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Enbridge Line 6B MP 608
Marshall, MI Pipeline Release

Work Plan for Monitoring, Restoration, and Invasive Species Control in Wetlands along Talmadge Creek and the Source Area

Prepared for Michigan Department of Environmental Quality

Enbridge Energy, Limited Partnership

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FIGURES

ATTACHMENT

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LIST OF ACRONYMS

C value	Coefficient of Conservatism Value
Enbridge	Enbridge Energy, Limited Partnership
FQI	Floristic Quality Index
GIS	Geographic Information System
GPS	Global Positioning System
Line 6B	The pipeline owned by Enbridge Energy, Limited Partnership that runs just south of Marshall, Michigan
MDEQ	Michigan Department of Environmental Quality
Mean C	Mean Coefficient of Conservatism
NRCS	Natural Resource Conservation Service
NRDA	Natural Resource Damage Assessment
SHLs	Soil hydrologic parameter sample locations
sq. ft.	Square feet
Talmadge Creek Report	*Report for Monitoring, Restoration, and Invasive Species Control in Wetlands along Talmadge Creek and the Source Area – 2013,* submitted to the MDEQ on May 15, 2014
VSL	Vegetation sample location

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1.0 INTRODUCTION

This work plan outlines a general process for monitoring, maintaining, and confirming the final restoration of National Resources and Environmental Protection Act Part 303 regulated wetlands along Talmadge Creek affected by crude oil deposition and subsequent response activities associated with the Enbridge Energy, Limited Partnership (Enbridge) Line 6B Mile Post 608 Marshall, Michigan pipeline release on a site-specific basis. The goal of the final restoration effort is to return the affected wetland areas to the conditions that were present immediately prior to the 2010 Line 6B crude oil release event and document those conditions. The process described in this work plan is designed to:

- Identify vegetative site condition data immediately prior to the release (Summer 2010) and/or appropriate control locations for each wetland area affected by crude oil deposition and subsequent response activities.
- Assess plant community metrics, including invasive species coverage, in each wetland community area affected by crude oil deposition and subsequent response activities for comparison with pre-release or reference conditions.
- Assess soil parameters of wetland areas affected by crude oil deposition and subsequent response activities that were excavated to a depth greater than 1 foot.
- Assess ground surface topography within wetland areas affected by crude oil deposition and subsequent response activities that were excavated to a depth greater than 1 foot.
- Delineate and develop control plans for invasive plant occurrences. Invasive species of concern provided by the Michigan Department of Environmental Quality (MDEQ) are:
    - Reed Canary Grass (*Phalaris arundinacea*),
    - Common Reed (*Phragmites australis*),
    - Narrowleaf Cattail (*Typha angustifolia*),
    - Hybrid Cattail (*Typha glauca*),
    - Common Buckthorn (*Rhamnus cathartica*),
    - Glossy Buckthorn (*Rhamnus frangula*),
    - Multiflora Rose (*Rosa multiflora*),
    - Black Alder (*Alnus glutinosa*),
    - Japanese Knotweed (*Fallopia japonica*),

  - Tatarian Honeysuckle (*Lonicera tatarica*), and
  - Morrow's Honeysuckle (*Lonicera morrowii*).
- Determine what, if any, additional maintenance work may be needed in order to restore each of the wetland areas affected by crude oil deposition and subsequent response activities as nearly as possible to its condition immediately prior to the Line 6B pipeline release.
- Monitor and document site development until each area affected by crude oil deposition and subsequent response activities resembles its condition immediately prior to the Line 6B pipeline release.
- This work plan may be modified over time during implementation. Changes to the work plan may be made following agreement on the specific changes by both Enbridge and the MDEQ, in accordance with applicable terms of the consent judgment associated with this plan.

On June 6, 2014, the MDEQ met with Enbridge to discuss MDEQ comments to the *Report for Monitoring, Restoration, and Invasive Species Control in Wetlands along Talmadge Creek and the Source Area – 2013,* submitted to the MDEQ on May 15, 2014 (Talmadge Creek Report) (Enbridge, 2014). Some of the comments discussed related to portions of this work plan that subsequently have been revised regarding performance standards for the Source Area. *Section 7.0* has been added to address these comments. Additional modifications have been made to eliminate monitoring of tree and shrub metrics at Talmadge Creek other than to monitor tree and shrub survival of proposed plantings. Modifications were also made to *Figure 1* and *Figure 2*.

Affected wetland areas and control locations for vegetation monitoring were identified by using operational response and assessment geographic information system (GIS) data along with wetland data provided by the MDEQ for identifying wetland vegetation monitoring sites *(Figure 1* and *Figure 2)*, topographic cross-section locations, and soil parameter sample points *(Figure 3)*. These monitoring and sample locations are located within wetland areas affected by crude oil deposition and subsequent response activities along Talmadge Creek. MDEQ has identified specific control locations for the Source Area, Sedge Meadow, and Tamarack Area. Control locations for other community types were selected based on the MDEQ wetland data and historic aerial photography.

This work plan addresses concerns related to plant community composition and coverage as well as invasive species occurrence and density on a site-specific basis. The plan also addresses concerns relating to topography and soil hydrologic parameters in areas excavated to a depth greater than 1 foot. The approach considers conditions presently existing at each area affected by crude oil deposition and subsequent response activities, pre-release conditions (where known), and adjacent unaffected similar habitat (control site). The plan process involves development of site-specific restoration criteria, as needed, for each unique habitat area using a combination of desktop analysis and field assessment in order to address restoration and monitoring requirements for regulated areas under *Section 7.6* and *Section 7.7 of the MDEQ Administrative Consent Order And Partial Settlement Agreement entered In the Matter of Enbridge Energy Partners, L.P., and Enbridge Energy, Limited Partnership, proceedings under the Michigan Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, MCL 324.101 et seq. signed November 1, 2010* (MDEQ, 2010). Work and reporting will be organized using the following creek segments:

1. Talmadge Creek downstream of the Source Area to Interstate 69, excluding the areas known as “Sedge Meadow” and “Tamarack Area”,
2. Interstate 69 downstream to the Talmadge Creek Confluence with the Kalamazoo River,
3. Sedge Meadow,
4. Tamarack Area, and
5. Source Area.
    a. North of the pipeline corridor,
    b. Within the pipeline corridor, and
    c. South of the pipeline corridor.

1.1 Annual Reporting

Annual reports will be prepared by Enbridge and submitted to MDEQ for review and approval addressing affected wetland area monitoring efforts and results consistent with the consent judgment. With the exception of Source Area monitoring, reporting will be divided into three distinct monitoring phases (Base Phase, Restoration Phase, and Maintenance Phase), as discussed in further detail in *Section 4.0* and *Section 5.0*. On June 6, 2014, the MDEQ met with Enbridge and discussed the MDEQ comments regarding the Source Area

and requested that Enbridge provide a separate monitoring program and performance standards for the Source Area. Updated Monitoring and Performance Standards for the Source Area are addressed in *Section 7.0* and will apply to monitoring of the Source Area in 2014 and beyond. The metrics that were agreed upon for use in evaluation of vegetation monitoring in 2014 and beyond are also contained in *Section 7.0*.

The Base Phase monitoring data and results, completed in 2013, will be used to assess the status of vegetation, soils, and topography restoration efforts. The 2013 data and results will also provide information to evaluate the applicability of various vegetation metrics for use as potential performance standards in determining additional maintenance activities and completion of restoration. The 2013 reporting will focus on the status of restoration efforts and evaluation of vegetation metrics.

The Restoration Phase will begin in 2014 following an agreement between Enbridge and MDEQ identifying vegetation metrics to be used as restoration performance standards. Reporting of Restoration Phase vegetation monitoring data and results will focus on evaluating if specific affected wetland areas meet restoration performance standards.

Once a particular affected wetland area has met Restoration Phase performance standards, that site will enter a Maintenance Phase monitoring and reporting period.

Maintenance Phase vegetation performance standards will be developed by mutual agreement of Enbridge and MDEQ. Maintenance Phase reporting will focus on evaluating if specific affected wetland areas meet maintenance performance standards.

In accordance with this reporting structure, a Talmadge Creek Monitoring Report will be provided by January 31, 2014 to MDEQ addressing 2013 data collection and results. This will include information addressing soils, topography, and vegetation conditions at Talmadge Creek, as well as data for assessment of potential metrics for restoration and maintenance monitoring (Talmadge Creek Report). Beginning in 2014, annual reporting will consist of a Talmadge Creek Monitoring Report addressing affected wetland areas that are in Restoration Phase and Maintenance Phase monitoring, as well as a report on the monitoring and performance standards adopted for the Source Area. Annual reports will be submitted to MDEQ within 6 weeks following completion of data collection for that monitoring year, unless an alternate date is agreed upon by Enbridge and MDEQ. The annual monitoring report will address specific creek segments identified above in separate sections of the

report. MDEQ will be notified in writing upon completion of field inspections necessary for completion of annual reporting. Once a particular affected wetland area has achieved the completion of maintenance monitoring that site will no longer be investigated or reported for compliance with Part 303.

Annual Monitoring Report Schedule:

- 2013
    - Talmadge Creek Report
        - Document status of soils, topography, and vegetation monitoring; data/analyses for evaluation of vegetation metrics for performance standards; and invasive species treatment, and proposed restoration activities.
- 2014 and beyond
    - Talmadge Creek Restoration and Maintenance Phase Monitoring Report
        - Document Restoration Phase vegetation monitoring results; invasive species treatment; proposed restoration activities; and, status of soils and topography as necessary.
        - Document Maintenance Phase vegetation monitoring results and invasive species and restoration activities as necessary.
        - Document monitoring and performance standards for the Source Area, and invasive species and restoration activities as necessary.

1.1.1 Invasive Species Reporting

To allow for prompt treatment of invasive species, Enbridge will provide MDEQ with maps indicating the location of identified invasive species and planned treatment as soon as possible following field identification, including invasive species mapped within the Source Area. Enbridge will conduct treatment of invasive species as soon as possible following field identification, and MDEQ approval for treatment of invasive species will not be required other than normal permitting requirements. MDEQ reserves the right to request alternative treatment techniques or additional locations. Details of invasive species mapping and treatment will also be summarized in the annual monitoring report.

2.0 VEGETATION AND INVASIVE SPECIES SAMPLING AND DATA PROCESSING

2.1 General Approach

This work plan is based on elements of the 2011 sampling plan developed for Natural Resource Damage Assessment (NRDA) Trustees and discussion with the MDEQ during several technical group meetings. The 2011 vegetative study utilized three vegetative assessment methodologies that are also proposed for use in the 2013 assessment. Those methodologies are described in the sections below. Vegetation monitoring at Talmadge Creek will be initiated early to mid-June of each monitoring year and is anticipated to last 3 to 5 weeks.

2.1.1 Direct Measurements of Species Present

As in the 2011 assessment, direct field measurements will provide information on community composition and will include:

- Meander survey of species observed within affected and control area polygons,
- Species total percent cover by stratum within affected and control area sample locations. This was modified to include percent cover only within the herbaceous stratum. No percent cover will be collected for the tree and shrub stratum in 2014 and beyond.
- Stem density (shrub and tree stratum) within affected and control area sample locations. This was modified to eliminate stem counts from monitoring in 2014 and beyond. *Section 7.0* details the new monitoring and performance standards for the Source Area and other portions of Talmadge Creek. Mapping of areas dominated by non-wetland vegetation or bare ground greater than 0.01 acre in size within affected area polygons. This was modified to eliminate meander surveys within significant areas of upland, the upland areas or bare ground will not be mapped, but avoided during meander survey, and,
- Mapping of the presence and extent of highly invasive species within affected area polygons.

2.1.2 Base Vegetation Analyses and Metrics

Vegetation data collected within affected wetland and control areas in 2013 will be used to calculate the following metrics:

- Native Species Coverage (i.e., all native species, native wetland species only),
- Native Species Richness (i.e., all native species, native wetland species only),
- Shrub stem density (for shrub and tree communities only),
- Shannon Species Diversity,
- Floristic Quality Index (FQI) (i.e., all species, native species only), and
- Mean Coefficient of Conservatism (Mean C) (i.e., all species, native species only).

Data collected in 2013 will be used to evaluate the applicability of metrics identified above for use as performance standards in determining additional maintenance activities and completion of Restoration Phase and Maintenance Phase monitoring. The parties agree to discuss these metrics and, prior to the onset of 2014 field work, select the pertinent ones for use as performance standards for assessment of affected wetland areas in 2014 and beyond. *Section 7.0* provides details on the metrics agreed upon by the MDEQ and Enbridge for use in 2014 and beyond.

2.2 Sampling Plan Detail

GIS desktop methods were used by MDEQ and Enbridge to identify affected wetland areas (polygons) for field investigation. MDEQ specified the location of control polygons for the Source Area, Tamarack Area, and Sedge Meadow. Enbridge identified the location of control polygons within undisturbed wetland for comparison to affected wetland areas using GIS desktop methods. The location of control polygons was based on modified National Wetlands Inventory wetland mapping provided by MDEQ.

2.2.1 Meander Survey

A meander survey will be conducted within both the affected wetland area polygons and neighboring unaffected control areas of similar composition.

Plant lists will be recorded for both the affected area and control area that indicate individual species by strata (e.g., herbaceous, shrub, and tree/woody vine) and note the apparent dominant or co-dominant species. Highly invasive species occurrences will be mapped within affected wetland polygons for the development of restoration plans. Invasive species will be mapped to an approximate distance of 50 feet beyond the affected wetland area polygon boundary.

Meander time will vary dependent upon the sample area size and diversity of species present in a particular affected or control area. The meander will cease when it is apparent that the number of new species identified per unit meander time has declined to a point where additional meander time will not result in identification of a significant number of new species. Representative photographs of community types found in the affected area and control area will be collected and referenced using a sub-meter global positioning system (GPS) unit.

Results of the meander survey will be utilized to provide a final classification of each affected area and control area by vegetative community type based on the Cowardin classification system (Cowardin, et al., 1992). Based on discussions with the MDEQ, meander survey was eliminated within significant areas of upland that may be encountered with affected wetland or control polygons.

2.2.2 Areas Dominated by Non-wetland Vegetation or Bare Ground

During the meander survey, field staff will note the presence of apparent areas of bare ground greater than 0.01 acre that may be present within affected wetland areas and representative photograph(s) will be recorded. Significant areas of upland vegetation will be avoided during the meander survey.

2.2.3 Data Sample Locations

Sample locations were initially placed within affected wetland area and control polygons by Enbridge using a random methodology as requested by MDEQ. Additional sample points added for 2014 and subsequent monitoring were included so as to result in random stratification by avoiding clustered sample locations and achieving broad spatial coverage (*Attachment A*). A stratified random method was utilized within polygons 1.0 acre or greater in size.

Three nested sampling plots will be established at each vegetation sample location (VSL), centered on the sample point:

- 5-foot radius herbaceous stratum plot,
- 15-foot radius shrub stratum plot, and
- 30-foot radius tree/woody vine stratum plot.

The center of the nested plot will be marked using a temporary stake and a GPS point will be recorded. The VSL identification number will be indicated on photographs of sample locations.

The three-stratum sample plots were utilized for 2013 vegetation monitoring. However, the collection of tree and shrub vegetation plot data for metrics calculations was eliminated. *Section 7.0* details the revised vegetation monitoring plan.

Vegetative cover estimates and stem counts (tree and shrub only) will be recorded at each VSL within the affected and control areas by species using percent absolute cover. This has been modified for vegetation monitoring in 2014 and beyond. Starting in 2014, percent cover data will be collected only within the herbaceous stratum, and tree and shrub data collection for metrics calculations has been eliminated. See *Section 7.0* for the revised vegetation monitoring plan.

Sampling density will be based on sampling polygon area. At a minimum, 3 VSLs will be located in each affected and control area polygon equal to or greater than 0.5 acre in size with an average of 3 plots per acre for polygons greater than 1.0 acre in size. Polygons smaller than 0.5 acre will contain 2 VSLs except for those polygons smaller than the shrub plot area (706 square feet (sq. ft.)) which will have 1 VSL.

Calculations for determining plot density in each polygon are:

- Less than or equal to 706 sq. ft.
    - One VSL.
- Greater than 706 sq. ft. to less than 0.5 acre.
    - Two VSLs.
- 0.5 acre to 1.0 acre.
    - Three VSLs.

- 1.0 acre to 1.33 acre.
    - Four VSLs.
- Greater than 1.33 acre.
    - Add one VSL for each additional increase of 0.33 acre.

The percent cover by species data will be used to determine relative cover by species for each stratum and cover percentage of invasive species by stratum. Invasive species of concern are listed in *Section 1.0*.

VSL points and representative photographs of each VSL (close-up of herbaceous plot and panoramic view of the sample location) will be collected and referenced using a sub-meter GPS unit. Data collected at each VSL will include:

- 5-foot herbaceous plots.
    - Absolute percent cover of each species by canopy cover.
- 15-foot shrub plots.
    - Absolute percent cover of each species by canopy cover, and
    - Stem density of each species by number of stems in each plot.
- 30-foot tree/woody vine plots.
    - Absolute percent cover of each species by canopy cover, and
    - Stem density of each species by number of stems in each plot.

The above description of data collected in VSL's applies only to the data collection in 2013. *Section 7.0* provides details of the revised vegetation monitoring plan for 2014 and beyond. MDEQ will be notified of scheduled field inspections no less than 2 days in advance and may attend the inspections.

2.2.4 Field Adjustment of Polygons and Sample Locations

Field staff will relocate the control polygon or sample locations in instances where field investigation determines that control polygons, or affected or control polygon sample locations, are not situated within wetland. A random number generation technique will be used to relocate control polygons or sample locations while still maintaining the random stratification of sample locations to the extent possible. Control polygons will be relocated in the vicinity of the original control polygon if possible.

VSLs may need to be adjusted based on observations of variability in the field. This may include adjustment in plot geometry or location to keep the plot area out of aquatic habitat and within terrestrial habitat near the creek, adjustment of plot geometry where affected polygons are narrower than the plot radius, adjustment if the plot is located in apparent upland, or adjustment of plot geometry to keep plot areas within the affected wetland polygon. Adjustments to plot geometry will only be performed when necessary to maintain plot integrity and the adjustments will maintain consistent plot area (i.e., equivalent to the corresponding circular plot of appropriate radius). Sample plots that must be moved will be relocated in a random stratified fashion and within the vicinity of the original plot location. VSLs will also be relocated if determined to exist in mowed lawns or similar actively maintained areas that are not representative of the surrounding wetland habitat. Control VSLs will not be located in areas of known or suspected recent disturbance.

2.3 Data Processing

The following metrics will be evaluated in 2013 utilizing the 2013 vegetation field data. The results of those analyses will be utilized to identify vegetation metrics to be used as restoration performance standards for vegetation monitoring in 2014 and beyond. Only those metrics that Enbridge and MDEQ mutually agree to use for performance metrics will be analyzed in 2014 and beyond.

For all metrics indicated below, the Sedge Meadow and Tamarack Area along Talmadge Creek and Source Area will be analyzed the same except that their sample plots will only be compared to the control plots within their own adjacent unique control polygons, rather than aggregated control values. Similarly, the values for the Sedge Meadow, Tamarack Area, and Source Area control polygons will not be used when establishing overall aggregate control values for comparison with other affected wetland polygons.

2.3.1 Native Species Coverage

Native species coverage will be determined within each affected wetland area polygon and compared to the interquartile range of the aggregated control polygon data.

The procedure to evaluate native species coverage is as follows:

a. Separate data by creek segment.
b. Separate sample locations into respective groups based on MDEQ specified polygon community type. Aggregations and comparisons between affected area and control areas will be made only between identical community types.
c. Separate species absolute percent cover observations within each sample plot into stratum (herb, shrub, and tree).
d. Select native species within each stratum (those with coefficient of conservatism value greater than zero are native).
e. Sum the absolute percent coverages for native species by stratum for each sample plot (i.e., total percent native cover for herb, shrub, and tree for each plot). Result is total native percent coverage for each stratum within each sample plot.
    1. Control Polygon Data
        - Aggregate total percent native coverage for each stratum across all control sample data within particular creek segment and community type. The result will be three data populations of total percent native coverage for control data plots within creek segment (herb, shrub, and tree).
        - Determine interquartile range for control area total percent native coverage by stratum by creek segment and community type.
    2. Affected Polygon Data
        - Aggregate total percent native coverage by stratum for all affected area sample locations by polygon ID within particular creek segment and community type (i.e., total percent native coverage within each affected area polygon are aggregated by stratum).
        - Determine median and mean total percent native coverage by stratum for each affected area polygon.
        - Compare affected area polygon median and mean total percent native coverage by stratum to associated control interquartile range.

Species coverage will also be calculated as indicated above for native wetland species only including a comparison between impacted mean, median values, and control interquartile ranges.

2.3.2 Native Species Richness

Native species richness is an indicator to assess the number of native plant species observed. Native species richness will be determined within each affected wetland area polygon and compared to the interquartile range of the aggregated control polygon data.

The procedure to evaluate native species richness is as follows:

a. Separate data by creek segment.
b. Separate sample locations into respective groups based on MDEQ specified polygon community type. Aggregations and comparisons between affected area and control areas will be made only between identical community types.
c. Separate species percent cover observations within each sample plot into stratum (herb, shrub, and tree).
d. Select native species within each stratum (those with a C value greater than zero are native).
e. Sum the number of different native species identified within each sample plot by stratum. This value is the native species richness.

Control Polygon Data:

a. Aggregate native species richness values by stratum for all control sample data within particular creek segment and community type.
b. Determine interquartile range for control area native species richness by stratum within particular creek segment and community type.

Affected Polygon Data:

a. Aggregate native species richness for all affected area sample locations by polygon ID within particular creek segment and community type.
b. Determine median and mean native species richness for each affected area polygon.
c. Compare affected area median and mean native species richness data aggregated by polygon to aggregated control native species richness interquartile range by stratum.

Species richness will also be calculated as indicated above for native wetland species only, including appropriate metric comparisons.

2.3.3 Shrub and Tree Stem Density (for shrub and tree communities only)

The procedure to evaluate shrub and tree stem density is as follows:

a. Separate data by creek segment.
b. Separate sample locations into respective groups based on MDEQ specified polygon community type. Aggregations and comparisons between affected area and control areas will be made only between identical community types.
c. Identify stem count for shrub and tree layers by species.
d. Separate species stem count observations within each sample plot into stratum (i.e., shrub, tree).
e. Sum the stem counts for shrub and tree species by stratum for each sample plot separately (i.e., total stem count shrub and tree).
f. Determine shrub and tree stem density for each stratum; divide total stratum stem count by plot area (e.g., 15-foot radius shrub, 30-foot radius tree). The result is shrub and tree stem density per sq. ft.

Control Polygon Data:

a. Aggregate shrub and tree stem density by stratum for all control sample data within particular creek segment and community type.
b. Determine interquartile range for control area shrub and tree stem density by creek segment.

Affected Polygon Data:

a. Aggregate shrub and tree stem density for all affected area sample locations by polygon ID within particular creek segment and community type.
b. Determine median and mean shrub and tree stem density for each wetland affected area polygon by stratum.
c. Compare affected area median and mean stem density aggregated by polygon to aggregated stem density interquartile range by stratum.

2.3.4 Shannon Species Diversity

Shannon Species Diversity is an indicator to assess the number and “evenness” of observed plant individuals relative to one another. Stem counts of shrub and tree stratum will provide data relative to individual species observed. However, it is not reasonable to count

herbaceous species individuals. Herbaceous species count will be based on relative percent cover. Relative values normalized to percentage of total must be used for all stratums in this calculation.

The procedure to evaluate Shannon Species Diversity is as follows:

a. Separate data by creek segment.
b. Separate sample locations into respective groups based on MDEQ specified polygon community type. Aggregations and comparisons between affected area and control areas will be made only between identical community types.
c. Identify herbaceous species absolute percent cover observations within each sample plot.
d. Calculate relative percent cover for each herbaceous species within each specific sample plot (i.e., sum all percent coverages within a plot, divide each species by the sum to get relative percent coverage). Note: this value must be reported as a decimal percent for the logarithm function in the equation below (i.e., 59% = 0.59).
e. Identify stem count for shrub and tree layers by species.
f. Sum the stem counts for native and non-native species by stratum for each sample plot.
g. Calculate relative percent stem count for each shrub and tree species within each specific sample plot (i.e., sum all shrub and tree stem counts within a plot, divide each species by the sum to get relative percent coverage). Note: this value must be reported as a decimal percent for the logarithm function in the equation below (i.e., 59% = 0.59).
h. Calculate Shannon Diversity (H)

$$H = \sum (P1) \, | \ln P1 |$$

Where: H = Shannon Diversity
P1 – percent relative abundance as decimal
(cover for herbaceous, stem count for shrub/tree)

Control Polygon Data:

a. Aggregate Shannon Species Diversity values by stratum for all control sample data within particular creek segment and community type.
b. Determine interquartile range for control area Shannon Species Diversity values by

stratum and by creek segment and community type.

Affected Polygon Data:

a. Aggregate Shannon Species Diversity values for all affected area sample locations by polygon ID within particular creek segment and community type.
b. Determine median and mean Shannon Species Diversity value for each affected area polygon by stratum and community type.
c. Compare affected area median and mean Shannon Species Diversity value aggregated by polygon to aggregated Shannon Species Diversity interquartile range by stratum and community type.

2.3.5 Floristic Quality Index

Meander survey data will be utilized for this metric. The procedure to evaluate FQI is as follows:

a. Separate data by creek segment.
b. Separate meander survey locations into respective groups based on MDEQ specified polygon community type. Aggregations and comparisons between affected area and control areas will be made only between identical community types.
c. Identify meander species for each affected and control polygon and associated C value. Adventive species (i.e., those with a C value of zero, or lacking a C value) are not included in the analysis of native FQI. Adventives without a C value will be assigned a C value of zero.
d. Calculate FQI for each affected and control area polygon utilizing a qualitative data list of species identified during the meander survey. The FQI is calculated using a coefficient of conservatism (C) and the total number of species found in the sample (n) (MDEQ, 2001), as follows:

$$FQI = \bar{C}\sqrt{n}$$

Where:

$$\bar{C} = \frac{\sum C}{n}$$

Control Polygon Data:

- Aggregate FQI values for all control sample data within particular creek segment and community type.
- Determine interquartile range for control area FQI values by creek segment and community type.

Affected Polygon Data:

- Compare each affected area FQI value by polygon to aggregated FQI interquartile range by stratum and community type.

FQI will also be calculated as indicated above for all species, including adventives, and used in appropriate metric comparisons.

2.3.6 Mean Coefficient of Conservatism (Mean C)

Meander survey data will be utilized for this metric.

The procedure to evaluate Mean C is as follows:

a. Separate data by creek segment.
b. Separate meander survey locations into respective groups based on MDEQ specified polygon community type. Aggregations and comparisons between affected area and control areas will be made only between identical community types.
c. Identify meander species for each polygon and associated C value. Adventive species (i.e., those with a C value of zero will not be included in the analysis of native Mean C). Calculate Mean C value of all native species.

Control Polygon Data:

- Aggregate Mean C values for all control sample data within particular creek segment and community type.
- Determine interquartile range for control area Mean C values by creek segment and community type.

Affected Polygon Data:

- Compare each affected area Mean C value by polygon to aggregated Mean C interquartile range by stratum and community type.

Mean C will also be calculated as indicated above for all species, including adventives, and used in appropriate metric comparisons.

2.3.7 Invasive Species

For treatment purposes, highly invasive species (11 species) in affected and 50-foot buffer areas along Talmadge Creek will be inventoried and mapped, separately as point or polygon features, during late spring of each monitoring year based on field conditions for that growing season. Invasive species mapping data within the entire affected wetland area polygon and associated 50-foot buffer area (not sample location data) will be used to evaluate if invasive species occurrences within affected wetland areas meet the conditions for this metric.

The procedure to evaluate highly invasive species is as follows:

a. Separate data by creek segment (for reporting purposes only).
b. Separately calculate total areal coverage (sq. ft.) of each highly invasive species (occurrence area) within each affected wetland area and associated buffer area based on invasive species mapping data and stratum.
c. Multiply areal coverage above by observed percent coverage (decimal) within the occurrence area for each species and stratum identified. This yields an “effective” area of coverage if the invasive species were present within an occurrence area at 100% coverage (as opposed to the observed percent coverage).
d. Separately calculate final percent effective areal coverage of each highly invasive species by stratum within each affected area polygon and associated buffer by dividing “effective” coverage above by the polygon total area. This removes the bias associated with variation in size of polygons.

Affected Polygon Data:

- Compare affected area mapped invasive species final percent effective areal coverage value for each affected wetland area and associated 50-foot buffer area to the values indicated in *Section 5.1* and *Section 5.3* by stratum.

3.0 TOPOGRAPHIC AND SOIL EVALUATION

The work plan approach addresses concerns related to soil hydrologic parameter and topographic conditions on a site-specific basis, taking into consideration, conditions presently existing at affected wetland areas, pre-release conditions (where known), adjacent unaffected similar control soil and topographic conditions, and mapped soil units. During the 2013 survey, topographic cross-section surveys will be compared to similar cross-section survey data collected prior to excavation. The plan process involves development of site-specific soil hydrologic parameter criteria, as needed, for each individual area using a combination of desktop analyses and field assessment as appropriate in order to address restoration and monitoring requirements.

Four phases of evaluation are described below for assessing potential topographic and soil hydrologic parameter alteration at each affected wetland area based on existing conditions, pre-release data, and/or control site characteristics. Results of 2013 soils and topography evaluations will be included in the Talmadge Creek Report. Any subsequent soil and topography evaluation and monitoring will be reported as indicated in *Section 1.1*.

3.1 Phase 1 – Existing Data Assessment and Compilation

Operational response and assessment GIS data were used as the primary tools for identifying affected wetland sites where removal activities included excavation to depths greater than one foot.

These sites will be assessed by comparing the following data sets:

- Review of backfill material source information, including the analytical results,
- Review of MDEQ approvals and permits,
- Review of existing surveyed topographic cross-sections of Talmadge Creek from top of bank to top of opposite bank, as well as various spot elevations, and

- Review of existing high resolution aerial photography.

During the review of the above data sets, a review of the inventory of other data sets will be completed to determine their potential usefulness. Such additional data sets may include:

- Natural Resource Conservation Service (NRCS) soil composition, texture, and hydrologic parameters from soil survey information,
- NRDA data sets for Talmadge Creek, and
- Historical aerial imagery.

Results of analyses of these data will be used to determine the nature of soils replaced in areas excavated and backfilled to greater than 1 foot depth as compared to soils existing prior to excavation, and hydrologic properties of these replaced soils compared to soils existing prior to excavation. The purpose of this evaluation is to utilize existing data to evaluate the nature of replacement soils versus pre-existing soils in affected wetland areas.

Topographic cross-section data will be utilized to indicate the degree of variance between pre- and post-restoration ground surface elevation within affected wetland areas.

3.2 Phase 2 – Identification of Supplemental Field Work Sites

Elevation points will be collected along approximately 100 topographic cross-sections located perpendicular to Talmadge Creek within affected wetland areas and as near as possible to existing cross-section survey data collected in August 2010 prior to initial removal and restoration activities (*Figure 3*). This number of cross-sections provides a distribution of surveyed cross-sections a maximum of approximately every 200 feet along Talmadge Creek and within each change in excavation depth along the creek.

Depths of excavation for removal of affected soils were recorded by Enbridge during restoration activities at Talmadge Creek. These data were used to create polygons along Talmadge Creek that indicate excavation depth during restoration activities *(Figure 3)*. Each depth of excavation polygon contains at least one proposed topographic cross-section location if pre-excavation topographic data exists within a particular excavation polygon. The specific location of cross-sections coincides with previously recorded cross-section data. The length of cross-sections indicated on *Figure 3* is approximate only and will be

adjusted in the field as necessary to capture elevations extending beyond the associated affected wetland area and into the adjacent undisturbed area.

An evaluation of soil hydrologic parameters will be completed at affected wetland areas that coincide with the location of the topographic cross-sections indicated above. The purpose of this field work is to supplement existing data and to evaluate the nature of replacement soils versus pre-existing soils in affected wetland areas. Data will be collected in adjacent, undisturbed control wetlands of similar type to the extent possible for comparison. If suitable undisturbed wetlands are not present for comparison, then data collected in affected wetland areas will be compared to appropriate on-site post-restoration data, NRCS data, or other appropriate source.

Soil hydrologic parameter sample locations (SHLs) will be identified based on evaluation of site-specific affected wetland areas at each surveyed cross-section location. One soil sample will be collected on each bank of Talmadge Creek at each 2013 surveyed cross-section location as well as within each depth of excavation polygon if the cross-section intersects more than one depth of excavation polygon.

These sites will be sent to the MDEQ for review in advance of proceeding with subsequent work phases as part of the work plan approval and implementation process.

3.3 Phase 3 – Supplemental Field Work

Topographic cross-sections will be surveyed utilizing survey-grade GPS equipment. The top and toe of bank will be surveyed on both banks of Talmadge Creek as well as the thalweg centerline at each cross-section location. The surveyed cross-section will continue laterally so as to extend beyond the associated affected wetland area and into the adjacent undisturbed area. Sufficient elevation points will be collected to adequately represent the exiting topography. These data will be compared to August 2010 topographic data to evaluate post-restoration ground surface elevations relative to pre-restoration elevations.

SHLs will be located at each 2013 cross-section survey location within the affected wetland area on each bank of Talmadge Creek (two SHLs per cross-section location) as well as within each depth of excavation polygon if the cross-section intersects more than one depth of excavation polygon. A soil profile will be recorded to document the soil composition (i.e., field determination of mineral and organic) and texture from the ground surface to 6 inches

below the excavation depth. Soil texture will be determined utilizing the *NRCS Guide to Texture by Feel* (Thien, 1979). The purpose of the soil evaluation is to confirm the ability of the soils to convey groundwater in a manner similar to previously existing soils. Soil borings will extend to a depth approximating the depth of excavation at each location, if possible. Highly saturated soils may preclude advancement of soil borings below the water table if the borehole cannot be maintained without caving.

The flow of water under saturated conditions is determined by two major factors: the hydraulic force driving the water through the soil (commonly gravity) and the hydraulic conductivity, or the ease with which the soil pores permit water movement. The texture and structure of soils are the properties to which hydraulic conductivity is most directly related. Pre-restoration soil types at Talmadge Creek consisted almost entirely of muck. Replacement soils also consisted of muck. Mucky soils generally have very similar hydraulic conductivities and all six of the muck soils listed in the Soil Survey of Calhoun County, Michigan (United States Department of Agriculture, 1997) have hydraulic conductivity listed in the range of 0.2 to 6.0 inches per hour with the one exception of the deeper portions of the Martisco muck.

Since original and replacement soil types at Talmadge Creek consisted primarily of mucky soils and mucky soils exhibit very similar permeability values in Calhoun County, field confirmation of soil texture will be used to confirm the ability of the soils to convey groundwater in a manner similar to previously existing soils.

The common field method of determining the textural class of a soil is by its “feel”. This is ascertained by rubbing a sample of the soil, usually in a moist to wet condition, between the thumb and fingers. The “feel” method is used in soil survey and land classification.

MDEQ will be notified of scheduled field work no less than 2 days in advance and may attend the inspections.

3.4 Phase 4 – Topography and Soils Data Evaluation and Assessment

Topographic cross-section data will be compared to pre-restoration cross-section survey data to evaluate functional changes in surface topography within affected wetland areas excavated to a depth greater than 1 foot.

Soil hydrologic parameter data will be utilized to evaluate replacement soil hydrologic characteristics, where excavation of affected wetland areas occurred to greater than 1 foot depth. These data will be used to evaluate potential functional alteration of ground water movement through the ground and over the surface by removal and restoration actions, through damming or draining, across affected wetland areas.

Data will be evaluated to identify sites, or site type, where soil hydrologic parameters have been substantively modified by post-response and post-remedial restoration actions as compared to conditions existing immediately prior to the Line 6B crude oil release event as indicated by adjacent undisturbed soils or mapped soil units. The results of the assessment will be summarized in a final report and sites that demonstrate a functional alteration in soil hydrologic characteristics relative to pre-release conditions or reference conditions for soil properties, or terrain slope and elevation, will be identified, characterized, and assessed for the need of corrective action. The topographic and soil evaluation will be conducted in 2013. Any additional surveying or soil investigation will only be conducted following corrective action, if necessary.

4.0 BASE PHASE VEGETATION DATA EVALUATION AND ASSESSMENT

Data collected during 2013 will be used to calculate native species coverage and richness, wetland native species coverage and richness, as well as shrub and tree stem density, Shannon species diversity, FQI and native FQI, and Mean C and native Mean C for each affected wetland area and associated control site. Control site data will be aggregated across creek reaches of similar character and vicinity to develop a range of metric data that illustrates the natural variability among control sites.

Data collected in 2013 will be used to evaluate the applicability of metrics identified above for use as potential performance standards in determining additional maintenance activities and completion of restoration. The parties agree to evaluate these metrics, and the use of median or mean values for comparison, and to select a final set prior to or near the onset of 2014 field work for use as performance standards for monitoring of affected wetland areas in 2014 and beyond. Information collected during the 2013 field season will be compiled and included in the Talmadge Creek Report describing the data collected and results of metric calculations and invasive species mapping. The report will be divided into sections that address results of data analyses for each creek segment separately. The report will include

recommendations for metrics to be used for vegetation performance standards associated with future monitoring. The 2013 report will also evaluate the progress of each affected wetland area relative to achieving proposed restoration metrics including a plan for control of identified invasive species occurrences. The 2013 report will include the following elements:

- Raw data in electronic format,
- Tables documenting field monitoring data collected,
- Photographs of monitoring locations,
- Details for comparison of affected wetland area data to control area data for each of the vegetation metrics,
- Details of invasive species mapping results,
- Details of topographic and soils monitoring results,
- Discussion and recommendations for metrics to be used for future vegetation restoration and maintenance performance standards,
- Recommendations for future monitoring activities, and
- Recommendations for additional restoration activities where necessary.

Historic data from 2010 and 2011 (e.g. NRDA sampling) may be used to further assess or assist in interpreting data from 2013 or planning restoration efforts.

5.0 RESTORATION AND MAINTENANCE MONITORING PHASES

5.1 Restoration Phase Metrics

For the vegetation community within an affected area polygon to be considered "restored" the value for FQI and Mean C (if utilized), and medians (or means if applicable) for other metrics must fall within or exceed the interquartile range (comprising the middle 50% of observations – 25% to 75%) of all aggregated control plots for each community type.

For the vegetation community within an affected area polygon to be considered "restored" relative to invasive species, percent invasive species cover must fall within the following ranges:

- *Phragmites australis* – 0% cover within affected area polygons and associated 50-foot buffers.

- Other Highly Invasive Species – 5% final effective areal cover within an affected area polygon.

Modification of restoration metrics may be made upon concurrence by the MDEQ in writing that alternative site criteria are appropriate.

Each year the selected metrics will be applied on a site-by-site basis in order to determine which sites have achieved restoration and those that have not. Sites meeting the restoration metrics will then be moved to and evaluated under the maintenance phase as described in *Section 5.3*. Successful completion of restoration metrics will constitute successful completion of the first year of maintenance monitoring and credited toward the 5 years of consecutive maintenance.

Section 7.0 specifies the metrics that will be utilized to evaluate affected wetlands in 2014 and beyond.

5.2 Restoration Actions

Any additional restoration or control actions will be identified and included in the annual Talmadge Creek Report and subsequent Restoration Phase Reports on a site-by-site basis. Any proposed planting plans generated subsequent to monitoring will match the species, density, and diversity found in the detailed vegetation survey for similar community types and take into consideration each site's landscape setting (Hughes et al., 2005). Enbridge will demonstrate good faith efforts to also match age classes for plantings other than trees, where feasible. Limited hand cuttings may be appropriate for harvesting clonal material to aid in the re-establishment of native communities. Should undisturbed sites be relied upon as a source of native plant material, harvest will be conducted lightly and with care to not disturb the site of the "take" or introduce invasive species seeds into the area.

Necessary additional restoration actions will be identified and submitted to the MDEQ as part of the annual report not less than 15 business days prior to Enbridge's desired start of implementation. The growing season presents a limited window of opportunity to complete both monitoring and maintenance activities during the same year. Therefore, if the MDEQ has not expressed concerns regarding the additional restoration actions within 20 business days of submission of the annual report, Enbridge intends to initiate the restoration work so that it can be completed during the growing season and be monitored the following year.

For affected wetland areas excavated to greater than 1 foot depth where the existing topography is functionally inconsistent with contours found in adjacent undisturbed areas of similar ecotype or in comparison to pre-response contours, a site-specific evaluation will be conducted to determine if soil addition or removal is necessary to restore the natural function of the site, subject to MDEQ concurrence. If fill or excavation is deemed the appropriate course of action, soil will be added or removed to bring the surface elevation to within 6 inches of the appropriate elevation. The affected portion of the site will then be replanted using appropriate native species typical of the affected habitat within the Talmadge Creek drainage system.

Additional restoration at affected wetland sites not meeting the site-specific restoration criteria will be completed as soon as reasonably possible. Sites will then be re-evaluated during the following late spring or early summer based on the monitoring schedule and within 30 days of the prior year's survey of the relevant polygon. Vegetation restoration and monitoring activities, as indicated in *Section 2.0*, *Section 4.0, Section 5.0*, and *Section 7.0* will continue until agreed upon metrics are achieved. At that point, the restoration will be deemed complete for that site and maintenance monitoring will begin as described in *Section 5.3*.

5.3 Maintenance Phase Metrics

Once restoration of a site has been achieved based on metrics specified for use in *Section 7.0*, that site will be moved into the maintenance monitoring phase. The maintenance monitoring phase will be identical to the field investigation and analyses described in *Section 2.0* above. However, upon mutual written agreement between Enbridge and MDEQ, fewer metrics may be chosen for evaluation and determination of success during maintenance monitoring as compared to those required during restoration monitoring.

Metrics mutually agreed upon by Enbridge and MDEQ, as described in *Section 7.0*, will be used to evaluate vegetation maintenance performance standards. For the vegetation community within an affected area polygon to be considered "maintained", the value for FQI and Mean C (if utilized), and medians (or means if applicable) for other metrics must fall within or exceed the interquartile range (comprising the middle 50% of observations – 25% to 75%) of all aggregated control plots for each community type.

For the vegetation community within an affected area polygon to be considered "maintained" relative to invasive species, percent invasive species cover must fall within the following ranges:

- *Phragmites australis* – 0% cover within affected area polygons and associated 50-foot buffers.
- Other Highly Invasive Species – 5% final effective areal cover within an affected area polygon.

Each year the selected metrics will be applied on a site-by-site basis in order to determine which sites have achieved successful annual maintenance and those that have not. Successful annual maintenance of a site will be determined by evaluation of agreed upon maintenance metrics as a whole, versus evaluation of specific metrics in isolation. This will allow a site to achieve acceptable annual maintenance when one or more metrics are below expectations but the metrics as a whole are considered acceptable, additional restoration/maintenance activities are not required, and the annual achievement of successful maintenance can be approved for that period. Achievement of all agreed upon maintenance metrics will, by default, constitute successful annual maintenance.

Triggers for corrective action during the maintenance period will be agreed upon by Enbridge and MDEQ prior to the 2014 field season as identified in *Section 4.0*. Maintenance period triggers for corrective action are anticipated to be less stringent than restoration triggers to reduce disturbance to restored wetlands and allow the wetland to reach an acceptable level of equilibrium.

Modification of maintenance phase metrics may be made upon concurrence by the MDEQ in writing that alternative site criteria are appropriate.

5.4 Termination of Monitoring

Within each annual monitoring report, the sites that meet the agreed-upon restoration metrics specified in *Section 7.0* (i.e., sites in restoration phase monitoring) and those achieving successful annual maintenance (i.e., sites in maintenance phase monitoring) will be identified and each site's progress toward completion will be tracked. Maintenance phase monitoring will cease, and no further monitoring, restoration, or maintenance activities will be required, when a site achieves 5 consecutive years of successful maintenance (i.e.,

the year of restoration plus 4 additional maintenance years). As requested by MDEQ, the Source Area has separate performance standards and monitoring requirements that are specified in *Section 7.0*. Upon written agreement by MDEQ, a site may be deemed complete and maintenance monitoring may be terminated prior to the 5 consecutive years should Enbridge demonstrate to the satisfaction of the MDEQ that additional monitoring is not warranted.

5.5 Annual Monitoring Reports

Information collected during the 2014 and subsequent field inspections will be compiled and included in an annual report describing conditions existing at the time of the field inspection and evaluating the progress of each affected wetland area relative to agreed upon restoration or maintenance metrics specified in *Section 7.0*, including achievement of successful restoration and successful annual maintenance.

The annual vegetation data and analyses will be presented in the annual monitoring report for each affected wetland area as indicated on *Figure 1*, including a plan for control of identified invasive species occurrences.

The annual report will include the following elements:

- Pertinent background information such as precipitation and flooding patterns,
- Tables documenting field monitoring data collected,
- Photographs of monitoring locations,
- Details for comparison of affected wetland area data to control area data for each of the agreed upon vegetation metrics,
- Details of invasive species mapping results,
- Sections documenting and discussing the status of each site with respect to the pertinent restoration metrics or achievement of successful annual maintenance,
- Recommendations for future monitoring activities, and
- Recommendations for additional restoration activities (if necessary).

6.0 POTENTIAL SITE VISITS

Site visits may be scheduled in early 2014 to allow MDEQ and/or Enbridge staff to evaluate specific affected wetland and control areas in the field following completion and review of the

2013 Talmadge Creek Report. This may assist in confirming the use of agreed upon metrics for future monitoring.

Site visits may also be scheduled to evaluate specific affected areas where differences of opinion arise between Enbridge and MDEQ regarding corrective actions, or achievement of restoration or successful maintenance.

7.0 JUNE 2014 ADDENDUM

Based on a meeting between MDEQ and Enbridge on June 6, 2014, the following amendments to this work plan were agreed upon and apply to all affected wetlands at Talmadge Creek:

- Tree and shrub metrics originally developed will be replaced by an evaluation of tree and shrub presence based on a survivability metric of 70% of planted individuals. The number of trees and shrubs planted within each affected wetland polygon will be recommended by Enbridge in the 2013 Talmadge Creek Report for review and approval by the MDEQ. Some affected wetlands will not have tree or shrub plantings, and therefore will not require future evaluation of trees or shrubs.
- Based on a field inspection by the MDEQ and Enbridge on May 28, 2014, control polygon boundaries were adjusted to remove upland areas within control polygons C02, C04, C10, and C15 as reflected in *Figure 1* and *Figure 2*. Additional modifications were made to adjust the location of sample points C04-11, C04-12, C10-25, and C15-35 (*Figure 1* and *Figure 2*). Modifications were also made to *Figure 1* and *Figure 2*. Minor adjustments were made to sample point locations to keep sample plots within the boundaries of control and affected wetland polygons, where possible, as original sample point placement was based on a smaller plot diameter. Previous modifications to the plot diameter resulted in some sample points being too close to the polygon edge. Some sample locations for 2014 and beyond are shifted slightly from their original locations to keep the entire plot diameter within the polygon boundary.

7.1 Agreed Upon Metrics for 2014 and Beyond

Based on a June 6, 2014, meeting between the MDEQ and Enbridge, the following metrics will be utilized for evaluation of affected wetlands at Talmadge Creek in 2014 and beyond as indicated in *Section 5.2* and *Section 5.3* with the exception of the Source Area:

- Herbaceous Native and Native Wetland Species Coverage (i.e., all native species, native wetland species only),
- Herbaceous Native and Native Wetland Species Richness (i.e., all native species, native wetland species only),
- Total and Native Species FQI (i.e., all species, native species only) based on meander survey data and including tree and shrub stratums,
- Planted tree and shrub survivability of 70% of individual plants installed based on 2013 annual report recommendations and subsequent approval by the MDEQ, and
- Invasive species mapping.

7.2 Source Area Performance Standards

At a June 6, 2014, meeting the MDEQ requested that Enbridge develop site-specific performance standards for the Source Area vegetation monitoring and restoration.

In 2013 Enbridge collected vegetation data from a reference area (REF-SA) specified by the MDEQ for use in comparison to vegetative conditions in the Source Area. Various metrics were calculated from these data and reported to the MDEQ including a comparison to metrics calculated from vegetation data collected in the Source Area. During a meeting conducted on June 6, 2014, the MDEQ indicated a concern regarding the number of shrubs present within the REF-SA control and a desire to limit the number of shrubs and trees within the Source Area to less than what was observed in REF-SA.

The 2013 monitoring data collected by Enbridge indicates that the REF-SA metrics had a lower interquartile stem density value of 4,622 per acre (all stems). The revised stem values requested by the MDEQ during the June 6, 2014 meeting for other portions of Talmadge Creek are in the range of approximately 350 stems per acre for native wetland species.

Vegetation monitoring during 2013 indicated that portions of the Source Area likely experience periodic inundation, including the 100-foot wide Line 6B pipeline right-of-way that historically was devoid of trees/shrubs due to maintenance clearing. These areas could not be accessed in 2013 and hence sample plots are situated around the perimeter of the source area. The northern portion of the Source Area was not able to be accessed due to lack of landowner permission. Since plantings and monitoring within inundated portions of the Source Area is not feasible, the vegetation performance standards developed for the Source Area apply only to non-inundated areas and plantings per acre are applicable only to non-inundated areas.

Due to the MDEQ concerns regarding suitable control for the Source Area and a desire to limit shrub and tree presence, performance standards for the Source Area below are not dependent upon annual sampling within and comparison to a control area. The proposed Source Area performance standards are based upon data collected and discussed in the 2012 report referenced above as well as the 2013 vegetation monitoring conducted by Enbridge.

Source Area Performance Standards:

- Herbaceous Percent Cover Native Species: 70% (as indicated by 5-foot radius sample plot data),
- Maximum Percent Cover Invasive Species: 5% (as specified in the Work Plan for other Talmadge Creek segments); *Phragmites australis* 0%,
- Total Native Wetland Tree Stem Count: Twenty-six or more, based on meander count of entire Source Area; number of trees to be planted pending discussion and approval by the MDEQ,
- Total Native Wetland Shrub Density: 350 per acre (as indicated by 15-foot radius sample plot data); number of shrubs to be planted pending discussion and approval by the MDEQ, and
- Wetland Status: Vegetation in each herbaceous sample plot (5-foot radius) will be dominated by wetland species as described by the “50/20” rule in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (USACE, 2012).

Monitoring Period:

The Source Area shall meet the above referenced performance standards after the fifth year of annual monitoring beginning in 2013. During the five years of annual monitoring, results of the monitoring may be used to plan additional restoration activities, if needed. Monitoring may be suspended prior to the five years given the MDEQ, in mutual agreement with Enbridge, deem the restoration successful.

8.0 REFERENCES

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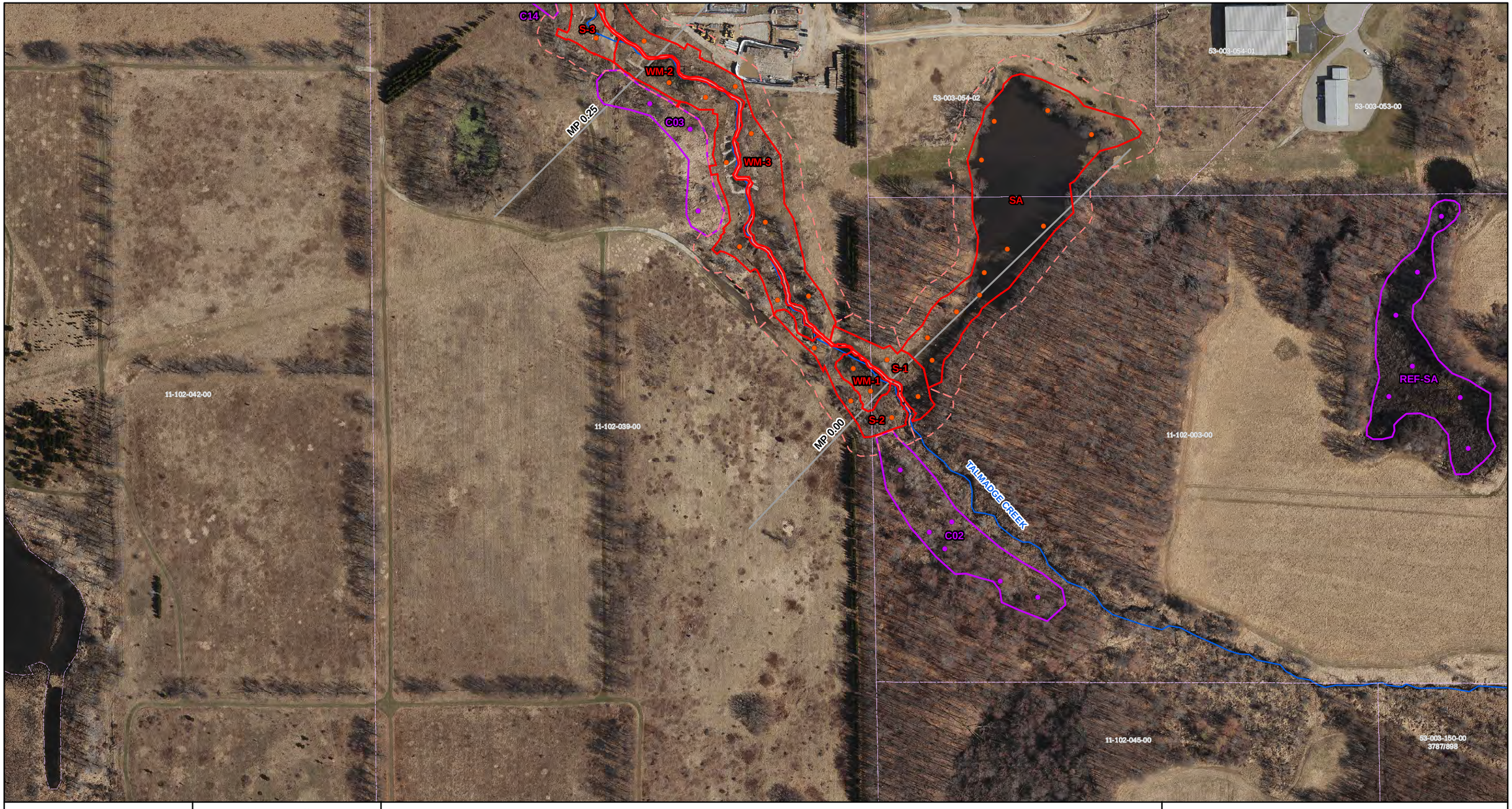
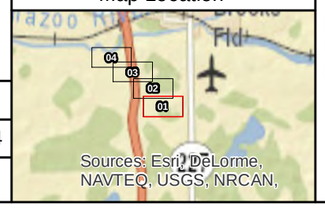
Figures



ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



Legend

- Affected Wetland Vegetation Area
- Affected Wetland Vegetation Area 50ft Buffers
- Wetland Vegetation Control Area
- Affected Wetland Vegetation Sample Location
- Control Area Vegetation Sample Location
- Calhoun Parcels
- Quarter Mile Grid Segment
- Perennial Stream

N

0 125 250

Scale in Feet

FIGURE 1
TALMADGE CREEK
WETLAND VEGETATION SAMPLE AREAS

SHEET 1 OF 4
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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Aerial Photography Date: April 2011

REF-T
T
C05
C06
WM-7
MP 0.75
16-350-030-03
16-350-030-05
16-342-003-00
WM-6
16-350-030-00
16-350-036-00
16-350-030-01
WM-5
C04
C15
WM-4
16-350-030-02
16-350-030-08
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16-350-039-00
16-351-006-00
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16-350-003-00
16-351-012-00
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MP 0.50
Division Dr
ROW
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11-102-012-00
53-003-025-00
11-102-042-10
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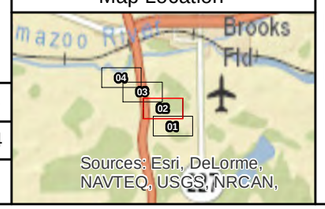
11-103-004-00
11-102-042-00
C14
S-3
WM-3
11-102-039-00
53-003-054-02
MP 0.25
TALMADGE CREEK
WM-2
C03
SA

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



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- Wetland Vegetation Control Area
- Affected Wetland Vegetation Sample Location
- Control Area Vegetation Sample Location
- Calhoun Parcels
- Quarter Mile Grid Segment
- Perennial Stream

N

0 125 250

Scale in Feet

FIGURE 1
TALMADGE CREEK
WETLAND VEGETATION SAMPLE AREAS

SHEET 2 OF 4
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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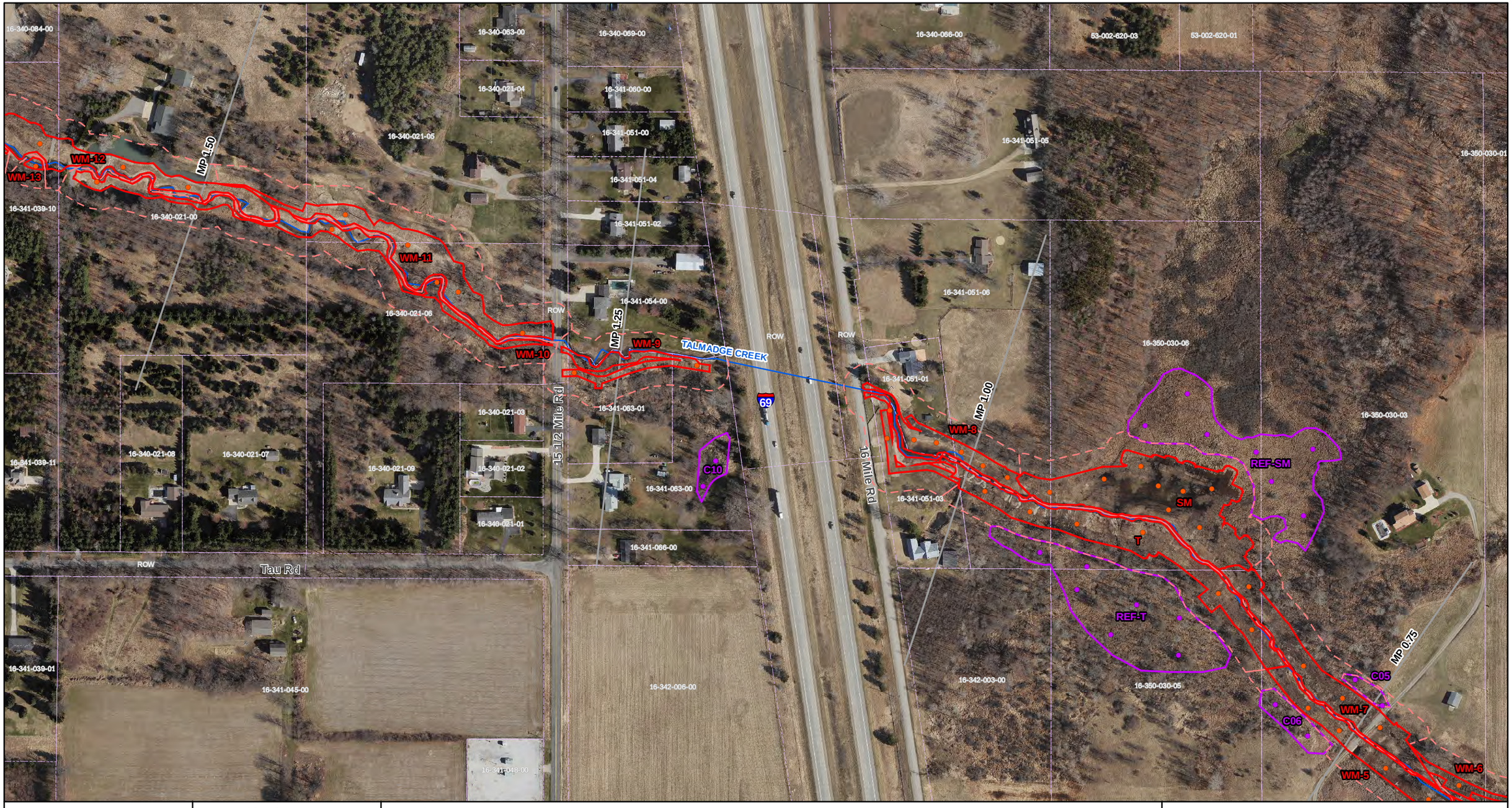
Aerial Photography Date: April 2011



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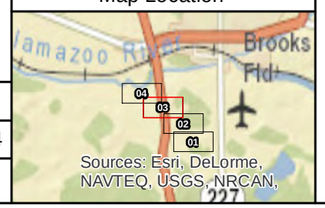
Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



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- Affected Wetland Vegetation Area
- Affected Wetland Vegetation Area 50ft Buffers
- Wetland Vegetation Control Area
- Affected Wetland Vegetation Sample Location
- Control Area Vegetation Sample Location
- Calhoun Parcels
- Quarter Mile Grid Segment
- Perennial Stream

N

0 125 250

Scale in Feet

FIGURE 1
TALMADGE CREEK
WETLAND VEGETATION SAMPLE AREAS

SHEET 3 OF 4
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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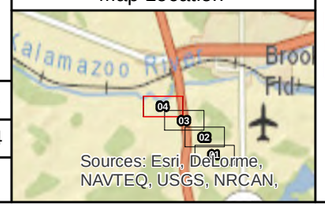
Aerial Photography Date: April 2011

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



Legend

- Affected Wetland Vegetation Area
- Affected Wetland Vegetation Area 50ft Buffers
- Wetland Vegetation Control Area
- Affected Wetland Vegetation Sample Location
- Control Area Vegetation Sample Location
- Calhoun Parcels
- Quarter Mile Grid Segment
- Perennial Stream

N

0 125 250

Scale in Feet

FIGURE 1
TALMADGE CREEK
WETLAND VEGETATION SAMPLE AREAS

SHEET 4 OF 4
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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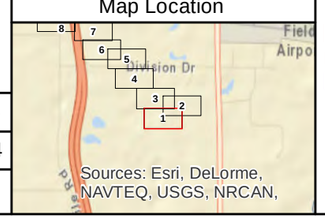
Approved:	BJ	02/24/2014

Map Location



Legend

- Affected Wetland Vegetation Area
- Affected Wetland Vegetation Area 50ft Buffers
- Wetland Vegetation Control Area
- Affected Wetland Vegetation Sample Location
- Control Area Vegetation Sample Location
- Calhoun Parcels
- Quarter Mile Grid Segment
- Perennial Stream

N

0 50 100

Scale in Feet

FIGURE 2
TALMADGE CREEK WETLAND
VEGETATION SAMPLE AREAS DETAIL

SHEET 1 OF 10
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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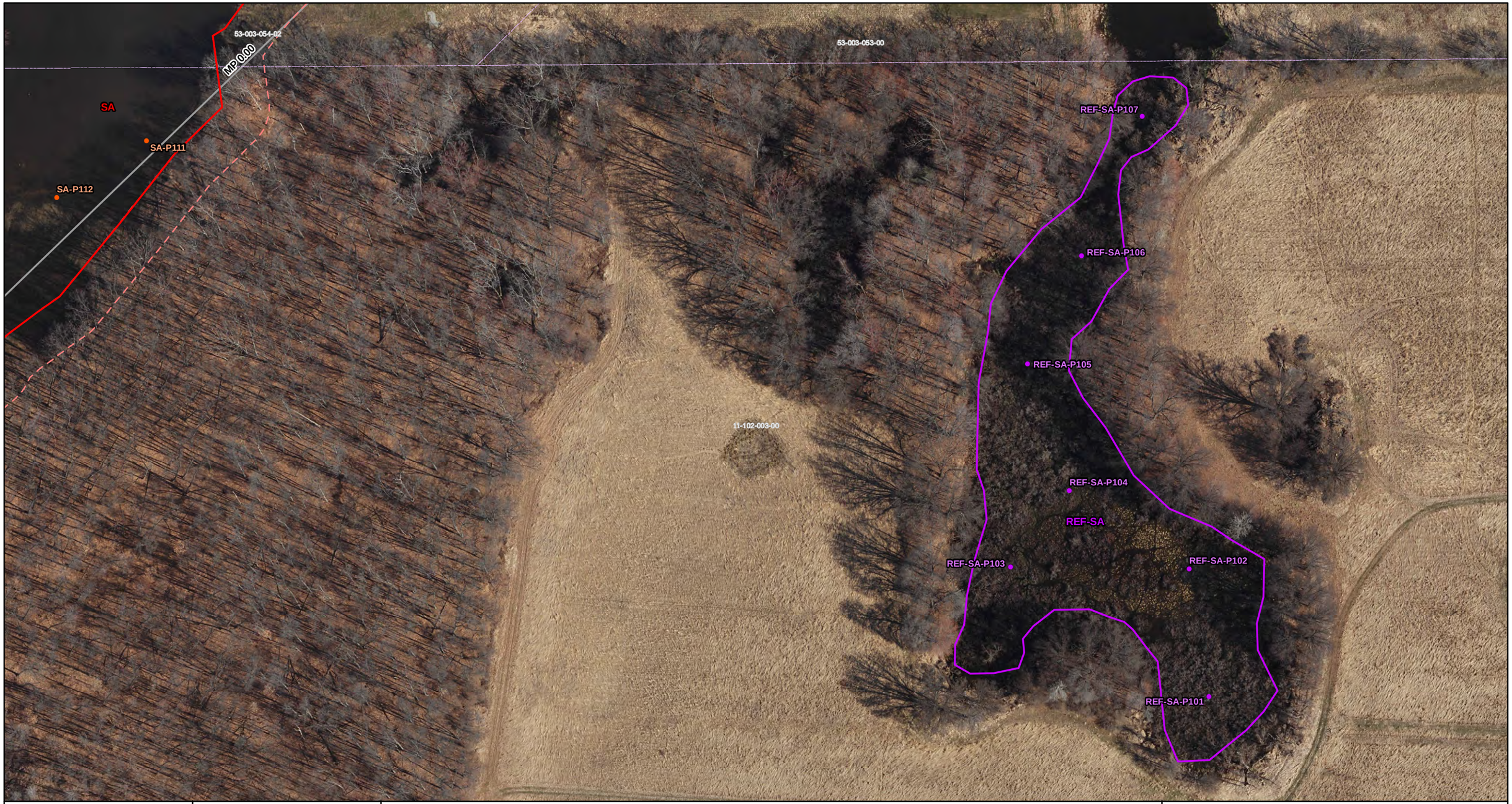
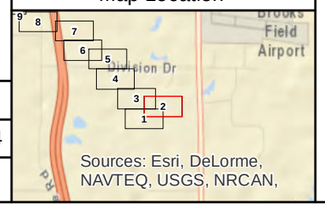
Aerial Photography Date: April 2011



ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



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- Perennial Stream

N

0 50 100

Scale in Feet

FIGURE 2
TALMADGE CREEK WETLAND
VEGETATION SAMPLE AREAS DETAIL

SHEET 2 OF 10
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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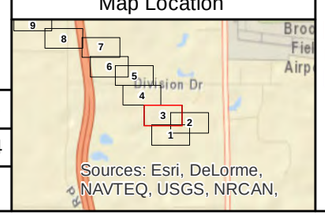
Aerial Photography Date: April 2011

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



Legend

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- Quarter Mile Grid Segment
- Perennial Stream

N

0 50 100

Scale in Feet

FIGURE 2
TALMADGE CREEK WETLAND
VEGETATION SAMPLE AREAS DETAIL

SHEET 3 OF 10
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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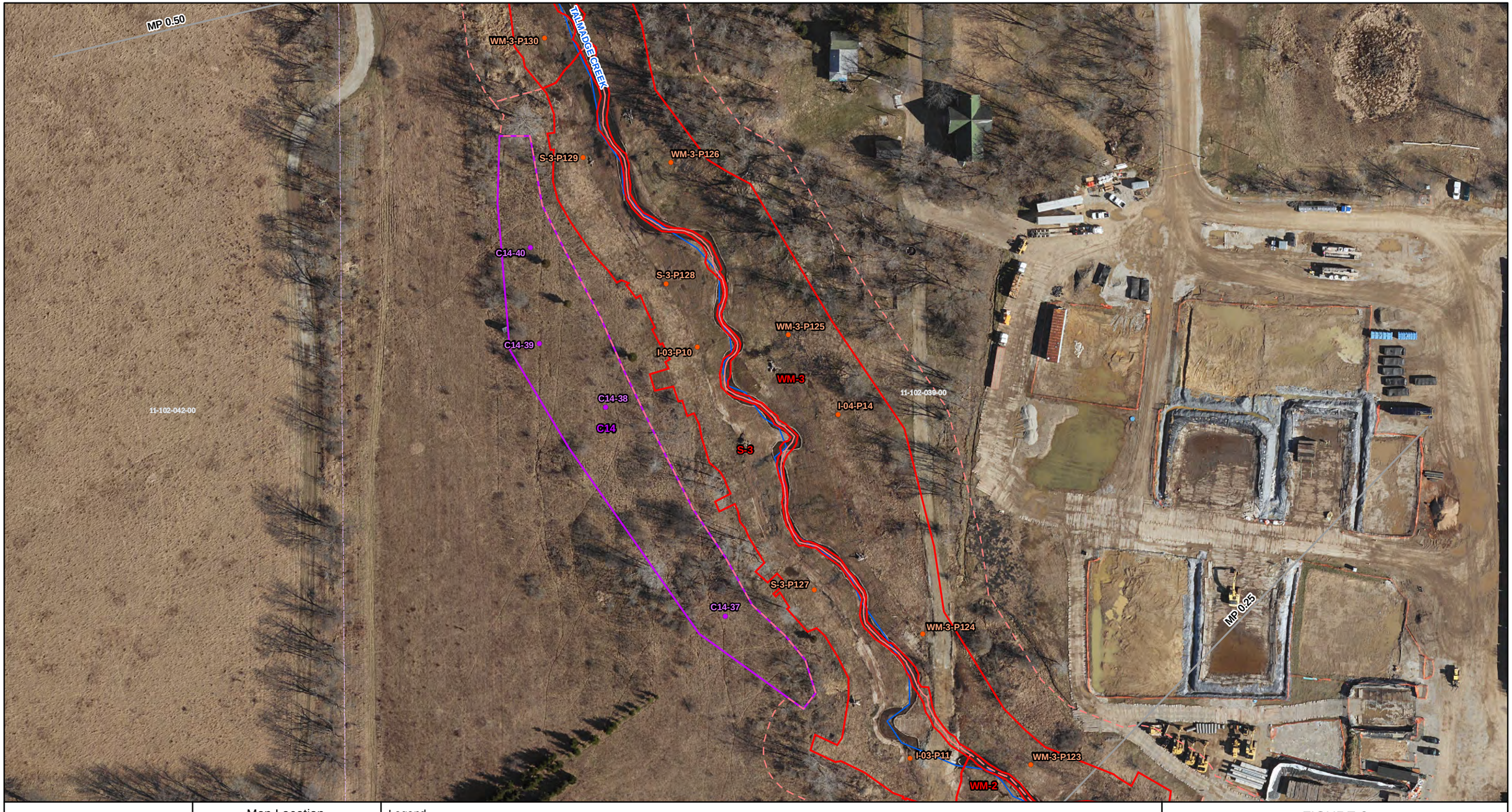
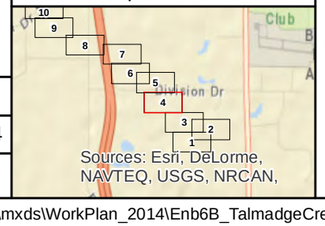
Aerial Photography Date: April 2011



ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



Legend

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- Affected Wetland Vegetation Area 50ft Buffers
- Wetland Vegetation Control Area
- Affected Wetland Vegetation Sample Location
- Control Area Vegetation Sample Location
- Calhoun Parcels
- Quarter Mile Grid Segment
- Perennial Stream

N

0 50 100

Scale in Feet

FIGURE 2
TALMADGE CREEK WETLAND
VEGETATION SAMPLE AREAS DETAIL

SHEET 4 OF 10
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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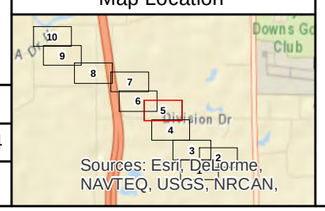
Aerial Photography Date: April 2011

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/24/2014

Map Location



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N

0 50 100

Scale in Feet

FIGURE 2
TALMADGE CREEK WETLAND
VEGETATION SAMPLE AREAS DETAIL

SHEET 5 OF 10
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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Aerial Photography Date: April 2011