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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 the Kalamazoo River

Prepared for Michigan Department of Environmental Quality

Enbridge Energy, Limited Partnership

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FIGURES

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LIST OF ACRONYMS

C value	Coefficient of Conservatism Value
Cowardin System	Cowardin classification system
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
MP	Mile Post
NRCS	Natural Resource Conservation Service
NRDA	Natural Resource Damage Assessment
NWI	National Wetlands Inventory
%	Percent
SL	Soil sample location
sq. ft.	Square feet
TE	Topographic elevation location
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 Natural Resources and Environmental Protection Act Part 303 regulated wetlands along the Kalamazoo River affected by Line 6B crude oil deposition and subsequent response activities associated with the Enbridge Energy, Limited Partnership (Enbridge) Line 6B Mile Post (MP) 608 Marshall, Michigan pipeline crude oil release on a site-specific basis. The goals of the final restoration effort outlined in the Work Plan are to:

1. Monitor the development of areas restored in conjunction with removal of Ceresco dam to confirm they are achieving specified performance standards or to identify needed maintenance, and
2. Return affected wetlands along the remainder of the river to their condition, as reasonably as possible, immediately prior to the 2010 Line 6B crude oil release event and document those conditions.

In order to achieve these goals, the process described in this work plan is designed to:

- Identify vegetative site condition data from immediately prior to the 2010 Line 6B crude oil release and/or appropriate control locations for each wetland affected by Line 6B crude oil deposition and subsequent response activities.
- Assess plant community metrics, including invasive species coverage, in each wetland affected by Line 6B crude oil deposition and subsequent response activities for comparison with pre-release or reference conditions.
- Assess soil parameters of wetlands affected by Line 6B crude oil deposition and subsequent response activities that were excavated to a depth greater than 1 foot.
- Assess ground surface topography within wetlands affected by Line 6B 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 wetlands affected by Line 6B crude oil deposition and subsequent response activities as nearly as possible to its condition immediately prior to the Line 6B pipeline crude oil release.
- Monitor and document site development until each wetland affected by Line 6B crude oil deposition and subsequent response activities resembles its condition, as reasonably as possible, immediately prior to the Line 6B pipeline crude oil release.
- Establish restoration criteria for areas exposed as a result of removal of Ceresco Dam and guide the monitoring of plant community development in the restored areas.

Work and reporting in 2014 will be organized using the following river segments:

1. Talmadge Creek Confluence to Milepost 3.40,
2. MP 3.40 to 12 Mile Road,
3. 12 Mile Road to Interstate 94,
4. Interstate 94 to Raymond Road,
5. Raymond Road to Main Street,
6. Main Street to Battle Creek River Confluence,
7. Battle Creek River Confluence to Custer Drive,
8. Custer Drive to the Michigan Avenue Bridge in Augusta,
9. Michigan Avenue bridge in Augusta to the 35th Street Bridge in Galesburg, and
10. 35th Street Bridge in Galesburg to Morrow Lake Dam.

Survey work and reporting in 2013 included a river segment from "Dickman Road to the Battle Creek River Confluence," which was moved into segment 6 above at the request of MDEQ. River reporting segments may be modified by mutual agreement between Enbridge

and the MDEQ following review of the 2013 Base Phase vegetation data evaluation and assessment.

Removal of Ceresco Dam will create a unique situation in the area affected by elimination of the impoundment in the MP 3.40 to 12 Mile Road River Segment (River Segment 2). In this area, most wetlands along the perimeter of the former impoundment will likely exhibit changes in community composition as a consequence of decreased riverine influence. Formerly submerged areas will develop based on the newly established river hydrology and the restoration planting plan. Consequently, the monitoring approach in this river segment is focused on identification and control of invasive species in the wetlands along the perimeter of the former impoundment (i.e., the fringe area) and evaluating restoration plan success in the newly exposed areas.

For the remainder of the river (river segments other than 2), 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. For these areas the plan also addresses concerns relating to topography and soils in wetlands excavated to a depth greater than 1 foot. The approach considers conditions presently existing at each wetland affected by Line 6B crude oil deposition and subsequent response activities, pre-release conditions (where known), and adjacent unaffected similar habitat (control polygons). 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).

Affected wetlands and control locations (i.e., control polygons) 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*), topographic survey locations, and soil sample points (*Figure 2*). These monitoring and sample locations are located within and adjacent to wetlands affected by Line 6B crude oil deposition and subsequent response activities along

the Kalamazoo River. Control polygons for wetland community types were selected based on MDEQ wetland data and historic aerial photography. For the purposes of this Work Plan, the following definitions apply:

- Affected Wetland: an area 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*). These areas are presumed to be wetlands affected by the Line 6B crude oil deposition and subsequent response activities.
- Affected Wetland Polygon: a geometric shape that defines the limits of an affected wetland, including the affected wetland within *(Figure 1)*.
- Control Polygon: a geometric shape that defines the limits of an unaffected area, presumed to be wetland, and used for collection of vegetative data for comparison to affected wetlands.

The Affected Wetland Vegetation Areas – Screening Group polygons and points shown on *Figure 1* are areas that are very small, isolated, and/or of uncertain response type (if any). Enbridge and the MDEQ have agreed to evaluate these locations in 2014 with potential site visits, to determine if they should remain categorized as affected wetlands or removed from the wetland assessment. This determination will be made based on visual assessment of the polygons in the field, as well as meander or plot data that may be collected during the site visit.

This work plan may be modified over time during implementation by written agreement on the specific changes by both Enbridge and the MDEQ.

1.1 Annual Reporting

Annual reports addressing affected wetland monitoring efforts and results will be prepared by Enbridge and submitted to the MDEQ for review and approval.

The report for River Segment 2 will address invasive species within identified affected wetlands along the fringe area of the former impoundment *(Figure 2)* as described in portions of *Section 7.0* relative to invasive species metrics, and success of the restoration plan in formerly submerged areas based on evaluation of performance criteria metrics described in *Section 7.0*.

For the remaining segments, 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*.

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 and will address specific river segments identified above in separate sections of the report.

The Restoration Phase will begin in 2014 following an agreement between Enbridge and the 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 wetlands meet restoration performance standards.

Once a particular affected wetland has met Restoration Phase performance standards, that site will enter the Maintenance Phase monitoring and reporting period. Maintenance Phase vegetation performance standards will be developed by mutual agreement between Enbridge and the MDEQ. Maintenance Phase reporting will focus on evaluating if specific affected wetlands meet the agreed upon maintenance performance standards.

A “Report for Monitoring, Restoration, and Invasive Species Control in Wetlands along the Kalamazoo River – 2013” will be provided by April 15, 2014 to the MDEQ addressing 2013 data collection and results. This will include information addressing soils, topography, and vegetation conditions along the Kalamazoo River, as well as data for assessment of potential metrics for restoration and maintenance monitoring. Landowner access may affect the date and order of completion of data collection at various river segments, but will not affect submission of the related deliverables. The MDEQ will be notified in writing upon completion of field inspections necessary for completion of annual reporting.

Beginning in 2014, a final comprehensive Kalamazoo River monitoring report for will be submitted to the MDEQ by December 31 of each monitoring year, not including River Segment 2. River Segment 2 is associated with the Ceresco Dam removal. Monitoring and reporting for this river segment is different and considered separately from the remaining

Kalamazoo river segments as discussed in *Section 7.0*. Once a particular affected wetland 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
    - Kalamazoo River Base Phase Monitoring Report
        - Document status of soils, topography, and vegetation monitoring; data and analyses for evaluation of vegetation metrics for performance standards; and invasive species treatment; and, proposed restoration activities.
- 2014 and beyond
    - Kalamazoo River Restoration and Maintenance Phase Monitoring Report for all river segments except River Segment 2.
        - A final report will be compiled and submitted by December 31 of each monitoring year.
        - 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.
    - Kalamazoo River Restoration and Monitoring Report for River Segment 2.
        - A final report will be submitted by December 31 of each monitoring year.
        - Document restoration and monitoring results of recently exposed areas due to removal of Ceresco Dam.
        - Document invasive species monitoring and restoration activities as necessary for affected wetlands along the fringe of the former impoundment to control invasive species.

Should the need for maintenance plantings be identified during preparation of the annual report, Enbridge will consult with the MDEQ prior to implementation in order to inform the Department of the planned work.

1.1.1 Invasive Species Reporting

To allow for prompt treatment of invasive species, Enbridge will provide the MDEQ with maps indicating the location of identified invasive species and planned treatment as soon as possible following field identification. Enbridge will conduct treatment of invasive species as soon as possible following field identification, and the MDEQ approval for treatment of invasive species will not be required other than normal permitting requirements. Enbridge may modify treatment techniques or locations upon request by the MDEQ. 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 builds on and modifies elements of the 2011 sampling plan developed for the 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 along the Kalamazoo River will be initiated in late June or early July of each monitoring year and is anticipated to last through the first week in October. The monitoring described in *Sections 2.0* through *Section 5.0* applies to all river segments except River Segment 2. Monitoring elements for River Segment 2 are described in *Section 7.0*.

2.1.1 Direct Measurements of Species Present

As in the 2011 assessment, direct field measurements will include:

- Meander survey of species observed within affected wetland and control polygons,
- Species total percent (%) cover by stratum within affected wetland and control polygons sample locations,
- Stem density (i.e., shrub and tree stratum) within affected wetland and control polygons sample locations, and
- Mapping of the presence and extent of highly invasive species within affected wetland polygons and associated buffers.

2.1.2 Base Vegetation Analyses and Metrics

Vegetation data collected within affected wetlands and control polygons 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 wetlands in 2014 and beyond. Additionally, the 2013 data will be used to evaluate the study design to determine if sufficient control data is available for affected wetland polygons. If sufficient control data is not available in a particular river segment, control data may be aggregated across proximal river segments.

2.2 Sampling Plan Detail

GIS desktop methods were used by the MDEQ and Enbridge to identify affected wetlands (polygons) for field investigation. Enbridge identified the location of control polygons within undisturbed wetland for comparison to affected wetlands using GIS desktop methods. The location of control polygons was based on modified National Wetlands Inventory (NWI) wetland mapping provided by the MDEQ.

Wetland types (i.e., palustrine forested, palustrine scrub-shrub, and palustrine emergent) were assigned to each affected wetland and control polygon based on NWI mapping provided to Enbridge by the MDEQ. Field investigation of these polygons and sample points may indicate that adjustments to wetland type are warranted to allow appropriate

comparison of affected wetland data to control polygon data; this may include adjustment of control polygon boundaries to avoid identified upland. Enbridge will discuss recommended changes to polygon wetland type with the MDEQ.

2.2.1 Meander Survey

A meander survey will be conducted within both the affected wetland polygons and unaffected control polygons of similar vegetative composition. Meander surveys will be conducted to avoid upland areas that may occur within the polygons.

Plant lists will be recorded for both the affected wetlands and control polygons that indicate individual 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 15 feet beyond the affected wetland polygon boundary.

Meander time will vary dependent upon the sample area size and diversity of species present in a particular affected wetland or control polygon. 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 wetlands and control polygons may be collected as necessary 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 wetland and control polygon by vegetative community type based on the Cowardin classification system (Cowardin System) (Cowardin et al., 1992). Changes to the original polygon Cowardin classifications provided by MDEQ will be clearly described and supported with appropriate data in the reporting.

2.2.2 Data Sample Locations

Sample locations were placed within affected wetlands and control polygons by Enbridge using a stratified random methodology as requested by the MDEQ. 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. Two photographs of each sample point will be collected; one close-up of the herbaceous stratum and a more panoramic view of the shrub/tree stratums.

Vegetative cover estimates will be recorded at each VSL within the affected wetlands and control polygons by species using % absolute cover. Tree and shrub stem counts will be based on stems emerging from the ground surface.

Sampling density will be based on affected wetland size and community type diversity. At a minimum, two VSLs will be located in each community type present in the affected wetland polygon, assuming the polygon is spatially large enough to accommodate two sample locations, as well as the control polygons. Sampling density has been developed based on two sampling locations per acre and adjusted for larger affected wetlands to limit the sample locations to a reasonable number that provides sufficient data to characterize observed habitat types. Calculations for determining plot density in each polygon are:

- Less than 1.0 acre.
    - Two VSLs.
- 1.0 acre to less than 2.0 acres.
    - Four VSLs.
- 2.0 acres to less than 3.0 acres.
    - Five VSLs.
- 3.0 acres to less than 4.0 acres.
    - Six VSLs.
- 4.0 acres to less than 10.0 acres.
    - Eight VSLs.
- 10.0 acres to less than 15.0 acres.
    - Nine VSLs.
- Greater than 15.0 acres.
    - Ten VSLs

The % 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 will be collected and referenced using a sub-meter GPS unit. Data collected at each VSL will include:

- 5-foot herbaceous plots.
    - Absolute % cover of each species by canopy cover.
- 15-foot shrub plots.
    - Absolute % 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 % cover of each species by canopy cover, and
    - Stem density of each species by number of stems in each plot.

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

2.2.3 Field Adjustment of Sample Locations

Field staff will relocate the sample locations in instances where field investigation determines that sample locations are not situated within wetland. A random number generation technique will be used to relocate sample locations while still maintaining a random stratification of sample locations to the extent 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 river, adjustment of plot geometry where affected wetland 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 or location 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 polygon VSLs will not be located in areas of known or suspected recent disturbance.

2.3 Data Processing

The following metrics will be evaluated in early 2014 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 based on 2014 data collection and beyond. Only those metrics that Enbridge and the MDEQ mutually agree to use for performance metrics will be analyzed based on 2014 field data and beyond.

2.3.1 Native Species Coverage

Native species coverage will be determined within each affected wetland 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 river segment.
b. Separate sample locations into respective groups based on the Cowardin System. Aggregations and comparisons between affected wetlands and control polygons will be made only between identical community types.
c. Separate species absolute % cover observations within each sample plot into stratum (i.e., herb, shrub, and tree).
d. Select native species within each stratum. Exclude highly invasive species listed in *Section 1.0*.
e. Sum the absolute % coverages for native species by stratum for each sample plot (i.e., total % native cover for herb, shrub, and tree for each plot). Result is total native % coverage for each stratum within each sample plot.
    1. Control Polygon Data
        - Aggregate total % native coverage for each stratum across all control polygons sample data within particular river segment and community type. The result will be three data populations of total % native coverage for control polygon data plots within river segment (i.e., herb, shrub, and tree).
        - Determine interquartile range for control polygons total % native coverage by stratum by river segment and community type.

2. Affected Wetland Polygon Data
    - Aggregate total % native coverage by stratum for all affected wetland sample locations by polygon ID within particular river segment and community type (i.e., total % native coverage within each affected wetland polygon aggregated by stratum).
    - Determine median and mean total % native coverage by stratum for each affected wetland polygon.
    - Compare affected wetland polygon median and mean total % native coverage by stratum to associated control polygons 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 polygons 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 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 river segment.
b. Separate sample locations into respective groups based on the Cowardin System. Aggregations and comparisons between affected wetlands and control polygons will be made only between identical community types.
c. Separate species % cover observations within each sample plot into stratum (i.e., herb, shrub, and tree).
d. Select native species within each stratum. Exclude highly invasive species listed in *Section 1.0*.
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:

- Aggregate native species richness values by stratum for all control polygon sample

data within particular river segment and community type.

- Determine interquartile range for control polygons native species richness by stratum within particular river segment and community type.

Affected Polygon Data:

- Aggregate native species richness for all affected wetland sample locations by polygon ID within particular river segment and community type,
- Determine median and mean native species richness for each affected wetland polygon, and
- Compare affected wetland median and mean native species richness data aggregated by polygon to aggregated control polygon 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 river segment.
b. Separate sample locations into respective groups based on the Cowardin System. Aggregations and comparisons between affected wetlands and control polygons 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, and 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 by plot (i.e., 15-foot radius shrub and 30-foot radius tree). The result is shrub and tree stem density per plot. Results may also be reported in stem density per acre in addition to stem density per plot.

Control Polygon Data:

- Aggregate shrub and tree stem density by stratum for all control polygon sample data within particular river segment and community type, and
- Determine interquartile range for control polygons shrub and tree stem density by river segment.

Affected Polygon Data:

- Aggregate shrub and tree stem density for all affected wetland sample locations by polygon ID within particular river segment and community type,
- Determine median and mean shrub and tree stem density for each affected wetland polygon by stratum, and
- Compare affected wetland 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 % 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 river segment.
b. Separate sample locations into respective groups based on the Cowardin System. Aggregations and comparisons between affected wetlands and control polygons will be made only between identical community types.
c. Identify herbaceous species absolute % cover observations within each sample plot.
d. Calculate relative % cover for each herbaceous species within each specific sample plot (i.e., sum all % coverages within a plot, divide each species by the sum to get relative % coverage). Note: this value must be reported as a decimal % 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 % 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 % coverage). Note: this value must be reported as a decimal % 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 – % relative abundance as decimal
(cover for herbaceous, stem count for shrub/tree)

Control Polygon Data:

- Aggregate Shannon Species Diversity values by stratum for all control polygon sample data within particular river segment and community type, and
- Determine interquartile range for control polygons Shannon Species Diversity values by stratum and by river segment and community type.

Affected Polygon Data:

- Aggregate Shannon Species Diversity values for all affected wetland sample locations by polygon ID within particular river segment and community type,
- Determine median and mean Shannon Species Diversity value for each affected wetland polygon by stratum and community type, and
- Compare affected wetland 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 Native FQI is as follows:

a. Separate data by river segment.
b. Separate meander survey locations into respective groups based on the Cowardin System. Aggregations and comparisons between affected wetlands and control polygons will be made only between identical community types.

c. Identify meander species for each affected wetland and control polygons and associated C value. Adventive species are not included in the analysis of native FQI. Exclude highly invasive species listed in *Section 1.0*.
d. Calculate Native FQI for each affected wetland and control polygons utilizing a qualitative data list of species identified during the meander survey. The FQI is calculated using a C value 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 Native FQI values for all control polygon sample data within particular river segment and community type, and
- Determine interquartile range for control polygons Native FQI values by river segment and community type.

Affected Polygon Data:

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

FQI will also be calculated as indicated above for all species, including adventives and highly invasive species listed in *Section 1.0*, and used in appropriate metric comparisons. Adventives without a C value will be assigned a C value of zero.

2.3.6 Mean Coefficient of Conservatism

Meander survey data will be utilized for this metric.

The procedure to evaluate Native Mean C is as follows:

a. Separate data by river segment.
b. Separate meander survey locations into respective groups based on the Cowardin System. Aggregations and comparisons between affected wetlands and control polygons will be made only between identical community types.

c. Identify meander species for each polygon and associated C value. Adventive species will not be included in the analysis of native Mean C. Exclude highly invasive species listed in *Section 1.0*. Calculate Native Mean C value of all native species.

Control Polygon Data:

- Aggregate Native Mean C values for all control polygon sample data within particular river segment and community type.
- Determine interquartile range for control polygons Native Mean C values by river segment and community type.

Affected Polygon Data:

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

Mean C will also be calculated as indicated above for all species, including adventives, and highly invasive species listed in *Section 1.0*, and used in appropriate metric comparisons. Adventives without a C value will be assigned a C value of zero.

2.3.7 Invasive Species

For treatment purposes, highly invasive species (11 species) in affected wetlands and 15-foot buffer areas along the Kalamazoo River will be inventoried and mapped as point or polygon features each monitoring year. Invasive species mapping data within the entire affected wetland polygon (not sample location data) will be used to evaluate if invasive species occurrences within affected wetlands meet the conditions for this metric. In order to accurately determine % cover within the affected wetland polygon, the polygon and buffer will be analyzed separately in order to eliminate any influence the buffer may have on the polygon % cover.

The procedure to evaluate highly invasive species is as follows:

a. Separate data by river segment (for reporting purposes only).
b. Separately calculate total areal coverage in sq. ft. of each highly invasive species (occurrence area) within each affected wetland and buffer area based on invasive species mapping data.

c. Multiply areal coverage above by observed decimal % coverage within the occurrence area for each species 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 % coverage). The maximum percent coverage of invasive species in any mapped invasive species polygon is 100%; i.e., multiple species identified in a single mapped polygon cannot sum to greater than 100% or result in an effective area of coverage that is larger than the field mapped invasive species polygon.

d. Separately calculate final % effective areal coverage of each highly invasive species within each affected wetland polygon by dividing "effective" coverage above by the polygon total area. This removes the bias associated with variation in size of polygons.

e. The same method described in Section d. above will be used to determine a final % effective areal coverage of invasive species within each affected wetland polygon buffer area by using mapped invasive species data from the buffer area and total buffer area.

Affected Polygon Data:

- Compare affected wetland polygon mapped invasive species final % effective areal coverage value for each affected wetland to the values indicated in *Section 5.1* and *Section 5.3*.

3.0 SOILS AND TOPOGRAPHIC EVALUATION

3.1 Soils Sampling

Soil profile data will be collected within and adjacent to affected wetlands that were excavated to a depth greater than 1 foot in order to assess whether the backfill material used matches as reasonably as possible the native soil.

Soil profiles 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 and soil replacement depth. Soil texture will be determined utilizing the National Resource Conservation Service (NRCS) Guide to Texture by Feel (Thien, 1979). 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. Excavated areas that are frequently inundated may preclude data collection and will not be investigated. 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.

The evaluation of collected soil data is described in *Section 3.4*. The density of sample points within each affected wetland polygon and adjacent control location is described in *Section 3.3.1*.

3.2 Topographic Surveying

Ground surface elevations will be collected within and adjacent to affected wetlands that were excavated to a depth greater than 1 foot utilizing survey-grade GPS equipment to assess whether or not the restored grade matches as reasonably as possible to the pre-excavation grade. The density of sample points within each affected wetland polygon and adjacent undisturbed area is described in *Section 3.3.1*. Excavated areas that are frequently inundated may preclude data collection and will not be investigated.

3.3 Sampling Locations

Operational response and assessment GIS data were used as the primary tools for identifying affected wetland evaluation sites. Depths of excavation for removal of affected soils were recorded by Enbridge during restoration activities along the Kalamazoo River. These data were used to create polygons along the Kalamazoo River that indicate excavation depths greater than 1 foot within affected wetlands during restoration activities *(Figure 2)*. Soil samples and topographic elevations will not be recorded in areas that lie below the field observed ordinary high water mark of the Kalamazoo River.

3.3.1 Sampling Density

Sampling density will be based on excavated area size, topography, and geomorphology. Soil sample locations (SL) and topographic elevation locations (TE) will be identified in the field based on evaluation of site-specific geomorphology with the intent of stratified random

location of sample points in areas representative of typical soils and elevation within the affected wetland or control location. SLs and TEs will be located independently from one another.

A minimum of two SLs will be placed in each affected wetland polygon equal to or greater than 2,500 sq. ft. in size. One SL will be located within wetland polygons less than 2,500 sq. ft. in size. Sampling density will be increased for affected wetland polygons that exceed 1.0 acre by one sample point for each half-acre incremental increase. This results in a sampling density of two samples per acre for affected wetland polygons that exceed 1.0 acre.

SLs will also be placed in control locations outside of and adjacent to the affected wetland polygons. The number of SLs utilized for control locations will typically match the number of SLs placed in any particular affected wetland polygon based on the affected wetland polygon acreage. A single control location SL may be utilized for multiple closely-spaced affected wetland polygons.

Topographic elevations will also be recorded in control locations outside of and adjacent to the affected wetland polygons. A minimum of two control location TEs will be surveyed for each affected wetland polygon; typically one on each side of the affected wetland polygon roughly the same distance from the river as the affected wetland polygon if practical. Additional TEs will be collected around larger affected wetland polygons to match the number of TEs surveyed within each particular affected wetland polygon if practical. Individual control location TEs may be utilized for multiple closely-spaced affected wetland polygons.

3.4 Topography and Soils Data Evaluation and Assessment

Soils data will be evaluated to assess whether or not the backfill material used during restoration of excavated sites matches as reasonably as possible the native soils. Topographic elevation data will be assessed in order to determine if the post-restoration grade matches as reasonably as possible to the pre-excavation grade (where known) or surrounding topography. Sites that demonstrate a significant alteration in soil characteristics or topography relative to reference conditions will be identified and the results, as well as suggested corrective action, of the assessment will be summarized. The topographic and soil evaluation will be conducted in 2013. Additional topographic or soil assessment will only

be conducted in subsequent years for those sites that experience additional restoration actions where soils are excavated to a depth greater than 1 foot.

Results of the 2013 soils and topography evaluations will be included in the Kalamazoo River Base Phase Monitoring Report. Any subsequent soil and topography evaluation and monitoring will be reported as indicated in *Section 1.1*. The MDEQ will be notified of scheduled field work no less than 2 days in advance and may attend the assessments.

4.0 BASE PHASE VEGETATION DATA EVALUATION AND ASSESSMENT

Vegetation 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 and associated control polygons. Control polygon data will be aggregated across river segments of similar character and vicinity to develop a range of metric data that illustrates the natural variability among control polygons.

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 for use as performance standards for monitoring of affected wetlands in 2014 and beyond. Information collected during the 2013 field season will be compiled and included in a Kalamazoo River Base Phase Monitoring 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 river segment separately. The report will include recommendations for metrics to be used for vegetation performance standards associated with future monitoring. The Kalamazoo River Base Phase Monitoring Report will also evaluate the progress of each affected wetland relative to achieving proposed restoration metrics including a plan for control of identified invasive species occurrences. The Kalamazoo River Base Phase Monitoring 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 data to control polygon 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 (i.e., 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 wetland 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 polygon plots for each community type.

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

- *Phragmites australis* – 0% cover within affected wetland polygons.
- Other highly invasive species – 10% final effective areal cover within an affected wetland 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 to each affected wetland being monitored in order to determine which affected wetlands have achieved restoration and those that have not. Affected wetlands 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.

5.2 Restoration Actions

Any additional restoration or control actions will be identified and included in the Kalamazoo River Base Phase and subsequent annual Restoration Phase Reports on a site-by-site basis for affected wetlands. Any proposed planting plans generated subsequent to monitoring will match as reasonably as possible the species, density, and diversity found in the detailed vegetation survey for similar wetland types and take into consideration each site's landscape setting (Hughes et al., 2005). Modification of metric performance standards may be imposed upon mutual agreement of Enbridge and the MDEQ, i.e., reduction of shrub density to a value other than the calculated lower aggregated interquartile value to limit shrub colonization. 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 not less than 20 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 any concerns within 20 business days of submitting the planting plans, Enbridge intends to initiate the work so that it can be completed during the growing season and be monitored the following year.

For affected wetlands 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 Kalamazoo River drainage system.

Additional restoration at affected wetlands not meeting the site-specific restoration criteria will be completed as soon as reasonably possible. Sites will then be re-evaluated during the following summer based on the monitoring schedule (i.e., within 30 days of the prior year's survey of the relevant polygon, if possible given weather and access limitations). Vegetation restoration and monitoring activities, as indicated in *Section 2.0*, *Section 4.0, and Section 5.0*, 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 an affected wetland has been achieved, that affected wetland 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*. However, upon mutual written agreement between Enbridge and the MDEQ, fewer metrics may be chosen for evaluation and determination of success during maintenance monitoring as compared to those required during restoration monitoring. Stem densities, for instance, may be determined to be a stable metric once restoration has been achieved and thus no longer necessary to evaluate during maintenance monitoring.

Metrics mutually agreed upon by Enbridge and the MDEQ, as described in *Section 4.0*, will be used to evaluate vegetation maintenance performance standards. For the vegetation community within an affected wetland 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 polygon plots for each community type.

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

- *Phragmites australis* – 0% cover within affected wetland polygons, and
- Other highly invasive species – 10% final effective areal cover within an affected wetland polygon.

Each year the selected metrics will be applied on a site-by-site basis for each affected wetland in order to determine which sites have achieved successful annual maintenance and those that have not. Successful annual maintenance of an affected wetland will be determined by evaluation of agreed upon maintenance metrics as a whole, versus evaluation of specific metrics in isolation. This will allow an affected wetland 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 the MDEQ, following the 2013 field season and after the 2013 report has been sufficiently reviewed, 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 affected wetland to reach an acceptable level of equilibrium.

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

5.4 Termination of Monitoring

Within each annual monitoring report, the affected wetlands that meet the agreed-upon restoration metrics (i.e., affected wetlands in restoration phase monitoring) and those achieving successful annual maintenance (i.e., affected wetlands in maintenance phase monitoring) will be identified and each affected wetland's progress toward completion will be tracked. Maintenance phase monitoring will cease, and no further monitoring, restoration, or maintenance activities will be required, when an affected wetland achieves 5 consecutive years of successful maintenance (i.e., the year of restoration plus 4 additional maintenance years).

Upon written agreement by the MDEQ, an affected wetland 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 annual reports as indicated in *Section 1.1* describing conditions existing at the time of the field inspection and evaluating the progress of each affected wetland relative to agreed upon restoration or maintenance metrics, including achievement of successful restoration and successful annual maintenance. A final monitoring report for each river segment will be submitted to the MDEQ by December 31 of each monitoring year. *Section 7.5* contains additional details for annual reporting associated with River Segment 2.

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

- Raw data in electronic format,
- 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 data to control polygon data for each of the agreed upon vegetation metrics,
- Details of invasive species mapping results,
- Sections documenting and discussing the status of each affected wetland 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 the MDEQ and/or Enbridge staff to evaluate specific affected wetland and control polygons in the field following completion and review of the 2013 Kalamazoo River Base Phase Monitoring Report. This may assist in confirming the use of agreed upon metrics for future monitoring.

Site visits may be scheduled to evaluate specific affected wetlands where differences of opinion arise between Enbridge and the MDEQ regarding corrective actions, or achievement

of restoration or successful maintenance. Site visits may also be scheduled to evaluate specific control polygons which may contain a predominance of upland vegetation and are not suitable reference sites for wetland habitat.

7.0 RIVER SEGMENT 2

7.1 Introduction

In the fall of 2013, the Ceresco Dam (MP 5.80) was notched and the impoundment lowered under MDEQ permit # 13-13-0028-P. In the early summer of 2014 the remaining portion of the dam will be removed and river restoration will occur from MP 3.37 to MP 5.80 (MDEQ permit # 13-13-0044-P), encompassed by River Segment 2. The newly exposed overbank areas resulting from the drawdown will be restored using a variety of techniques including seeding, live stakes, and bare root saplings.

The MDEQ has requested that vegetative monitoring of the newly exposed areas be included in this work plan. The following outlines the proposed monitoring plan for River Segment 2 which encompasses the newly exposed areas associated with the Ceresco Dam removal and affected wetlands located along the fringe area of the former impoundment. The MDEQ will be notified of scheduled field inspections no less than 2 days in advance and may attend the assessments.

The planting plan associated with the river restoration (found in MDEQ Permit # 13-13-0028-P) divides the newly exposed areas into three planting zones (*Figure 3*). Zone 1 represents the riverbanks. Zone 2 represents the new floodplain and anticipated wetland fringe. Zone 3 represents those areas that are expected to develop into upland. The goals associated with monitoring the newly exposed areas are to ensure that proper initial vegetative cover is achieved, appropriate planted live stakes and saplings survivorship is achieved, and invasive species are controlled within the restored areas. The goal associated with monitoring the affected wetlands along the fringe of the former impoundment is to control invasive species.

7.2 Methodology

The restored area, including affected wetlands along the fringe of the former impoundment, shall be monitored for 5 years following grading and planting. The monitoring may be

stopped prior to the 5 years if agreed to in writing by the MDEQ. Monitoring may be extended beyond the 5 years if the proposed performance standards have not been met.

7.2.1 Meander Surveys

Meander surveys will be conducted annually within each planting zone to:

- Map significant areas of bare ground (i.e., exceeding 1,000 sq. ft.) with an exception for floodplain areas of bare ground due to flooding and/or other natural disturbance.
- Map occurrences of invasive species listed in *Section 1.0*. This will also be conducted within affected wetlands along the former impoundment.
- Document observed dominant vegetative species, and map approximate vegetative community boundaries, if possible.
- Document general condition of planted trees/shrubs on a 0.10-mile basis.

Areas of bare ground exceeding 1,000 sq. ft., with an exception for floodplain areas of bare ground due to flooding and/or other natural disturbance, as well as observed occurrences of invasive species will be mapped utilizing GPS survey equipment. Invasive species will be mapped to an approximate distance of 15-feet outside of the newly exposed areas indicated on *Figure 3* as well as fringe-area affected wetlands indicated within River Segment 2 on *Figure 2*.

Dominant vegetative species observed during meander surveys will be recorded and used, in conjunction with vegetative plot sampling data, to map and classify vegetative community types based on the Cowardin System. Classification of vegetative community types will not occur until two full growing seasons have elapsed since revegetation of exposed areas.

7.2.2 Tree and Shrub Sampling Plots

Sampling plots will be established during tree and shrub planting to monitor their survival and mortality rate. Thirteen tree and shrub sampling plots each approximately 10,000 sq. ft. in size will be established. This represents approximately five % of the total newly exposed area subject to tree and shrub plantings (i.e., 58 acres). The sampling plots will be established at the time of planting and the number of trees and shrubs within each plot recorded at the time of planting. Subsequent annual monitoring will consist of counting the live shrubs and trees within each sampling plot. Four photographs will be collected at each plot location; one outside of each corner toward the center of the plot. This photograph

protocol is different from that for smaller vegetation plots so as to encompass the 10,000 sq. ft. plot size applicable here.

Tree and shrub mortality data will be compared to initial tree and shrub planting numbers to determine the overall tree and shrub survival rate and density within the sampling plots. These survival rates and densities will be averaged and extrapolated to yield an overall tree and shrub survival rate and density for the newly exposed areas. *Figure 3* indicates the approximate location of proposed tree and shrub sampling plots. Final locations will be determined in the field at the time of planting.

7.2.3 Herbaceous Vegetation Sampling Transects

Herbaceous vegetative sample locations will be established within the newly exposed areas along transects situated perpendicular to the river at 0.10-mile (approximately 500-foot) intervals on each river bank (i.e., north and south banks). A minimum of one VSL will be established in each planting zone along transects. Exposed areas where the planting zone is wider than approximately 75 feet along a transect will have two VSLs established in that planting zone.

VSLs will be centered on the sample point and consist of a 5-foot radius herbaceous stratum plot. The center of the sample location will be marked using a temporary stake and a GPS point will be recorded. The sample location identification number will be indicated on photographs of sample locations. Two photographs of each sample point will be collected; one close-up of the herbaceous stratum and a more panoramic view of the plot and surrounding area. Data collected at each herbaceous sample point will consist of absolute % cover of each species by canopy cover.

7.2.3.1 Field Adjustment of Herbaceous Sampling Locations

Herbaceous 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 river or adjustment of plot geometry where planting zones are narrower than the plot radius. 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).

7.3 Performance Standards

The proposed performance standards are based on a combination of industry standards and an analysis of undisturbed wetlands in the vicinity of the project. The performance standards may be modified pending written approval from the MDEQ.

7.3.1 Bare Ground

Areas of bare ground shall not exceed 15% of the total zone acreage in Zone 1 and Zone 3. A bare ground standard is not proposed for Zone 2 due to the natural tendency of floodplains to have natural large areas of bare ground as a result of flooding and natural disturbance.

7.3.2 Mean Percent Herbaceous Cover (native species)

The mean % cover of native herbaceous species shall be 80% or more within herbaceous sample locations across all transects for non-shrub and non-tree dominant vegetative communities, and 40% or more within shrub or tree dominant communities.

7.3.3 Number of Native Herbaceous Species

A mean value of 15 or more native species shall be present within herbaceous sample locations for each transect.

7.3.4 Invasive Species Cover

The mean % cover of invasive species shall not exceed 10% in newly exposed areas and affected wetland polygons. The newly exposed areas and affected wetlands shall be free of *Phragmites australis.*

7.3.5 Tree and Shrub Planting Survivorship

The number of living trees and shrubs shall meet or exceed 300 shrubs per acre in Zone 1, Zone 2, and Zone 3.

7.4 Additional Restoration Actions

Additional restoration actions, such as invasive species control and native seeding, will be conducted on an as needed basis following the annual monitoring. A summary of additional restoration actions taken will be included in the annual report (*Section 7.5*) each year.

7.5 Reporting

An annual report of the River Segment 2 monitoring will be prepared separately from the Kalamazoo River reporting described in *Section 4* and *Section 5.5*. The annual report will be submitted to the MDEQ by December 31 of the year the monitoring takes place. The report will include the results of the monitoring and a discussion of any additional restoration actions taken and/or needed. References

Cowardin et al., 1992. Cowardin, Lewis M., V. Carter, F. C. Golet, and E. T. LaRoe 1992. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-79/31, December 1979, Reprinted 1992.

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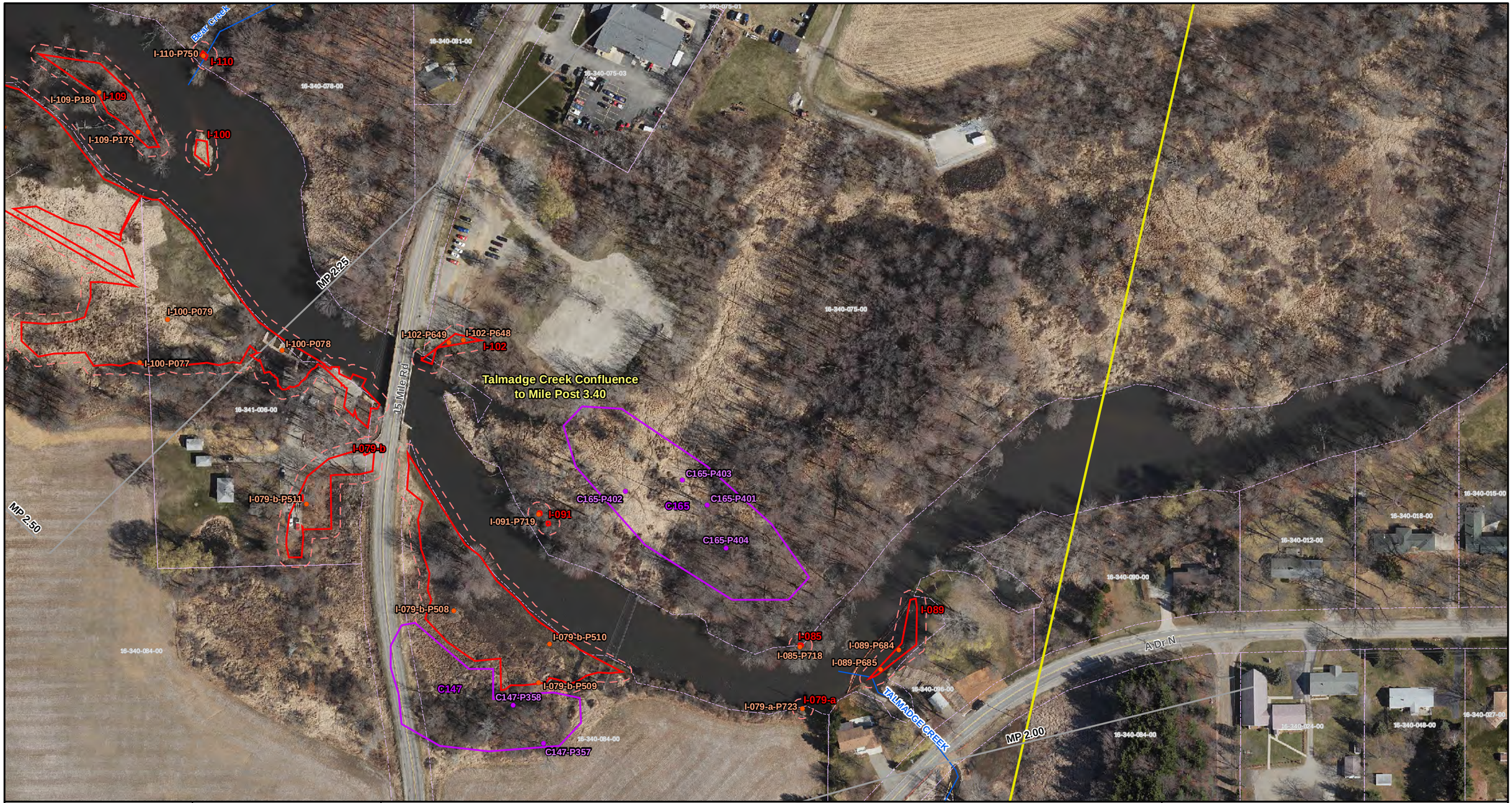
MDEQ, 2001. "*Floristic Quality Assessment with Wetland Categories and Examples of Computer Applications for the State of Michigan"*. Michigan Department of Natural Resources, Wildlife Division, Natural Heritage Program. Revised, 2nd Edition. October 2001.

MDEQ, 2010. *"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.

Thien, 1979. S.J. Thien 1979. *A flow diagram for teaching texture by feel analysis*. Journal of Agronomic Education. 8:54-55.http://soils.usda.gov/education/resources/lessons/texture/.

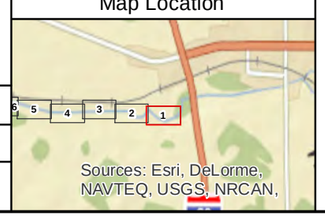
Figures



ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



Legend

- Wetland Vegetation Sample Areas
- Affected Wetland Vegetation Sample Areas 15ft Buffers
- Wetland Vegetation Control Sample Areas
- Affected Wetland Vegetation Sample Locations
- Control Area Vegetation Sample Locations
- Calhoun Parcels (2013-06-18)
- Kalamazoo Parcels (2012-11-19)
- River Segment Boundary
- Quarter Mile Grid Segment

National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 1 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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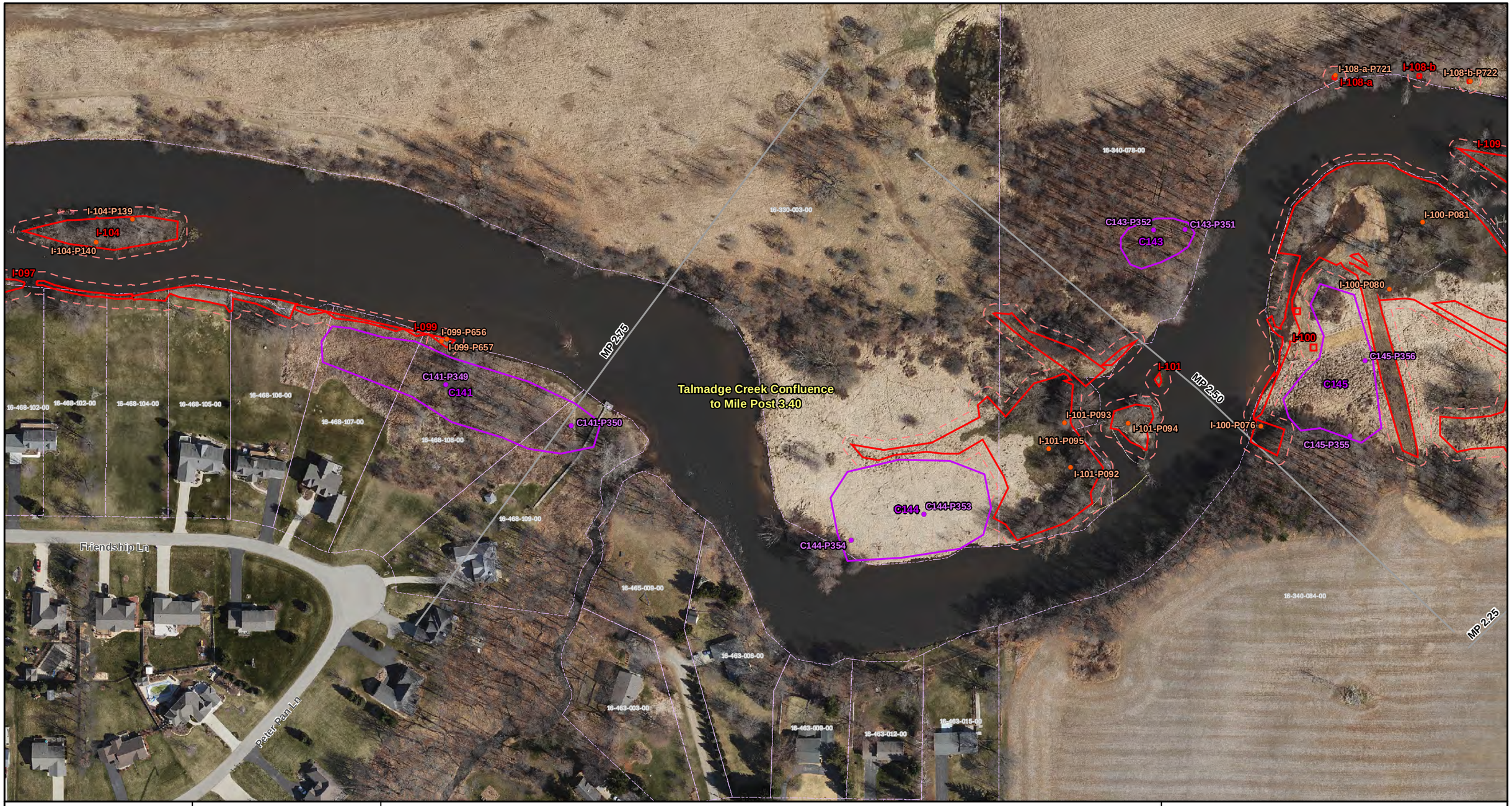
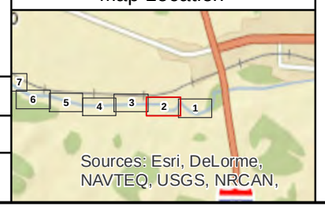
Aerial Photography Date: April 2011



ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



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- Quarter Mile Grid Segment

National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 2 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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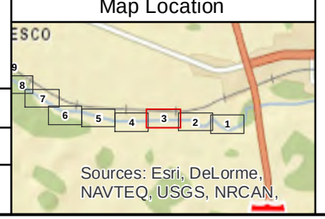
Aerial Photography Date: April 2011

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



Legend

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- Affected Wetland Vegetation Sample Areas 15ft Buffers
- Wetland Vegetation Control Sample Areas
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- River Segment Boundary
- Quarter Mile Grid Segment

National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 3 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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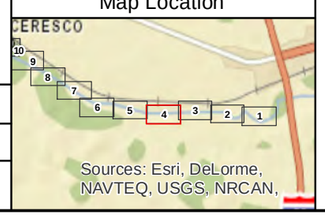
Aerial Photography Date: April 2011

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



Legend

- Wetland Vegetation Sample Areas
- Affected Wetland Vegetation Sample Areas 15ft Buffers
- Wetland Vegetation Control Sample Areas
- Affected Wetland Vegetation Sample Locations
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- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 4 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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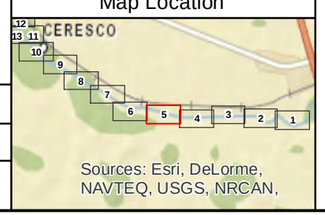
Aerial Photography Date: April 2011

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



Legend

- Wetland Vegetation Sample Areas
- Affected Wetland Vegetation Sample Areas 15ft Buffers
- Wetland Vegetation Control Sample Areas
- Affected Wetland Vegetation Sample Locations
- Control Area Vegetation Sample Locations
- Calhoun Parcels (2013-06-18)
- Kalamazoo Parcels (2012-11-19)
- River Segment Boundary
- Quarter Mile Grid Segment

National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 5 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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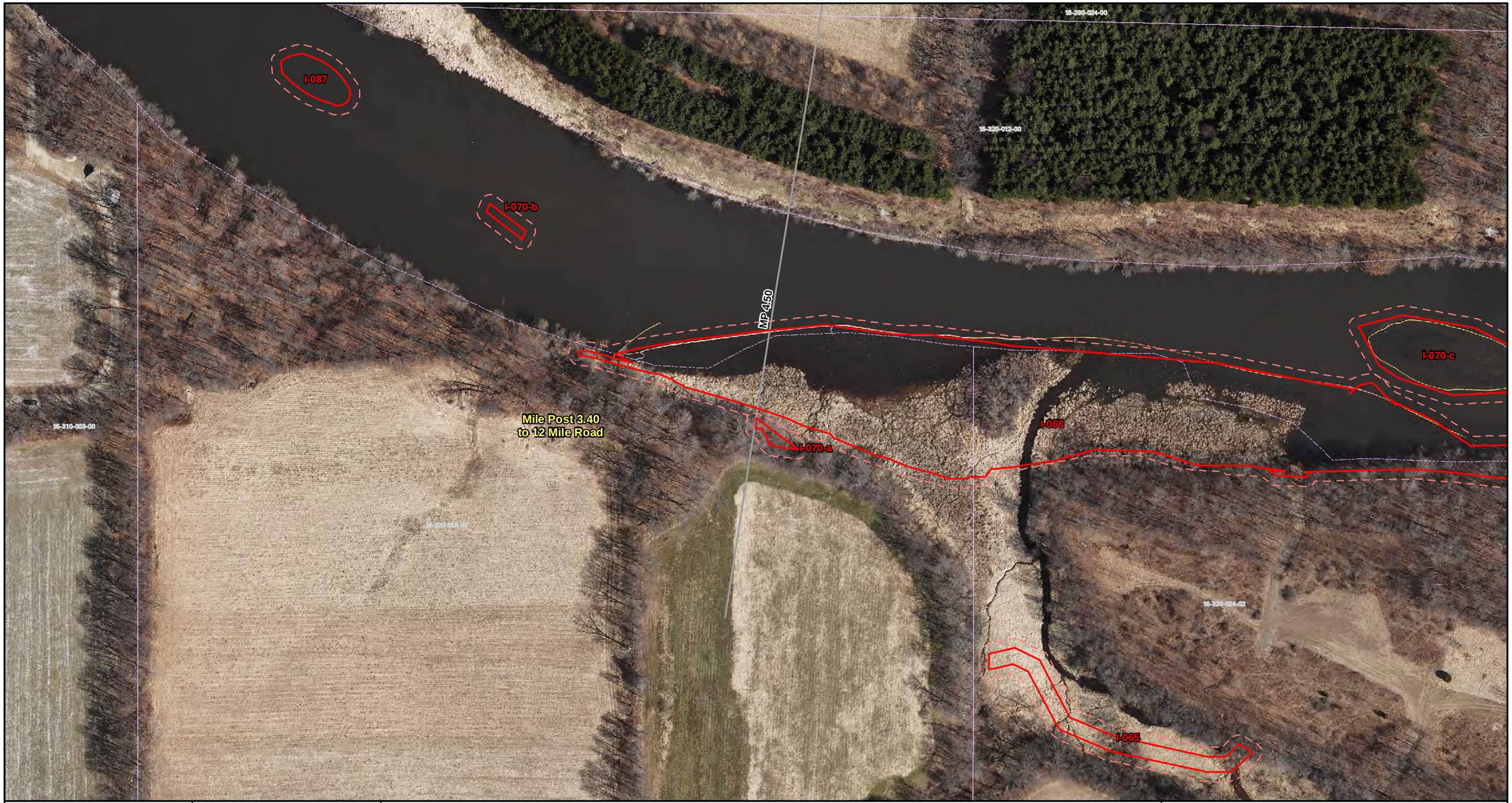
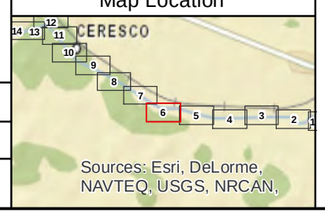
Aerial Photography Date: April 2011



ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



Legend

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- Quarter Mile Grid Segment

National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 6 OF 82
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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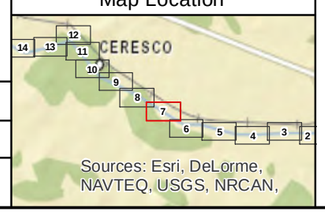
Map Location



Legend

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- River Segment Boundary
- Quarter Mile Grid Segment

National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 7 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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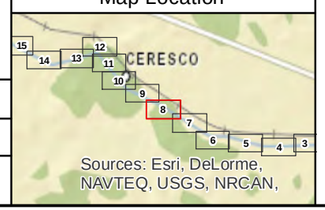
Map Location



Legend

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- River Segment Boundary
- Quarter Mile Grid Segment

National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 8 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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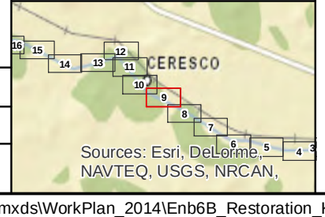
Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



Legend

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- Quarter Mile Grid Segment
- National Hydrography Data
- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 9 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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Aerial Photography Date: April 2011

C128
C128-P329
I-124-P030
10-520-011-00
10-520-012-00
10-520-005-00
10-200-012-00
10-520-004-00
10-200-009-00
10-520-011-00
10-520-003-00
10-200-007-01
10-200-008-00
10-200-007-00
Battle Creek St
Church St
N Main St
10-200-002-00
10-520-009-00
10-200-006-00
10-520-002-00
10-520-010-00
10-520-001-00
10-200-005-00
10-200-004-00
10-200-003-00
C130-P332
C130
C130-P331
10-025-014-00
12 Mile Road to Interstate 94
I-125-d-P716
I-125-d
I-124-P032
C131
C131-P333
C131-P334
I-124-P033
MP 600
I-124
I-124-P034
I-125-a
I-125-a-P646
I-125-a-P647
10-025-014-03
10-025-014-02
S Main St
12 Mile Rd
Crooked Creek
16-303-009-00
16-303-006-00
16-303-015-00
16-303-012-00
Court St
16-303-024-00
16-303-027-00
16-303-030-00
16-303-018-00
16-303-021-01
16-303-021-00
16-303-033-00
16-303-034-00
Pierce St
16-304-003-00
16-304-009-00
16-304-012-00
16-304-015-00
16-304-021-00
16-304-030-00
16-304-027-00
16-304-018-00
16-304-006-00
Mile Post 3.40
to 12 Mile Road
Mainsle St
16-305-018-00
16-304-024-00
16-305-003-00
16-305-009-00
16-305-012-00
16-305-024-00
16-305-006-00
16-305-015-00
16-305-021-00
C-Drive N
16-306-012-01
16-306-012-00
16-306-018-00
16-306-024-00
16-306-027-00
16-306-021-00
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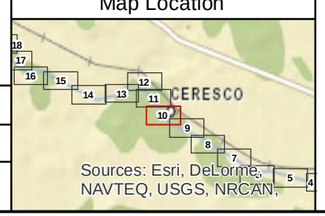
I-119
I-528
MP 575

ENBRIDGE

Drawn:	AB	02/21/2014
Approved:	BJ	02/22/2014

Map Location



Legend

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National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 10 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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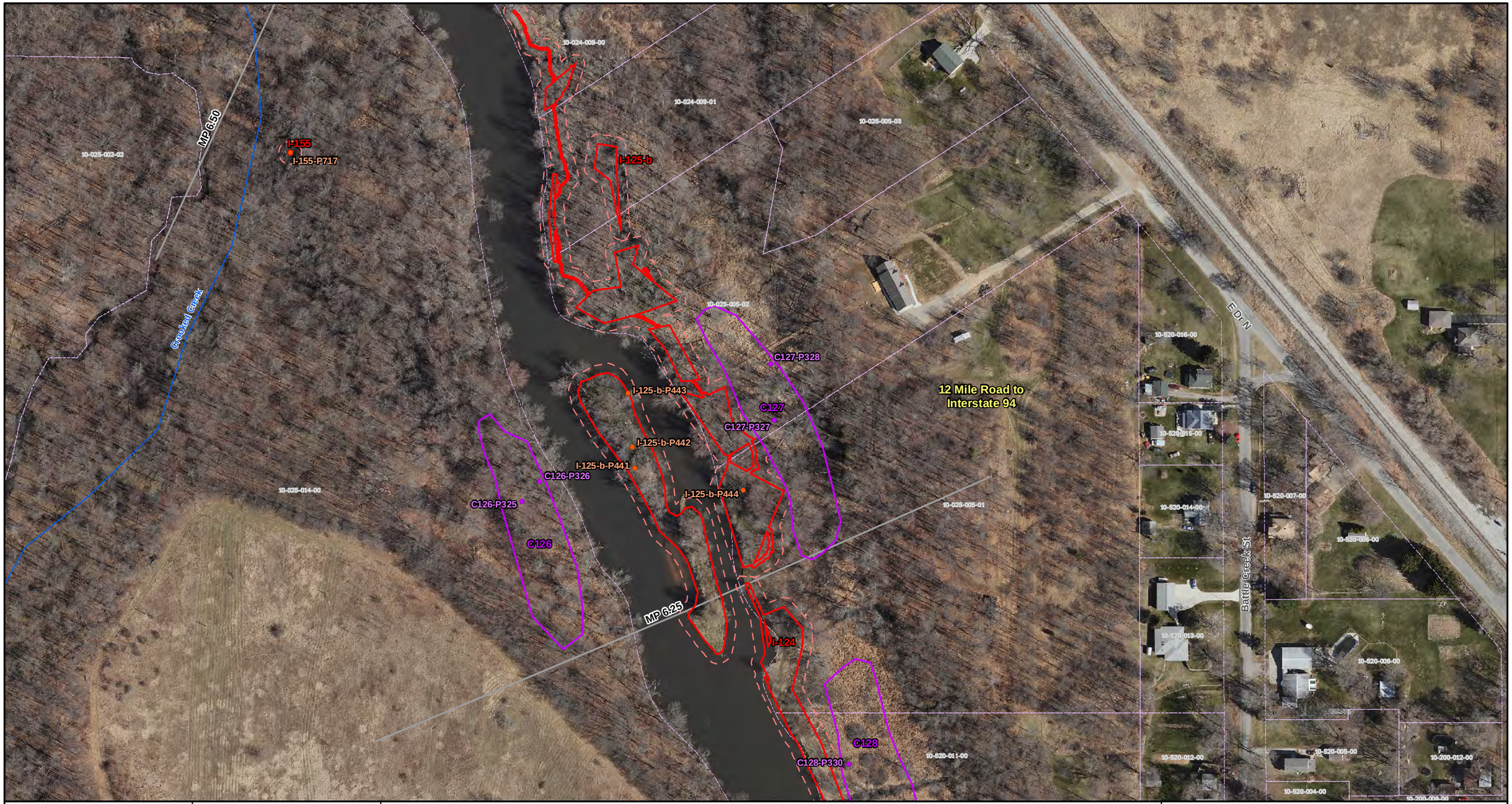
Aerial Photography Date: April 2011



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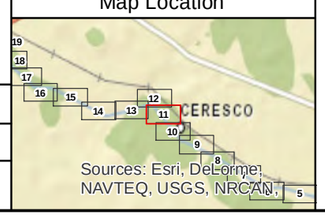
Map Location



Legend

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National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 11 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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Drawn:	AB	02/21/2014
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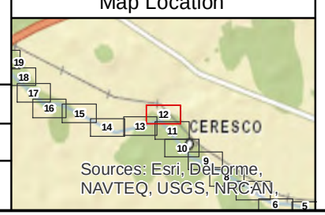
Map Location



Legend

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National Hydrography Data

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N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 12 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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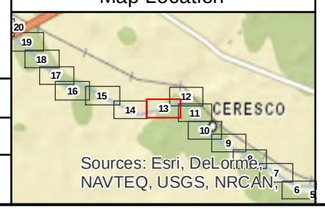
Map Location



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National Hydrography Data

- Perennial Stream

N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 13 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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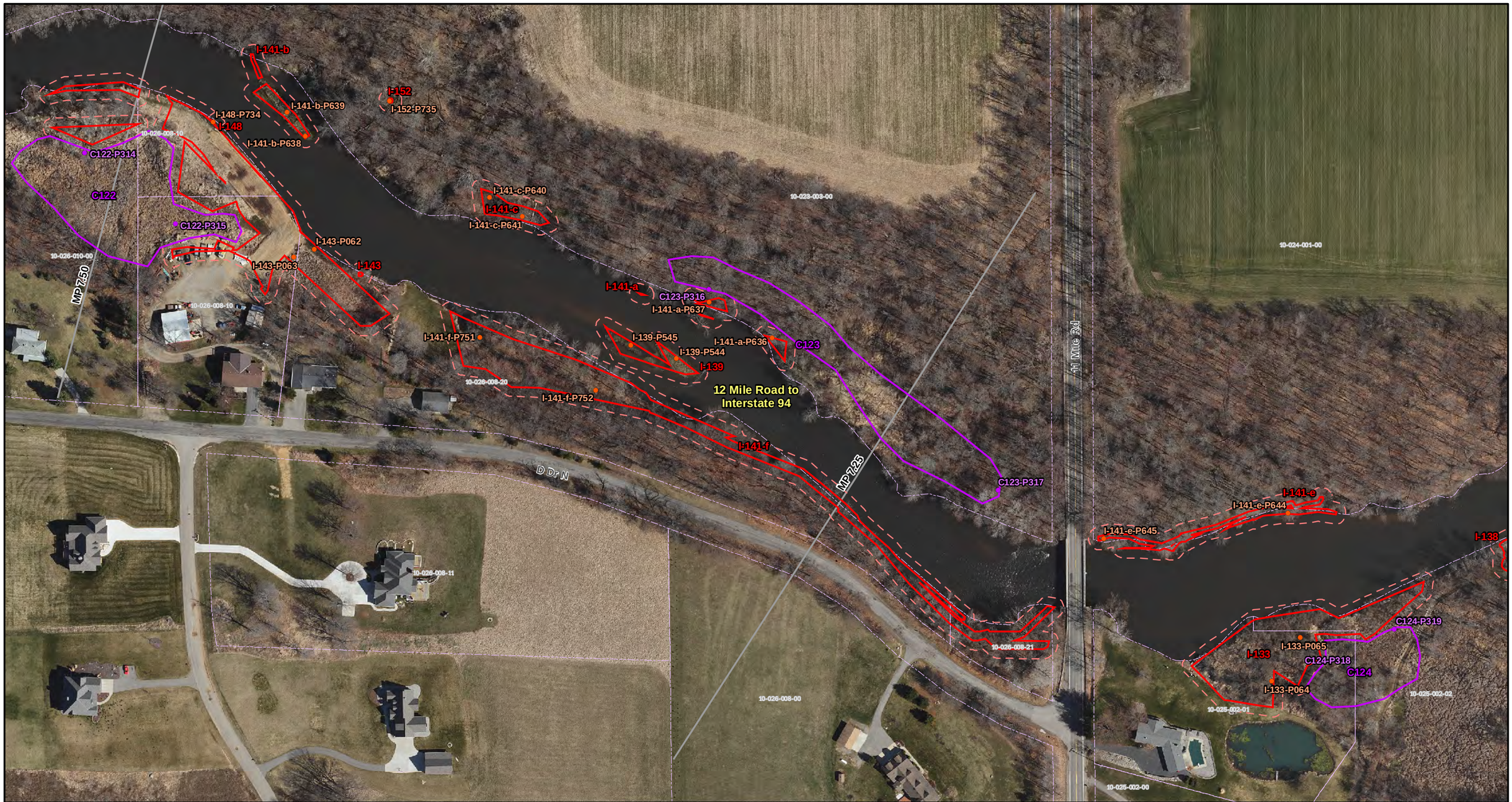

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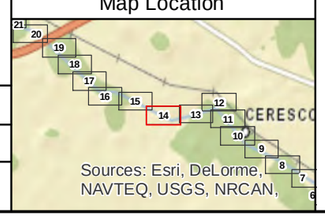

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National Hydrography Data

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N

0 75 150

Scale in Feet

FIGURE 1
KALAMAZOO RIVER
WETLAND VEGETATION SAMPLE AREAS

SHEET 14 OF 82
ENBRIDGE LINE 6B MP 608
MARSHALL, MI PIPELINE RELEASE
ENBRIDGE ENERGY, LIMITED PARTNERSHIP

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