

Approved

**Enbridge Line 6B MP 608
Marshall, MI Pipeline Release**

Case No.: 15-1411-CE

**Freshwater Mussel Evaluation & Management Plan
Supplement to Large Woody Debris Installation Plan**

Prepared for Michigan Department of Environmental Quality

Enbridge Energy, Limited Partnership

Submitted: August 3, 2016

Approved: September 8, 2016

(MDEQ Approval: August 23, 2016)

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LIST OF ACRONYMS

Freshwater Mussel Plan	Freshwater Mussel Evaluation & Management Plan
Enbridge	Enbridge Energy, Limited Partnership
LWD	large woody debris
LWD Installation Plan	<i>Large Woody Debris Installation Plan Supplement to Large Woody Debris Replacement Work Plan</i> , submitted to the MDEQ on July 25, 2016
MP	Mile Post

1.0 INTRODUCTION

This Freshwater Mussel Evaluation & Management Plan (Freshwater Mussel Plan) serves as a Supplement to the approved *Large Woody Debris Installation Plan Supplement to Large Woody Debris Replacement Work Plan*, submitted to the Michigan Department of Environmental Quality on July 25, 2016 (LWD Installation Plan) (Enbridge, 2016) and outlines a strategy to protect freshwater mussels to the extent practicable during large woody debris (LWD) installation activities. This Freshwater Mussel Plan was developed in response to the Michigan Department of Environmental Quality's approval with modifications of the LWD Installation Plan.

Specifically, the purpose of this Freshwater Mussel Plan is to provide the following:

- Approach to identify and document riffles within proposed travel routes for heavy equipment used to install LWD.
- Procedures to conduct freshwater mussel surveys in riffles potentially disturbed by heavy equipment used to install LWD.
- Process to relocate freshwater mussels identified in the surveys.

2.0 RIFFLE SURVEYS

Enbridge Energy, Limited Partnership (Enbridge) along with a contractor specializing in freshwater mussel surveys have developed an approach to conduct riffle surveys within LWD work sites of the Kalamazoo River where heavy equipment may be used to install LWD. This approach will field-verify the location of riffles. Riffles have been previously identified and documented within the Ceresco Restoration Reach (Mile Post (MP) 3.50 – MP 5.25) and therefore not included in the riffle survey.

Riffle surveys will be conducted in accordance with *Standard Operating Procedure for Identifying and Documenting Riffle Areas Within Work Segments of the Kalamazoo River* included in *Attachment A*. Data generated from this survey will be used to re-assess potential travel routes for LWD installation activities to minimize impacts to riffle areas. If impacts to these riffles are unavoidable, freshwater mussel surveys will be performed prior to navigating equipment through the impacted areas, and will be initiated as outlined in *Section 3.0*.

3.0 FRESHWATER MUSSEL SURVEYS & RELOCATION

Enbridge is prepared to relocate freshwater mussels if identified in riffles that may be disturbed by heavy equipment used to install LWD. Surveys will be conducted in accordance with *Standard Operating Procedure for Conducting Freshwater Mussel Surveys and Relocations Within Work Segments of the Kalamazoo River* included in *Attachment A*.

Regardless of mussel habitat, riffles within LWD travel routes will be documented and protected to the extent practicable during LWD installation activities. Specifically, identified riffle boundaries will be marked with rope buoys prior to LWD installation activities. In the unlikely event that riffles are impacted by LWD installation activities (e.g. tracking of equipment), restoration techniques shall include grading the affected areas using riffle material to match the riffle's surrounding profile and overall gradient.

4.0 REFERENCES

Enbridge, 2016. Enbridge Energy, Limited Partnership Line 6B MP 608 Pipeline Release, Marshall, Michigan; *Large Woody Debris Installation Plan Supplement to Large Woody Debris Replacement Work Plan*, dated July 25, 2016.

Attachment A
Standard Operating Procedures

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**Standard Operating Procedure for Identifying and
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1.0 BACKGROUND

This protocol has been developed for alluvial channels (channels that carry the same sediment that compose their bed and banks) that are primarily composed of riffle-pool sequences such as the Kalamazoo River which flows through Calhoun and Kalamazoo County, Michigan. It is not to be used for step-pool or bedrock confined channels such as those often found in the Upper Peninsula of Michigan.

River and stream shape is driven by the balance between transporting incoming water and sediment and moderating the energy that drives this transport. Fluvial geomorphology theory holds that the shape of flowing water systems is driven by minimizing the total work (energy expenditure) and the variance of energy loss along the channel (uniform distribution of energy utilization) as the channel accommodates changes in both flow and sediment load (Leopold, 1994). Both the channel cross-section and the meandering plan form of channels exhibit the results of these tendencies (*Figure 1*).

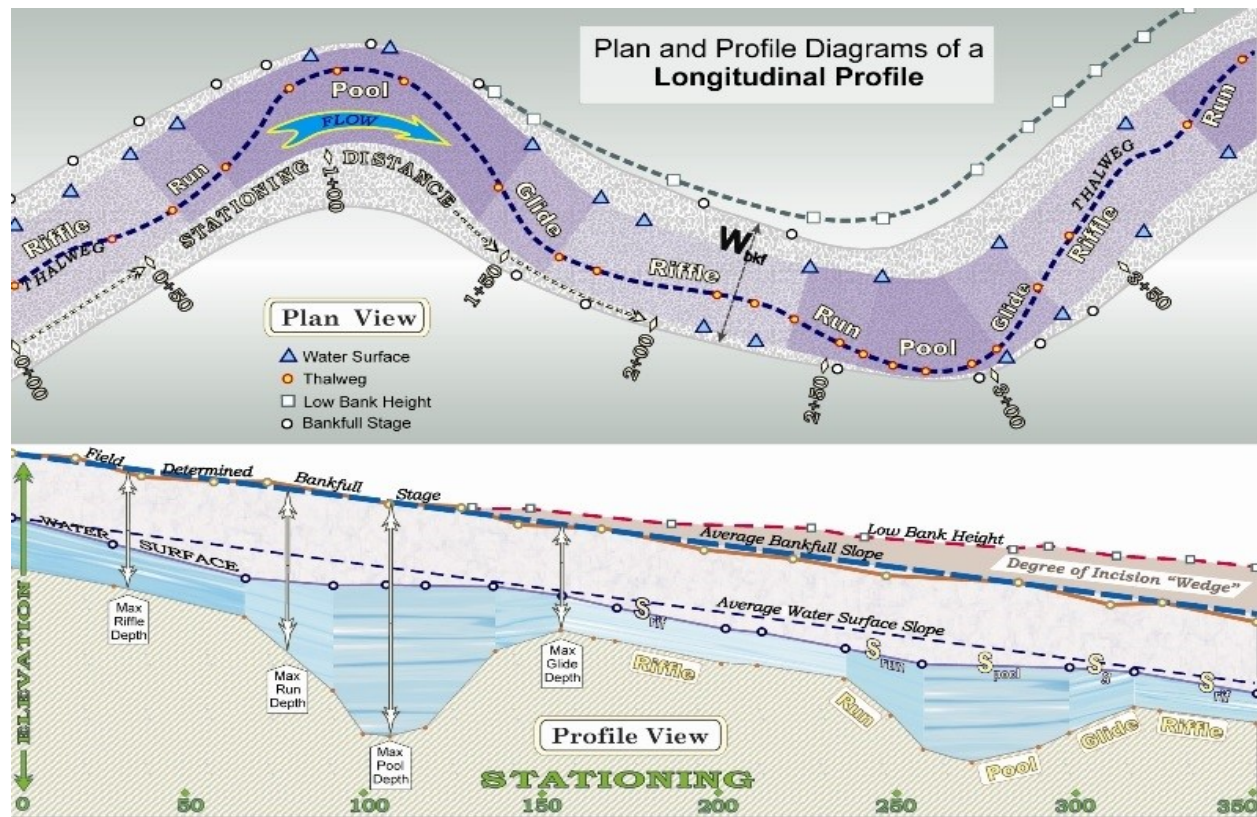


Figure 1. Idealized stream channel plan and profile with facet features identified (Rosgen, 2006).

Riffles are normally the sections of stream where the channel transitions from pool to pool. These areas typically possess uniform water depths across the channel and consist of coarse substrates containing a mixture primarily of gravel and cobble. Riffles will have the shallowest flow depths, highest flow velocities, the greatest likelihood for turbulent water, and the coarsest bed material within continuously inundated areas.

If considered in cross-section, the majority of flow will be along the thalweg (the deepest point of each cross-section). In unobstructed flow through bends, the thalweg will hug the outer bank. As flow exits the bend/pool feature, it will “cross-over” as it transitions to the outerbank of the next pool. Because of the channel's need to balance flow, sediment and energy dissipation, all alluvial channels will exhibit some degree of meandering. The degree of sinuosity that streams exhibit will vary, but this characteristic meandering pattern, however subtle will persist.

The riffle crest will be located at the high point of the transition/cross-over in each section and will transition to the shallowest flows between pools. This is also typically where the coarsest, consistently inundated bed material will be found. For instance, point bars, located on the opposite bank from meander bends can accumulate material coarser or similarly sized to riffle bed material, but point bars tend to be out of water for low to moderate flows that are below bankfull flows.

2.0 FIELD PROTOCOL

To assist with riffle identification and a general qualitative assessment within proposed work segments, the following actions shall be conducted:

1. Locate pool to pool transition zones (or point bar to point bar as indicators of relative pool locations) in the longitudinal direction.
2. Identify riffles. They will typically be located in the transition zone from pool to pool. Flow lines, or concentrated flow patterns, can sometimes be discerned on the water surface. The riffle can usually be found where the flow lines are approximately in the middle of the channel between successive pools.
3. At each riffle:
 - a. Record riffle boundaries using a global positioning system unit capable of sub-meter accuracy.

- b. Record current water depths or water depth ranges within each riffle. Water depths will assist in establishing the Area of Direct Impact as discussed in the *Standard Operating Procedure for Conducting Freshwater Mussel Surveys and Relocations Within Work Segments of the Kalamazoo River*.
- c. Assess the bottom substrate within the riffle with respect to percent cover by boulder, cobble, gravel, sand and other finer material. Those riffles exhibiting coarse substrates such as cobble, sand and gravel will be considered potential mussel habitat for future mussel survey if impacts cannot be avoided. Those riffles dominated by fine substrates such as muck, silt, clay, or detritus will be considered low-quality or less than optimal mussel habitat and will not require a mussel survey.
- d. Note the presence or absence of macroinvertebrate and fish species, with specific attention to those fish species often associated as hosts for transporting young mussels (glochidia). For example, these species include, but are not limited to, various dace and darter species. Utilize visual observations, viewing buckets, and/or kick nets to conduct a 10 minute timed search of the riffle. Record aquatic biota observed to the lowest possible taxonomy (typically family level).

3.0 EXAMPLE RIFFLES



Photograph of a riffle on an un-named river in the State of Vermont. Note cobble-sized riffle substrate, shallow flows, and froth of water over the riffle. Note the point bar in the background.



Photograph of a riffle on the Shiawassee River. Note the rippling of the water in the foreground as it goes over the riffle. Note meander bend and point bar in the background.

4.0 LITERATURE CITED

Leopold, 1994. Leopold, L.B. A View of the River, Harvard University Press, Boston, MA.
1994

Rosgen, 1996. Rosgen, D. Applied River Morphology. Wildland Hydrology, Pagosa
Springs, CO. 1996

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LIST OF ACRONYMS

ADI	Area of Direct Impact (ADI)
LWD	large woody debris
MDNR	Michigan Department of Natural Resources
ODNR	Ohio Department of Natural Resources
T&E	Threatened and Endangered Species
WVDNR	West Virginia Department of Natural Resources

1.0 BACKGROUND

Prior to conducting freshwater mussel surveys or relocations, a Scientific Collectors Permit is required and will be secured from the Michigan Department of Natural Resources (MDNR) for the handling or relocation of any non-listed mussel species (neither listed as endangered, threatened, nor of special concern). Proposed mussel surveys for work segments of the Kalamazoo River will encounter non-listed species based upon an October 2010 Mussel Shell Survey Report (Badra, 2011) which documented the presence of live mussels (non-listed) in various reaches of the Kalamazoo River.

In the unlikely event state-listed species are encountered (i.e. species listed as endangered, threatened, or of special concern), a MDNR Threatened and Endangered Species (T&E) Permit will be secured as a precaution.

To date, the MDNR has yet to establish their own freshwater mussel protocols for the survey and relocation of mussels within Michigan's streams or rivers. The MDNR has been utilizing protocols established by the West Virginia Department of Natural Resources (WVDNR) and more recently, the Ohio Department of Natural Resources (ODNR). The ODNR has adapted their protocols from the WVDNR protocols to account for more northern climates and conditions more indicative of the Great Lakes (ODNR, 2016). In light of the fact that future MDNR mussel survey and relocation methodologies will apparently be aligned closely with ODNR protocols, proposed Standard Operating Protocols for conducting the large woody debris (LWD) installation freshwater mussel survey and relocation will utilize the ODNR protocols unless otherwise provided in the field protocols below to account for the type of activities being proposed throughout the work segments.

2.0 FIELD PROTOCOL

Areas documented as riffles along LWD installation heavy equipment access routes that cannot be avoided will be surveyed, and any mussels that are found will be relocated in accordance with the ODNR protocols (ODNR, 2016). In addition to the defined Area of Direct Impact (ADI), 10-meter upstream and downstream buffers will also be surveyed and mussels relocated as listed in Appendix G of the *Ohio Mussel Survey Protocol* (ODNR, 2016). Using Appendix G, the proposed placement of LWD best fits the category of "shoreline protection" in that table, which recommends buffer distances of 10 meters

upstream and 10 meters downstream of the ADI. Based upon the relatively narrow width of the ADI, the lateral buffer of 10 meters recommended for mussel survey and relocation will be reduced to 2 meters given the precision to which equipment is expected to navigate through these proposed impact areas. The lateral buffer shall be on both sides of the ADI and may only be on one side if the ADI abuts the river bank.

Transects will not be used; instead the entire ADI, upstream, downstream, and lateral buffer areas will be surveyed, and all mussels encountered will be identified to the species level and relocated outside of the ADI and its associated buffer areas.

The following briefly summarizes portions of the Ohio Mussel Survey Protocol (ODNR, 2016) and past approved MDNR mussel protocols that will be utilized:

1. Visual or surface searches of the bottom substrates for mussels will be conducted of the entire ADI, including buffer areas. Each of these areas shall be subdivided into smaller areas or cells, not exceeding 100 square meters (m^2) in size, to assist in conducting systematic searches of each area or cell, to ensure that all areas are surveyed. This includes moving cobble and woody debris; hand sweeping away silt, sand, and/or small detritus; and disturbing/probing the upper 5 centimeter (2 inches) of substrate in order to better view or feel the mussels which may be present. A minimum rate of 20 minutes per 100 m^2 of visual searching shall be expended in each segment of heterogeneous substrate within each cell.
2. If any state-listed mussels are found, an additional 30 minutes of visual searching shall be expended within that existing 100 m^2 area along with any adjoining upstream, downstream and laterally abutting 100 m^2 areas or cells.
3. Visual searches will commence at the downstream end and work upstream.
4. All mussels encountered will be identified to species, enumerated, photographed (at least once per species), temporarily stored in submerged mesh bags, and then moved to a predetermined Relocation Area. The Relocation Areas consist of undisturbed riffle habitat outside of the ADI and 2-meter lateral buffer area within the same riffle complex containing the same or similar suitable habitat. Mussels will therefore be relocated a short distance and remain within their same riffle complex, where other mussels are also presumably present.. Mussels shall be inserted posterior end up and their location, either individually or in groups, will be mapped using a global positioning system unit capable of sub-meter accuracy.

5. Once the ADI and lateral buffer have been surveyed and mussels have been relocated, physical markers will be installed within the Kalamazoo River that clearly demarcate where mussel relocations have been conducted and the area in which LWD installation equipment can travel.
6. A mussel survey and relocation summary report will be prepared upon completion of the relocation effort. Information on the species and number of mussels encountered and relocated from the ADI and buffer zones shall be provided to the MDNR and/or other regulatory agencies requesting said survey/relocation work.

3.0 LITERATURE CITED

Badra, 2011. Badra, Peter. *Mussel Shell Survey Report: Kalamazoo River Unionid Mussel Shell Survey in the Marshall and Battle Creek Area*, October 2010. Prepared for Stephanie Milsap, U.S. Fish and Wildlife Service and Kalamazoo River Enbridge Line 6B Oil Spill Trustee Council. July 20, 2011.

ODNR. 2016. Ohio Department of Natural Resources, Division of Wildlife and U.S. Fish and Wildlife Service, Ohio Ecological Services Field Office; *Ohio Mussel Survey Protocol*. April 2016.