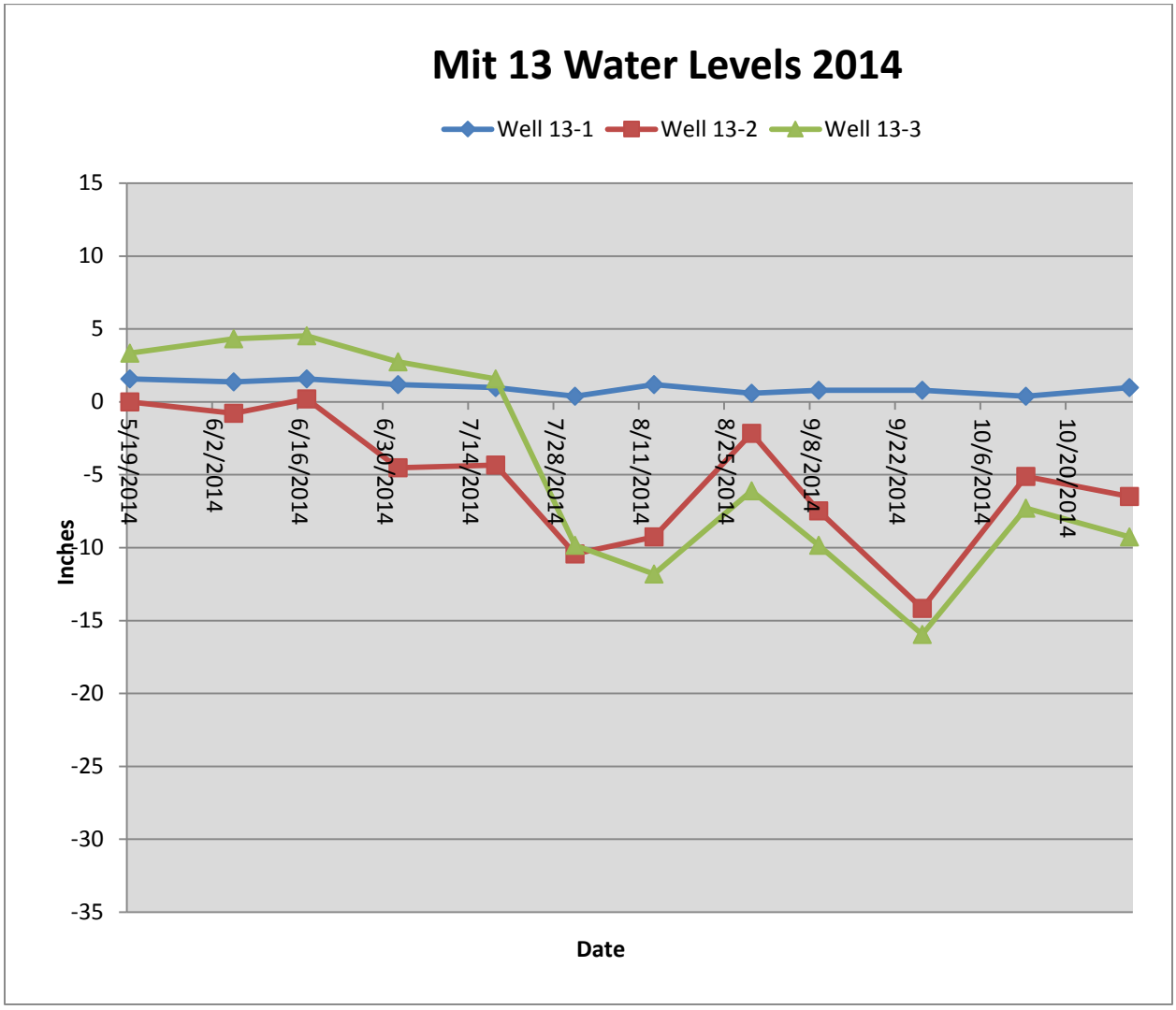
Wetland Type: Shallow Marsh	**Percent**
Area: 0.62acres	**Cover**
Typha angustifolia	44%
Scirpus cyperinus	19%
(thatch)	9%
(water)	6%
Carex lacustris	6%
Alnus rugosa	3%
Calamagrostis canadensis	3%
Campanula aparinoides	3%
Carex utricullata	3%
Juncus effusus	3%

FQA Condition Category: Fair

Mitigation Site 12
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	**Native**	**Total Species Present October 2014**	**Native**
Alisma plantago-aquatica	Yes	*Lysimachia terrestris*	Yes
Alnus rugosa	Yes	*Lythrum salicaria*	No
Aster puniceus	Yes	*Mentha arvense*	Yes
Aster sp.	X	*Onoclea sensibilis*	Yes
Beckmannia syzigachne	Yes	*Poa palustris*	Yes
Betula papyrifera	Yes	*Polygonum hydropiper*	No
Bidens cernua	Yes	*Polygonum saggitatum*	Yes
Caltha natans	Yes	*Populus tremuloides*	Yes
Caltha sp. seedlings	Yes	*Potentilla norvegica*	Yes
Campanula aparinoides	Yes	*Potentilla palustris*	Yes
Carex cannescens	Yes	*Rumex acetosella*	Yes
Carex crinita	Yes	*Saggitaria latifolia*	Yes
Carex trisperma	Yes	*Salix bebbiana*	Yes
Carex utriculata	Yes	*Salix pyrifolia*	Yes
Cicuta bulbifera	Yes	*Salix serissima*	Yes
Epilobium coloratum	Yes	*Scirpus atrovirens*	Yes
Epilobium leptophyllum	Yes	*Scirpus cyperinus*	Yes
Equisetum arvense	Yes	*Scirpus microcarpus*	Yes
Eupatorium maculatum	Yes	*Scirpus validus*	Yes
Eupatorium perfoliatum	Yes	*Scutellaria lateriflorus*	Yes
Glyceria grandis	Yes	*Sphagnum*	Yes
Glyceria striata	Yes	*Thelypteris palustris*	Yes
Hieracium aurantiacum	No	*Typha angustifolia*	Yes
Hypericum pyramidatum	Yes	*Typha latifolia*	Yes
Juncus brevicaudatus	Yes	*Typha X glauca*	Yes
Juncus effusus	Yes	**Species Richness**	**52**
Juncus nodosus	Yes		

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 13 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 13 - October 2014
Total Basin Area: 3.15 acres

Wetland Type: Shallow Marsh	**Percent**
Area: 0.44 acres	**Cover**
Typha angustifolia	26%
Typha X glauca	26%
Typha latifolia	15%
Glyceria canadensis	7%
Scirpus cyperinus	7%
Alnus rugosa	4%
Calamagrostis canadensis	4%
Eleocharis palustris	4%
Juncus effusus	4%
Scirpus microcarpus	4%

FQA Condition Category: Fair

Mitigation Site 8

Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Wetland Type: Sedge Meadow
Area: 2.39 acres

Calamagrostis canadensis	32%
Scirpus cyperinus	22%
Carex utriculata	8%
Juncus effusus	8%
Betula papyrifera	4%
Sphagnum moss	3%
Agrostis scabra	2%
Alnus rugosa	2%
Aster modestus	2%
Carex cannescens	2%
Carex lasiocarpa	2%
Lythrum salicaria	2%
Salix pyrifolia	2%
Typha angustifolia	2%
Typha latifolia	2%
(water)	1%
Agrostis gigantea	1%
Carex lacustris	1%
Equisetum arvense	1%
Euthamia graminifolia	1%
Picea mariana	1%
Salix discolor	1%
Scirpus atrovirens	1%

FQA Condition Category: Fair

Alder Thicket
Area: 0.32 acres, no data

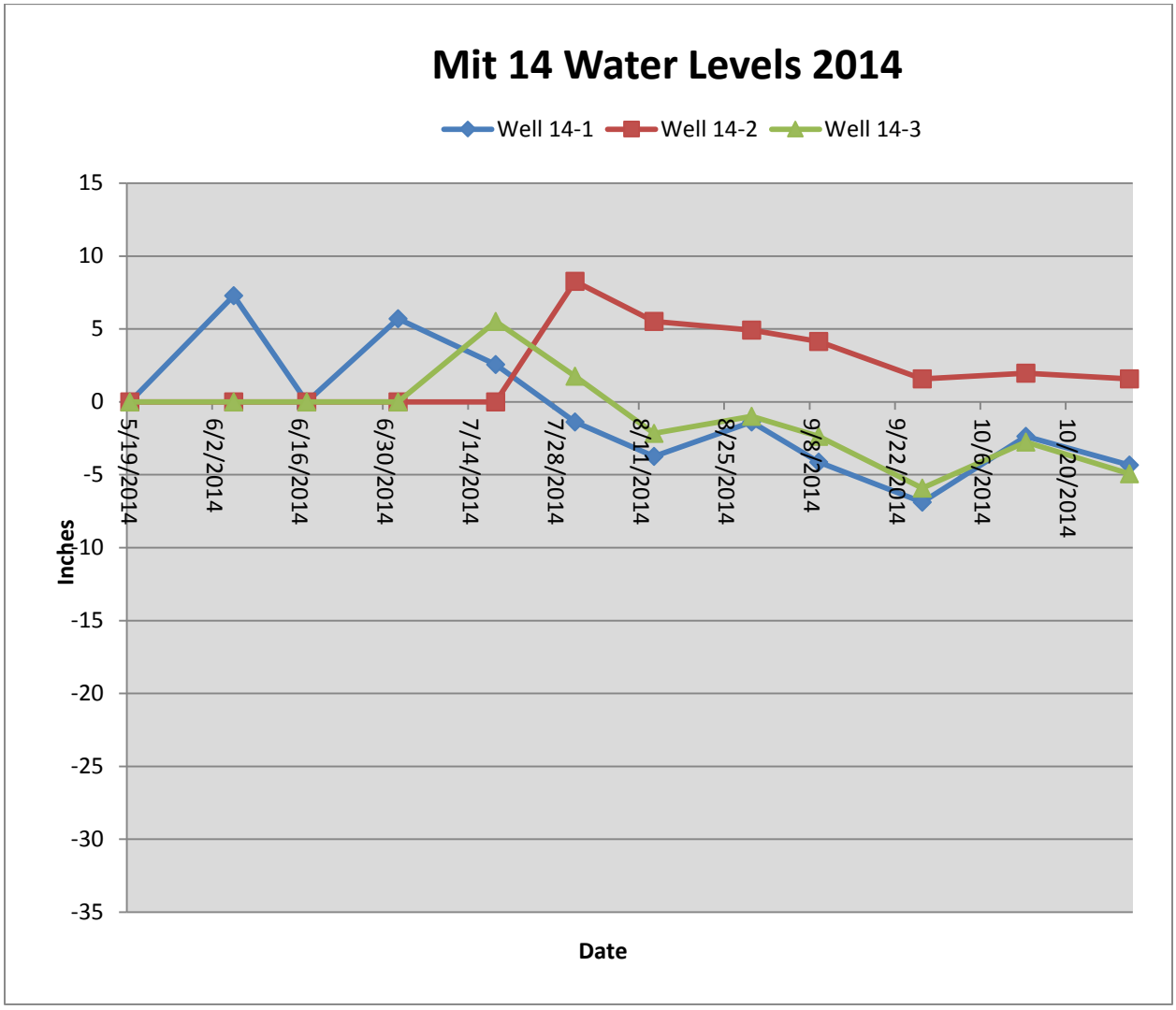
Mitigation Site 13
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	Native	Total Species Present October 2014	Native
Abies balsamea	Yes	*Epilobium coloratum*	Yes
Achillea millifolium	Yes	*Epilobium leptophyllum*	Yes
Agrostis gigantea	No	*Equisetum arvense*	Yes
Agrostis scabra	Yes	*Equisetum sylvaticum*	Yes
Alisma plantago-aquatica	Yes	*Eriophorum angustifolium*	Yes
Alnus rugosa	Yes	*Eupatorium maculatum*	Yes
Anaphalis margaritacea	Yes	*Eupatorium perfoliatum*	Yes
Aster lanceolatus	Yes	*Euthamia graminifolia*	Yes
Aster modestus	Yes	*Fragaria virginiana*	Yes
Aster puniceus	Yes	*Geum allepicum*	Yes
Aster sp.	X	*Glyceria canadensis*	Yes
Beckmannia syzigachne	Yes	*Hieracium aurantiacum*	No
Betula papyrifera	Yes	*Iris versicolor*	Yes
Calamagrostis canadensis	Yes	*Juncus brevicaudatus*	Yes
Calla palustris	Yes	*Juncus canadense*	Yes
Caltha natans	Yes	*Juncus effusus*	Yes
Campanula aparinoides	Yes	*Juncus nodosus*	Yes
Carex brunnescens	Yes	*Juncus tenuis*	Yes
Carex cannescens	Yes	*Lotus corniculatus*	No
Carex comosa	Yes	*Lysimachia sp.*	X
Carex interior	Yes	*Lysimachia terrestris*	Yes
Carex intumescens	Yes	*Lysimachia thyrsiflora*	Yes
Carex lasiocarpa	Yes	*Lythrum salicaria*	No
Carex leptalea	Yes	*Menyanthes trifoliata*	Yes
Carex magellanicum	Yes	*Onoclea sensibilis*	Yes
Carex retrorsa	Yes	*Phalaris arundinacea*	No
Carex sp. (gynocrates?)	Yes	*Phragmites australis*	?
Carex stipata	Yes	*Picea mariana*	Yes
Carex tenera	Yes	*Plantago major*	No
Carex trisperma	Yes	*Poa palustris*	Yes
Carex tuckermanii	Yes	*Polygonum amphibium*	Yes
Carex utriculata	Yes	*Polytrichum moss*	Yes
Chamaedaphne calyculata	Yes	*Populus balsamifera*	Yes
Cirsium arvense	No	*Populus tremuloides*	Yes
Drosera rotundifolia	Yes	*Potamogeton sp.*	Yes
Echinochloa crus-galli	Yes	*Potentilla norvegica*	Yes
Eleocharis acicularis	Yes	*Potentilla palustris*	Yes

Total Species Present October 2014	Native
Rumex orbiculatus	Yes
Salix discolor	Yes
Salix pedicellaris	Yes
Salix pyrifolia	Yes
Salix sp. seedlings	X
Scirpus atrovirens	Yes
Scirpus cyperinus	Yes
Scirpus microcarpus	Yes
Scirpus validus	Yes
Scutellaria galericulata	Yes
Sonchus arvensis	No
Sparganium chlorocarpum	Yes
Sparganium glomeratum	Yes
Sphagnum moss	Yes

Total Species Present October 2014	Native
Spiraea alba	Yes
Taraxacum officinale	No
Trifolium hybridum	No
Trifolium repens	No
Typha angustifolia	No
Typha latifolia	Yes
Typha X glauca	No
Utricullaria intermedia	Yes
Utricullaria vulgaris (macrorhiza)	Yes
Viola novae-angliae	Yes
Viola pallens	Yes
Species Richness	**99**

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015



Mitigation Site 14 Water Levels: May 19, 2014 – October 30, 2014.

The site meets wetland criteria of ≥14 consecutive days with the water table ≤ 12 inches below the soil surface.

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Overall FQA Condition Category: Fair

Mitigation 14 - October 2014
Total Basin Area: 0.77

Wetland Type: Wet Meadow	**Percent**
Area: 0.05 acres	**Cover**
Scirpus cyperinus	41%
Typha angustifolia	30%
Juncus effusus	11%
Calamagrostis canadensis	4%
Carex cannescens	4%
Graminoid seedlings	4%
Salix bebbiana	4%
Salix pyrifolia	4%

FQA Condition Category: Fair

Wetland Type: Shallow Marsh	
Area: 0.72 acres	
Typha angustifolia	50%
Scirpus cyperinus	25%
Salix bebbiana	8%
Typha x glauca	8%
Utricularia minor	8%

FQA Condition Category: Fair

Mitigation Site 14
Validation of Wetland Mitigation in Abandoned Borrow Pits
Annual Report – FY2015

Total Species Present October 2014	Native	Total Species Present October 2014	Native
Agrostis gigantea	Yes	*Picea mariana*	Yes
Agrostis scabra	Yes	*Populus tremuloides*	Yes
Alisma plantago- aquatica	Yes	*Pteridium aquilinum*	Yes
Alnus rugosa	Yes	*Salix bebbiana*	Yes
Beckmannia syzigachne	Yes	*Salix discolor*	Yes
Betula papyrifera	Yes	*Salix eriocephala*	Yes
Calamagrostis canadensis	Yes	*Salix lucida*	Yes
Carex cannescens	Yes	*Salix petiolaris*	Yes
Carex scoparia	Yes	*Salix pyrifolia*	Yes
Drosera rotundifolia	Yes	*Scirpus atrovirens*	Yes
Glyceria canadensis	Yes	*Scirpus cyperinus*	Yes
Glyceria striata	Yes	*Sparganium sp. (chlorocarpum?)*	Yes
Juncus effusus	Yes	*Sphagnum*	Yes
Juncus tenuis	Yes	*Typha angustifolia*	No
Larix laricina	Yes	*Typha latifolia*	Yes
Lycopodiella inundata	Yes	*Typha X glauca*	No
Lythrum salicaria	No	*Utricullaria minor*	Yes
Phragmites australis	?	**Species Richness**	**35**