Enbridge Line 6B MP 608 Pipeline Release

Marshall, Michigan

Supplemental Modification to the

Response Plan for Downstream Impact Area (the Plan)

Strategy and Tactics for Permanent Recovery of

Submerged Oil & Oil-Contaminated Sediment

September 11, 2010

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Acronyms and Definitions

API Gravity	A measure of the density of a petroleum liquid relative to water
cfm	Cubic feet per minute
Depositional Area	A term used by geomorphologists to describe a stable riverine environment
Enbridge	Enbridge Energy, Limited Partnership
Fluvial Geomorphology	The study of the formation and behavior of riverine landscapes and systems.
FOSC	Federal On-Scene Coordinator
GIS	Geographic Information System
IAI	Infrastructure Alternatives
IAP	Incident Action Plan
LNAPL	Light Non-Aqueous Phase Liquid (specific gravity < 1.0)
MDNRE	Michigan Department of Natural Resources and the Environment
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
Priority Location	Depositional area that potentially contains submerged oil and oil-contaminated sediment
Qualitative Assessment	As defined in supplement to RPDIA submitted August 29, 2010
Permanent Recovery	A Response Action - Removal of submerged oil and oil-contaminated sediment from identified Priority Locations
Remediation	Future long-term corrective actions beyond those included as an initial response
Response	The initial response to remove and/or abate visible oil and/or sheen that is either currently affecting navigable waterways and/or poses the threat of release of a visible oil and/or sheen to navigable waterways
RPDIA	Response Plan for Downstream Impacted Areas
SCAT	Shoreline Cleanup Assessment Technique (*also known as SCAT Assessment or SCAT Process*) – a systematic approach that uses standard terminology to collect data on impacted areas, support decision-making for cleanup; reference HAZMAT Report No. 2000-1; Office of Response and Restoration, Hazardous Materials Response Division, National Ocean Service, National Oceanic & Atmospheric Administration, Shoreline Assessment Manual – Third Edition, August 2000
SCAT Team	A team of qualified individuals using SCAT, organized and reporting to the FOSC and comprised of representatives from USEPA as the FOSC, MDNRE (as the SOSC and state NRDA trustee), NOAA or USFWS (as federal NRDA trustees) and Company to assess impacted areas and recommend cleanup methods and priorities. At least one member should have sufficient expertise in wetland and aquatic ecology to evaluate the sensitivity of impacted areas

SOSC	State On-Scene Coordinator
SOTF	Submerged Oil Task Force
Storm Event (50-year)	A storm event that generates a volume of stormwater with a 2% probability of occurring per year.
Source Area	The primary locations impacted by the crude oil release, includes Division A (i.e., the wetland area impacted by the release due to overland flow of oil) referred to as the Spill Release Area and Division B (i.e., the portion of Talmadge Creek impacted by the oil spill) referred to as the Creek
Submerged Oil	Non-floating oil
thalweg	middle of the main navigable channel of a waterway
TPH	Total Petroleum Hydrocarbon
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VSORS	Vessel Submerged Oil Recovery System

1.0 Introduction

A Submerged Oil Task Force (SOTF) was created on Tuesday, August 24, 2010 to perform field assessment, characterization, and mapping of submerged oil impacts in surface water and sediments of the Kalamazoo River and Morrow Lake (confluence of Talmadge Creek / Kalamazoo River to MP 40). The SOTF is comprised of representatives from the United States Environmental Protection Agency (USEPA), the Michigan Department of Natural Resources and the Environment (MDNRE), Stakeholders, Enbridge, Tetra Tech, and their contractors. Personnel responsible for recovery of oil in the initial response to the Line 6B Incident also participate in the SOTF providing site-specific information and field observations on the location and performance of existing containment systems (e.g., curtains, booms, gabions). The SOTF receives information from the Sediment Sampling Teams, Shoreline Cleanup Assessment Technique (SCAT) teams, Technical Specialists, and other in the field observations that are used to identify and prioritize potential submerged oil locations. Assessing, characterizing, and mapping these oil-contaminated sediments has been a primary operational period command emphasis as identified in the Incident Action Plan (IAP) since the Operational Period starting August 25, 2010. As of the Operational Period starting September 8, 2010, the Operational Period Command emphasis has shifted to finalizing submerged oil containment and recovery tactics for highest priority locations in the Kalamazoo River and at Morrow Lake. This document was developed to address this emphasis.

1.1. Purpose

This Supplemental Modification to the Response Plan for Downstream Impacted Areas (RPDIA) was prepared to address the directive received from USEPA on August 27, 2010. The purpose of this Supplemental Modification to the RPDIA is to describe the additional strategy and tactics that will be used for the permanent recovery of submerged oil and oil-contaminated sediments in the Kalamazoo River system, including all impacted receiving waters of the Kalamazoo River.

Priority locations that contain submerged oil and oil-contaminated sediments have been identified by the on-going characterization being performed on behalf of Enbridge and the SOTF. Table 1 presents potential Submerged Oil and Oil-Contaminated Sediment Priority Locations. These locations will continue to be refined as additional data and information from the on-going characterization activities are received, with some areas being removed and other areas added, as appropriate.

To clearly define and present the strategies and tactics for permanent recovery of submerged oil and oil-contaminated sediments, an approach has been developed to recognize the multiple types of locations and/or geomorphic settings that will require different types of oil recovery activities. To address the multiple situations at each individual Priority Location, a “toolbox” of various associated recovery techniques has been developed. It is the intent to select the best recovery technique from the “toolbox”

based on a systematic selection process for permanent recovery in each of these Priority Locations. These recovery techniques are discussed in sections below.

1.2. Permanent Recovery Objectives

The overall objective of the permanent recovery effort is to recover as much of the identified submerged oil and oil-contaminated sediment in the identified Priority Locations as possible. The Priority Locations have been prioritized (i.e., high, medium, low) by the SOTF. The recovery effort will be based upon the amount and volume of submerged oil and oil-contaminated sediment identified by fluvial geomorphologists during the qualitative assessment activities. The stability of the bedded material will be considered to determine the risk of remobilizing into surface water and/or sediment. Specific objectives of this phase of the permanent recovery plan include:

- Complete the qualitative characterization of aerial and vertical extent of the presence of visible submerged oil in each of the priority locations.
- Plan and expeditiously implement near-term containment strategies in priority areas based on current conditions and appropriate for rising river flow.
- Confirm effectiveness of near-term containment measures based on the Supplemental Modification to the RPDIA for Continuing Near-Term Containment of Submerged Oil & Oil-Contaminated Sediment dated September 6, 2010.
- Implement permanent recovery from priority locations prior to Spring 2011 at locations at greatest risk of remobilization of submerged oil and contaminated sediment based on rising water levels.

Additional objectives may need to be identified, considered, and potentially added to the list above to provide a complete compilation of objectives.

1.3. Organization and Communication

The existing organization will be used to implement the permanent recovery of submerged oil and oil-contaminated sediment from the priority locations. The current organization is presented on Figure 1; however, this is subject to modifications based upon the roles of EPA and MDNRE. Any change in organization structure will be updated and revised accordingly. The organization is managed by the Unified Command Commander's who review and approve the IAP for each Operational Period.

The SOTF conducts two standing meetings daily. The operations meeting occurs every morning at 0700 to discuss safety and the plan of the day. The second meeting occurs every day at 1730 to discuss the field observations and results. The SOTF also provides briefings to the Unified Command and Assisting & Cooperating Agencies. Special meetings of the SOTF are conducted to resolve technical, regulatory, and operational issues.

1.4. Roles and Responsibilities

The SOTF reports to Operations through the Monitoring Branch. The institutional knowledge and field observations made by the other groups represented on the current organization chart are used by the SOTF to select additional locations for assessment, characterization, and mapping. The Technical Services Group is responsible for the installation and operations & maintenance of the continuing near-term containment measures for each priority area. Operations are responsible for deploying labor and materials to implement the permanent recovery of submerged oil and sediment from the priority locations. The SCAT teams, working with USFWS evaluate the value of habitat in the vicinity of the priority areas and provide recommendations on potential environmental impacts and restoration. Individual group priorities are discussed between the parties regarding permanent recovery implementation and impairment of high value habitat.

2.0 Strategy Approach to Permanent Recovery of Submerged Oil and Oil-Contaminated Sediment

The permanent recovery of submerged oil and oil-contaminated sediment emphasizes removal of mass, and is not a process intended to meet any applicable cleanup criterion. The boundaries of the continuing near-term containment structures have been established using qualitative measures. The goal for installation of these near-term containment measures is isolation of the submerged oil and oil-contaminated sediment (e.g., to prevent remobilization into the system). The goal is not for the complete delineation of the aerial extent of contamination. Additional delineation may be performed concurrent with permanent recovery to optimize the work.

2.1 Understanding of Current Situation / Behavior of Submerged Oil

The Line 6B release was reported on July 26, 2010. The oil moved approximately 1000 feet through a wetland and into Talmadge Creek and was transported approximately two miles to the confluence with the Kalamazoo River. An appreciable amount of the oil released has been recovered and the amount of oil in the Kalamazoo River and Morrow Lake systems is not known. The distance from the confluence to the dam at Morrow Lake is approximately 40 miles. The Marshall, Michigan vicinity experienced a 50-year storm event (2% chance of occurrence per year) that coincided with the Line 6B release. This resulted in widespread overwash and breaching of the bank of the Kalamazoo River by the stormwater and moved the oil into near shore depositional areas of the system located away from the main channel. These locations are stable during normal conditions and are increasing in size as fine material deposits over time. An appreciable amount of the inventory of oil and sediment in these locations will not remobilize into the waterway unless the vicinity experiences another storm event with energy similar to a 50-year event.

The oil released was a crude oil with an American Petroleum Institute (API) gravity of 11. Generally oil with an API gravity of 10 or less will sink in water and oil with an API greater than 10 floats. The oil presumably partitioned into various phases when it came into contact with the water. The phases that float have been, and continue to be collected from the water surface. The phase that is non-floating is referred to as “submerged oil” and this material has moved through the system below the surface and has been collecting on near-term containment measures installed in the river. An unknown amount of the submerged oil was transported and deposited in the system prior to the installation of these measures. This volume of submerged oil is deposited onto the sediment in depositional areas in the Kalamazoo River and Morrow Lake.

The continuing near-term containment systems (e.g., booms, curtains, and gabions) used to collect submerged oil and sediment have been installed since mid-August. The inspections performed in the first three days to assess their effectiveness reported up to 45% coverage by oil and sediment from the water column. Inspections performed since that time have revealed that much less material has collected in these systems. The Marshall, Michigan vicinity experienced a storm event where 0.5-1.0 inches fell in a 24-

hour period. The stormwater from this event did not mobilize a volume of submerged oil and sediment that was visually detectable by the field technicians monitoring river conditions. This observation supports the assessments made by the SOTF field crews, and the professional judgment of the Tetra Tech fluvial geomorphologists that the submerged oil and sediment resides in stable depositional areas located a significant distance from the main channel of the Kalamazoo River, or behind structures in the river that are stable and preclude appreciable remobilization into the systems from occurring.

As described in the Supplemental Modification to the Response Plan for RPDIA for Continuing Near-Term Containment of Submerged Oil & Oil-Contaminated Sediment submitted to EPA on September 6, 2010 to address the August 27, 2010 directive received from the USEPA, the identification and prioritization of potential oil depositional areas for sampling and near-term containment were evaluated. This Supplemental Modification to the RPDIA addresses the identified priority locations and describes the strategy and tactics to permanently remove submerged oil and oil-contaminated sediment.

2.2 Approach

The approach to addressing the permanent recovery of submerged oil and oil-contaminated sediment in areas identified as priority locations requires an evaluation and understanding of several key concepts and assumptions, including:

- Implement permanent recovery of submerged oil and oil-contaminated sediment in a prioritized approach beginning in areas ranked as having the “highest” priority (e.g., Ceresco Dam).
- Coordinate with the Wildlife Environmental Damage Assessment Branch to evaluate each priority location prior to permanent recovery activities to determine sensitive, riparian, and/or critical habitat (e.g., wetlands) prior to selecting the most appropriate permanent recovery technology.
- Coordinate with SCAT Teams for permanent recovery of submerged oil and oil-contaminated sediment in priority locations using land based mechanical means and methods (e.g., excavator) in nearshore areas.
- Use of sediment removal technologies (e.g., mechanical, hydraulic, and sediment agitation) for permanent recovery of submerged oil and oil-contaminated sediment in priority locations which cannot be performed using land based mechanical means and methods.

Identifying and prioritizing locations in the surface water and sediment systems containing submerged oil and oil-contaminated sediment is of primary importance. The permanent recovery of the submerged oil and oil-contaminated sediment in these priority locations will be accomplished by using a “toolbox” of recovery technologies that have been successfully used to recover oil from surface water and/or sediment and that can be implemented under varying settings (e.g., different geomorphic features).

2.3 Permanent Recovery Performance and Tracking Process

A multiple step process will be utilized to perform and track the permanent recovery activities for each priority location. The major steps for this process are as follows:

Step 1 - Qualitative Assessment
The entire project is being assessed and Priority Locations are being identified based on the qualitative assessment process. As the project continues Priority Locations will be updated if necessary.

Step 2 - Near-Term Containment
Continue to review and finalize the near-term containment activities as presented in the "Supplemental Modification to the *Response Plan for Downstream Impact Area (the Plan)* for Continuing Near-Term Containment of Submerged Oil & Oil-Contaminated Sediment" submitted to EPA September 6, 2010.

Step 3 - Coordinate with Wildlife Environmental/Damage Assessment Branch
Prior to permanent recovery activities, coordinate with the Wildlife Environmental/Damage Assessment Branch to ensure that sensitive and/or critical wildlife and/or habitat features are not adversely impacted as a result of recovery efforts. This is a critical step in the overall success of this recovery effort.

Step 4 - Permanent Recovery Field Activities
Following Steps 1 and 2, execute site-specific permanent recovery field activities to remove submerged oil and oil-contaminated sediment. This step includes:

- Evaluating each Priority Location
- Selecting the Proper Permanent Recovery Technology
- Selecting the Proper Subcontractors to Implement the Permanent Recovery Technology
- Implementing the Permanent Recovery Technology
- Executing Permanent Recovery Task(s)

Step 5 - Enbridge / EPA Inspection
There is clear value to Enbridge and EPA inspections at various times at each priority location in this permanent recovery process. This step will be instrumental in determining if the permanent recovery field activities described in Step 3 and 4 are complete. If any items still need to be addressed as a result of the Enbridge and EPA inspection, Step 3 will be revisited.

Step 6 - Follow-Up Action Items
If Step 4 determines that follow-up actions items are necessary at any of the site-specific priority locations, these items will be addressed and Step 4 will be repeated upon completion.

Step 7- EPA Division Supervisor Sign-Off

Following Enbridge and EPA inspection completion and subsequent concurrence that the permanent recovery activities have been completed at the priority location, EPA Division Supervisor will Sign-Off.

This process will utilize several methods of measuring progress during the course of the permanent recovery activities at each priority location. This overall process mirrors the current in-place Action Plan for the Shoreline, Overbank, and Islands Clean-Up Recovery of oil currently being executed by the SCAT Team.

Progress Tracking Logs presented in Attachment A illustrate an example method for capturing a percentage complete for each of the seven identified steps at each of the priority locations.

3.0 Implementation Tactics for Permanent Recovery of Submerged Oil and Oil-Contaminated Sediments

Implementation of the approach described above involves several steps that include:

- Completion of installation of near-term containment.
- Identification and ranking of priority locations.
- Evaluation of the types of geomorphic settings among the priority location.
- Development of a "toolbox" of recovery technologies to decide appropriate means and methods to permanently remove submerged oil and oil-contaminated sediment, while discussions regarding the long-term remediation are conducted.

These tactics are discussed in further detail below.

3.1 Timing of Permanent Recovery Actions

Enbridge is following an aggressive schedule for the permanent recovery of the submerged oil and oil-contaminated sediments at the locations defined as high and medium priorities. All priority locations will have near-term containment measures installed according to the schedule developed by Enbridge and EPA.

It is the intent of Enbridge to plan and execute the permanent recovery efforts in the high priority locations as soon as possible; however, it is recognized that permanent recovery efforts may also be implemented simultaneously in all areas regardless of priority ranking, if feasible. The rationale for this is that some lower ranked priority locations are easily accessible and the selected recovery technology is readily available (e.g. sediment agitation).

In high priority locations where the recovery effort is considered more complex (e.g., Ceresco Dam) permanent recovery actions will be implemented after an evaluation of appropriate techniques and contractor logistics are determined.

3.2 Completion of Installation of Near-Term Containment

As part of the ongoing strategy to identify, contain, and recover submerged oil and oil-contaminated sediments, completing the installation of near-term containment measures for all identified priority locations is of highest priority. Near-term containment for many of the priority locations is already complete and the remainder will be completed as soon as additional materials are available, according to the schedule developed by Enbridge and EPA. Attached Figures 2 through 11 and Table 1 show the current progress and status of the near-term containment installations. Unless additional information is collected that removes a predicted priority location from the list, near-term containment is being implemented.

3.3 Continuation of Refining and Ranking Priority Locations

The qualitative and quantitative characterization of submerged oil and oil-contaminated sediments is an iterative process. Because not all areas of the river could be surveyed using hydrographics, a desktop geomorphic evaluation was conducted to identify the depositional areas within the river system most likely to contain accumulated submerged oil and oil-contaminated sediments. These locations were prioritized for assessment.

A special meeting of the SOTF was held on September 11, 2010 to prepare a list of the highest ranking priority locations using the available assessment data. Approximately 500 river transects have been characterized using poling, and over 100 sediment cores have been collected and logged. Observation data collected by the EPA and the Technical Services Group was also utilized. Priority locations were selected in the meeting based upon a discussion of the available data. Fourteen (14) of the priority locations were determined to be of the highest priority, which are classified as “Priority 1”. The design of necessary near-term containment was reviewed. A discussion of the likely permanent recovery methods was completed, including a detailed description of the highest priority site at Ceresco Dam.

Of the 14 Priority 1 locations, the initial qualitative assessment has been completed on 10 of the locations (September 11, 2010). Appropriate near-term containment measures have been installed at a minimum of 8 of the locations (September 10, 2010).

Table 1 presents the current status of the qualitative assessments and denotes a priority ranking (1, 2, and 3) for each priority location. Locations included in Table 1 identified in the desktop study by the fluvial geomorphologists will likely be removed from the target list based upon field observations and the qualitative assessment data for the location. If new locations are identified by new observations and qualitative assessment they will be added to the priority location list and the appropriate near-term containment will be installed.

As shown on Table 1, the locations listed below have been identified by the SOTF as Priority 1 locations.

- Mile Post (MP) 5.55 North
- MP 5.63 – South Area 37
- Mile Post (MP) 5.75 (Ceresco Dam – North)
- MP 5.75 (Ceresco Dam – South)
- MP 15.25
- MP 15.50
- MP 21.50
- MP 26.00
- MP 26.25
- MP 26.65
- MP 27.90

- MP 28.25
- MP 30.25
- MP 33.00

These Priority 1 locations are among the first areas where permanent recovery activities will be performed. These recovery activities may be conducted in parallel with other recovery operations at other locations.

3.4 Evaluation of Types of Geomorphic Settings to Assist in Determining Best Recovery Technology

Table 1 lists the predicted priority locations, includes a brief description of the geomorphic setting associated with the area, provides an assessment of the stability of the deposit, status of near-term containment, and a priority ranking. Each location is unique but there are several locations that can be grouped into the same or similar geomorphic setting (e.g., behind a dam, overflow channel, oxbow). The type of setting is one of the evaluation criteria for determining an appropriate recovery technology. Another tactic being utilized is the identification and grouping of priority locations that are located in shallow water and can be isolated, pumped dry, and excavated in the dry using the SCAT teams means and methods or isolate and perform sediment agitation.

3.5 Coordination with Wildlife Environmental/Damage Assessment Branch to Evaluate Sensitive and/or Critical Habitat in Priority Locations

One of the key tactics to be implemented as part of the permanent recovery of submerged oil and oil-contaminated sediments in priority locations is coordination and communication with the resource agencies (e.g., USFWS). We plan to work with the resource agencies to visit and evaluate each priority location to determine if there are concerns about the type of recovery technique that should be used or if there are sensitive and/or critical habitats. Based on this input, the following options would be evaluated:

1 Avoid destruction of sensitive/critical habitat
2 Adjust recovery technology accordingly, if possible
3 If permanent recovery activities destroy sensitive/critical habitat, document existing conditions prior to recovery activities for future restoration

3.6 Utilize “Toolbox” of Recovery Technologies to Select Most Appropriate Means and Methods to Permanently Remove Submerged Oil and Oil-Contaminated Sediment

As discussed above, because of the complexity of the river system and the different types of priority locations that require permanent recovery of submerged oil and oil-contaminated sediments, no single recovery technology will be applicable to all situations. Therefore, one of the key tactics is the development of a “toolbox” of potentially appropriate recovery technologies that can be reviewed and the most

appropriate technology selected for a specific location. The following descriptions and list of recovery technologies is what is currently under evaluation. There may be additional tools and technologies that are added to the "toolbox" as more information and experience are gathered. Table 2 presents a preliminary recovery technologies assessment matrix. This table will be used to assist in evaluating and determining appropriate recovery technologies for individual priority locations.

3.6.1 Permanent Recovery Techniques

The permanent recovery techniques proposed for submerged oil and oil-contaminated sediment are described below. Dredging and excavation are the two most common means of removing contaminated sediment from a water body, either while it is submerged (dredging) or after water has been diverted or drained (excavation). Both methods typically necessitate transporting the sediment to a location for treatment and/or disposal. They also frequently include treatment of water from dewatered sediment prior to discharge to an appropriate receiving water body. In addition to dredging and excavation, other less invasive methods are available, and included in the following descriptions.

Containment of Priority Location for Dewatering for Excavation

Prior to implementing recovery technologies, containment and site control measures are often implemented.

- **Reinforced Silt Curtain** – A heavy wire fencing (minimum 14 gauge with mesh) and filter cloth is attached to retain material moving through the water column. The system is weighted to bottom with a ballast chain and/or with a series of posts driven to a minimum of 16 inches below the mudline. The curtain is deployed in a manner that encloses the priority location to allow for the enclosure to be pumped dry to expose the bottom of the body of water so that permanent recovery may be performed.

- **Aqua Barrier** – A manufactured vinyl tube is filled with site water to provide a temporary/portable dam or barrier positioned to contain or divert the movement of water. The full wall is formed by overlapping partially inflated vinyl tube barriers using the first barrier as the shoreline. Partially inflated vinyl tube barriers are sequentially added and overlapped to form a wall in the priority area. Each vinyl tube barrier is then fully inflated beginning with the last barrier installed. The wall is oriented in a manner that encloses the priority location to allow for the enclosure to be pumped dry to expose the bottom of the body of water so that permanent recovery may be performed.

- **Coffer Dam** – Temporary coffer dams can be constructed using steel sheet piles, sand bags, or rocks.
    - Coffer dams using steel sheet piles are constructed by driving prefabricated sections into the sediment. If a coffer dam is deemed

necessary at a specific priority site, sediment conditions will determine whether the sheet piles are vibrated or hammered into the sediment. The full wall is formed by connecting the joints of adjacent sheet pile sections in sequential installation. The wall is oriented in a manner that encloses the priority location to allow for the enclosure to be pumped dry to expose the bottom of the body of water so that permanent recovery may be performed.

- Coffer dams using sand bags are constructed by filling sacks made of burlap, propylene or other materials that are filled with sand or soil and stacked in sequential order to create a wall. The wall is oriented in a manner that encloses the priority location to allow for the enclosure to be pumped dry to expose the bottom of the body of water so that permanent recovery may be performed.
- Coffer dams using rocks are constructed by individually stacking in sequential order or by placing rocks in gabion baskets to create a wall. The wall is oriented in a manner that encloses the priority location to allow for the enclosure to be pumped dry to expose the bottom of the body of water so that permanent recovery may be performed.

Recovery by Dredging or Excavation

Dredging involves mechanically grabbing, raking, cutting, or hydraulically scouring the bottom of a waterway to dislodge the sediment. Once dislodged, the sediment may be removed from a waterway either mechanically with buckets or hydraulically by pumping. Therefore, dredges may be categorized as either mechanical or hydraulic depending on the basic means of removing the dredged material. These conventional technologies are considered for permanent recovery efforts and described below.

- **Mechanical Dredging** – Mechanical dredges most commonly used for environmental dredging are the following:
  - *Clamshell:* Wire supported, conventional open clam bucket, circular shaped cutting action;
  - *Enclosed bucket:* Wire supported, near watertight or sealed bucket as compared to conventional open clam bucket (recent designs also incorporate a level cut capability as compared to a circular-shaped cut for conventional buckets. For example, the use of Cable Arm and Boskalis Horizontal Closing Environmental Grab).

- **Hydraulic Dredging** - Hydraulic dredges remove and transport sediment in the form of a slurry through the inclusion or addition of high volumes of water at some point in the recovery process. The excess water is usually discharged as effluent at the treatment or disposal site and often needs treatment prior to discharge. Hydraulic dredges may be equipped with rotating blades, augers, or high-pressure water jets to loosen the sediment. The hydraulic dredges most commonly used for environmental dredging are the following:

- *Cutterhead:* Conventional hydraulic pipeline dredge, with conventional cutterhead;
- *Horizontal auger:* Hydraulic pipeline dredge with horizontal auger dredgehead (e.g., Mudcat);
- *Plain suction:* Hydraulic pipeline dredge using dredgehead design with no cutting action, plain suction (e.g., cutterhead dredge with no cutter basket mounted, Matchbox dredgehead, articulated Slope Cleaner, Scoop-Dredge BRABO, etc.);
- *Pneumatic:* Air operated submersible pump, pipeline transport, either wire supported or fixed-arm supported (e.g., Japanese Oozer, Italian Pneuma, Dutch "d," Japanese Refresher, etc.);
- *Diver assisted:* Hand-held hydraulic suction with pipeline transport.

Hybrid or Specialty Dredging technologies have been developed in response to the demand for sediment remediation and environmental cleanup over the last decade. The dredges may be modified to meet specific project needs. These specialty dredges may combine aspects of both hydraulic and mechanical dredges and are listed below:

- **AMPHIBEX** - AMPHIBEX is an amphibious excavator hybrid dredge that integrates a closed bucket mechanical dredge with a positive-displacement pump for high-solids dredged material transport. The AMPHIBEX is versatile in its portability by flat bed truck and ability to move over ground, in shallow water, and in deeper water under its own power.

- **Terra SED-VAC** - Terra SED-VAC technology utilizes an industrial vacuum loader with an 8 inch diameter pipe that allows submerged oil and oil-contaminated sediment to be pulled from the priority areas with little to no turbidity. The SED-VAC vacuum loader is operated from an excavator and can be operated from land or loaded onto a modular dredge barge constructed from Flexifloat equipment. Flexifloat equipment assembles into floating and elevated platforms and can be configured to work in most priority areas.

In-Situ Recovery Alternatives

- **Sediment Agitation** - Sediment agitation involves enclosing a submerged priority area with absorbent boom material. A small pump is then used above the sediment mudline to "agitate" the surface sediments. Once the perimeter of the priority area is agitated, the free product is then blown toward a designated location within the enclosure using a cordless leaf blower. Absorbent pads are deployed on the surface of the water to absorb the free product. The absorbent pads are collected and disposed of at a proper disposal location. For areas with a larger footprint, the sediment agitation will be accomplished from a barge with a diffuser pipe supplied with compressed air from a compressor staged on the shoreline or a support vessel. The pneumatic technique will create air bubbles

that will carry the submerged oil to the surface for collection with skimmers or boom systems.

- **Vessel Submerged Oil Recovery System (VSORS)** – VSORS involves a series of chains with oil recovery snares attached to a bar being dragged by a vessel through the priority areas. The snare attachments containing recovered oil are disposed of at a proper disposal location.

- **Bioremediation** – Bioremediation involves the use of nutrients or oxygen to enhance the activity of indigenous organisms and/or the addition of naturally occurring non-indigenous microorganisms. Many compounds in crude oil are environmentally benign, but significant fractions are toxigenic or mutagenic. Bioremediation is a technology that converts the toxigenic compounds to nontoxic products without further disruption to the environment. The premise of bioremediation is to accelerate the rates of natural hydrocarbon biodegradation by overcoming the rate-limiting factors such as nutrients, oxygen and pH. Indigenous populations of microbial bacteria can be stimulated through the addition of nutrients or other materials. Exogenous microbial populations can be introduced in the oil-contaminated environment. The addition of extra bacteria is referred to as bioaugmentation. Once the bacteria are chosen, the nutritional needs of the bacteria need to be met by choosing the correct mix of fertilizer. Additionally, the oil-contaminated media can be manipulated by aeration or temperature control.

3.7 Methods for Measuring Effectiveness of Permanent Recovery Action

The presence of visible oil will be continually monitored to assess the effectiveness of the methods used to achieve permanent recovery. This is a qualitative measurement protocol. If a significant reduction of visible oil is observed following implementation of recovery efforts, this will be documented by the field crews and oversight personnel. Sediment sample cores will be collected from the project footprint and logged by scientists to qualitatively evaluate the permanent recovery effectiveness by comparing pre- and post-visible oil content in the sediment cores. The field crews will be demobilized from the area where the implementation of the permanent recovery occurred based upon this documentation confirming that an appreciable mass of submerged oil and contaminated sediment has been removed.

The existing oil, debris, and sediment containment systems and their corresponding sentinel systems (e.g., downstream gabions) will continue to be monitored. The observations made by the Technical Services Group on their performance will be compared to the existing data on oil, debris, and sediment loading on these systems dating back to their installation date in August, 2010. New near-term containment measures and their sentinel systems will be established, at possibly 2 or 3 locations across the river, and their performance observed in river reaches downstream of permanent recovery actions. All the qualitative data produced on the observations

made on the performance of the permanent recovery actions will be stored in the project database.

Robust monitoring systems will be selectively installed in river reaches as determined by the fluvial geomorphologists and reviewed with the SOTF. These systems will be designed to operate in the high water conditions anticipated in the Spring as determined by a review of the gauging data at 5 different locations on the Kalamazoo River. The design will address the anticipated 2 foot increase in water elevation and 6 fold increase in volumetric flow rate. A gabion basket installation with a height of 6-7 feet anchored to the stream bed is envisioned. The systems will be designed to polish the Kalamazoo River surface water and sediment systems of submerged oil and contaminated sediment mobilized from the depositional areas that were stable (Fall and Winter), but remobilized in the Spring by the increased energy imparted to the system by the stormwater.

A comparison will be made at the end of the 2011 Spring season between the observations made on the capture of submerged oil and oil-contaminated sediment between the Spring of 2011 and the Summer of 2010 by the Technical Services Group and the SOTF. This qualitative data will be used to discuss the status of the on-going permanent recovery effort.

3.8 Example Priority Locations for Strategy and Tactic Implementation of Permanent Recovery of Submerged Oil and Contaminated Sediment

This section describes the specific tactics and planned actions that are being implemented and considered for three example highest priority locations. These are Ceresco Dam at MP 6.0, the Mill Pond area at MP 15.25, and the Morrow Lake delta area between MP 36.50 (35th Street Bridge) and MP 37.50. As described above, similar strategy approach and tactics will be used for other priority locations.

3.8.1 Ceresco Dam

Qualitative assessments performed from August 30 to September 5 at Ceresco Dam identified visible oil during poling in a 5 acre area on the south side of the river. As a result, sediment cores were collected and logged, and visible oil was detected in the first 6 inches of the sediment column. The location of the poling transects and sediment cores are identified on Figure 2. The SOTF identified this as a high priority location. Near-term containment was installed. The SOFT ranked this area as the number one priority for implementation of a permanent recovery based upon this data.

The near-term containment was accomplished by isolating the main channel from the depositional areas on the South shoreline by installing a heavy duty silt curtain attached to hard boom and anchored to the bottom with a ballast chain. On the North shoreline depositional area, a hard boom and sediment curtains were installed. A silt fence was installed east of the Ceresco dam bulkhead. Full-scale field pilot test cells were created

within the South shoreline priority location so that the effectiveness of multiple technologies (e.g., dewatering, aeration, and vacuum dredging) could be evaluated.

The SOTF is evaluating mechanical and hydraulic means & methods to accomplish permanent recovery of submerged oil and oil-contaminated sediment at Ceresco Dam. Site visits have been conducted with dredging, dewatering, and water treatment contractors. These contractors have taken samples of the submerged oil and sediment to their off-site laboratories to perform bench scale testing for dewatering. The results of their testing will not be available until after this Supplement to the Plan has been submitted.

Several pilot tests were conducted within the Ceresco Dam high priority location. Three pilot test cells were constructed near the west end of the area. The test cells were designated as a control cell, an agitation cell and a vacuum dredge cell. Each of the cells were sampled prior to any test activities. The results of the initial pilot testing are discussed in this section.

A pilot test was performed on September 4, 2010 to demonstrate the effectiveness of the agitation and recovery technique for remediation of submerged oil and oil-contaminated sediments. A water pump with two inch hose and a nozzle on the discharge was used to aerate the first three inches of the sediment column for a duration of one hour in one of the three 10 foot by 20 foot pilot test cell areas. The area was agitated for three one-hour cycles interrupted by two periods of two hours each for recovery of the oil sheen. After the first agitation event, heavy hydrocarbon sheen surfaced over 100% of the test area and the surface sheen was recovered with absorbent boom for two hours. Observers noticed a 75% reduction in heavy hydrocarbon surface sheen after each of the next two agitation tests in the silt fence area. Sample cores were collected before and after the demonstration and logged for observations of visible oil. Total Petroleum Hydrocarbon (TPH) analysis was performed on samples taken from the cores but data were not available at the time of this submittal.

A full-scale field pilot was conducted on Tuesday, September 7 by Terra Contracting to demonstrate the ability of the Terra-Vac system for removal of submerged oil and oil-contaminated sediment. Sediment cores were collected inside the silt fence test cell prior to the demonstration and analyzed on-site by New Age Laboratories. The Terra-Vac system utilized a foot attachment to the vacuum nozzle designed to remove material in six inch lifts. The system was demonstrated with the foot in the east portion of the test cell, and without the foot in the west portion of the silt fence footprint. Sediment cores were collected in each area for testing and provided to New Age Laboratories for analysis for TPH (C10-C40). Samples were also secured from the vacuum box (solids) and the vacuum truck (liquids separated from the solids) and sent to New Age Laboratories for testing. TPH analysis data were not available at the time of this submittal. The full-scale field pilot test results will be used to evaluate if the Terra-Vac system can effectively remove submerged oil and oil-contaminated sediment from the Kalamazoo River. Production rates could not be established (square feet/hour)

for the system based upon this particular field pilot. All observers agreed that the productivity was hampered by the foot attachment to the vacuum nozzle. An alternate foot design is required to improve productivity.

Dredge America visited the Ceresco Dam site on September 8, 2010 to collect samples of the submerged oil and oil-contaminated sediment for dewatering testing and polymer selection. They recommended that Enbridge raise the water level elevation 3 feet by installing stop logs in Ceresco Dam. They recommended that GeoTubes be used to dewater the sediment slurry pumped by the dredge to an upland location. The results of their bench scale testing were not available at the time this report was submitted.

Infrastructure Alternatives (IAI) visited Ceresco Dam on September 9, 2010. Samples were collected for testing so that a polymer could be selected. IAI agreed to return on Monday, September 13 to conduct hanging bag tests to demonstrate the efficacy of their polymer using different nonwoven geotextile fabrics. A 2-acre plot of land located in a farmer's field south of the work area was recommended for staging dewatering and water treatment equipment by IAI.

PCi Dredging visited the site on September 8, 2010 and observed the Ceresco Dam location. PCi recommended utilizing the AMPHIBEX hybrid dredge. The AMPHIBEX is versatile in its portability by flat bed truck and ability to move over ground, in shallow water, and in deeper water under its own power. This dredge equipment was unique in its ability to work in shallow water with no water depth restrictions. PCi also recommended dewatering the dredged material utilizing Geo Tubes.

It appears that the soft sediment is over 6 feet deep in many of the areas within the project footprint. No contractors have recommended using mechanical means and methods, or working off timber mats, to remove and cast the submerged oil and oil-contaminated sediment to a near shore location. All the contractors expressed a concern about the unstable working platform that would exist using traditional mechanical means and methods. Each of the contractors indicated that they had the capacity to mobilize in the next two weeks, and said they were positioned to remove about 4000 cubic yards of material from the project footprint using their equipment spread in the next 30 days.

The SOTF will make a recommendation to Enbridge to select the dredging technology to remove the submerged oil and oil-contaminated sediment that does not require an increase in the water elevation to float the equipment (i.e., AMPHIBEX). Dewatering of the material will be conducted by pumping the dredge slurry into Geo Tubes. The water collected from the Geo Tubes will be treated to meet MDNRE General Permit conditions and discharged back to the river.

3.8.2 The Mill Pond Area at MP 15.25

Qualitative assessments performed between August 30 and September 9 have identified visible oil in the secondary channel near E. Burnham Street. This area was

assigned a high priority for near-term containment and permanent recovery. Near-term containment systems were installed on September 9, 2010 at MP 15.0 to reduce the potential of remobilization of the submerged oil and contaminated sediment. These systems include a section of 50 feet of hard boom complete with a 6 foot X-Tex curtain, and a section of 100 feet of hard boom with a 6 foot X-Tex curtain at MP 15.25. Absorbent boom was installed within and outside these installations. An additional 300 feet of reinforced silt fence with T-post anchors was installed at MP 15.5. The SOTF agreed that sediment agitation using pneumatic aeration was an appropriate method for permanent recovery in this area. A contractor is scheduled to mobilize to the area on Sunday, September 12, 2010 to implement permanent recovery using this technique.

3.8.3 Morrow Lake Delta

The qualitative assessments in the braided area of Morrow Lake delta were completed on September 11, 2010 between MP 36.50 and MP 37.50. The polling results and sediment cores indicate that decreasing amounts of submerged oil and oil-contaminated sediment are present moving from the east to the west, on the south side of this area. Water depths are below 1.5 feet and the inventory of soft sediment overlaying sand is less than 2 feet.

Permanent recovery using dredging is not under consideration for most of this area due to the impact on habitat. Selective dredging may be performed to remove hot spots. Less intrusive techniques are more likely to be habitat friendly and equally effective in capturing the submerged oil and oil-contaminated sediment.

The least intrusive permanent recovery method is sediment agitation using pneumatic aeration. The submerged oil and oil-contaminated sediment will be captured on the surface within a containment area using hard boom and sediment curtain or reinforced silt fence. The site specific conditions will be evaluated so the type and footprint of containment can be designed for the required service. Absorbent boom will be used to capture oil from the surface.

The Vessel Submerged Oil Recovery System (V-SORs) technique appears practicable for areas in the open water where submerged oil and contaminated sediment is present in a thin layer of sediment overlaying sand. The effectiveness of this method can be evaluated based upon visual observation of the presence of sheen in the project footprint containment area.

Tables

Table 1 - Potential Submerged Oil and Oil-Contaminated Sediment Priority Locations

Kalamazoo River Mile	Geomorphic Setting	Remobilization Potential	Near-Term Containment System	SOTF Priority Level	
				Priority Level	Comments
5.55 - North	Eddy, right bank 5.52 to 5.59	High	To be Completed	1	Need further assessment for assessing containment need
5.63 - South Area 37	Eddy, left bank 5.6 to 5.64	High	500' 18" Hard Boom, 400' X-Tex curtain with 3' skirt. Completed 9/10/10	1	No comment
5.75 (Ceresco Dam – North)	Upstream of Dam, right bank 5.62 to 5.83	High	Boom in-place	1	Containment effectiveness testing ongoing
5.75 (Ceresco Dam – South)	Upstream of Dam, left bank 5.65 to 5.82	High	1,000' curtain 6' skirt; 16 danforth anchors. Completed	1	Containment effectiveness testing ongoing
7 - South	Overflow Channel, left bank 6.77 to 6.97	Low	Complete by 9/20/10	3	No comment
7.75	Overflow Channel, left bank 7.74 to 7.81	High	Needs assessment for assessing need for containment	2	Reassess to evaluate of reinforced silt fence
12.5	Overflow Channel, right bank 12.43 to 12.65	High	Hard Boom with 3' silt curtain. Completed 9/10/10	2	No comment
14.75	Overflow Channel, right bank 14.61 to 14.75	Low	New site. To be completed	3	Needs reassessment
15	Secondary Channel @15.01	Low	50' Hard Boom X-Tex curtain; Abs.boom both sides. Completed	3	No comment
15.25	Wetland/Backwater, south of E. Burnham St.	High	100' Hard Boom with X-Tex curtain; Abs. boom both sides. Completed	1	Sediment agitation permanent recovery effort scheduled 9/12/10
15.5	Wetland/Backwater, right bank 15.49 to 15.54	High	300' reinforced silt fence installed with T-post anchors, Abs. boom inside. Completed	1	No comment
21.5	Oxbow, right bank 21.31 to 21.43	High	3' silt fence, 200' Abs. boom both sides; 8 lines total. Completed	1	No comment
22.75	Cutoff Channel, right bank 22.59 to 22.81	Low	Complete by 9/22/10	3	Not accessible by airboat. Heavy debris. Needs to be assessed
26	Possible man-made bay, right bank 26.01 to 26.06	High	300' 18" Hard Boom X-Tex, Abs. boom. Complete by 9/15/10	1	No comment
26.25	Overflow Channel, right bank 26.22 to 26.29	High	300' 18" Hard Boom X-Tex, Abs. boom. Complete by 9/23/10	1	No comment
26.65	Point Bar/Backwater, right bank 26.65 to 26.68	High	New site. To be Completed - 400' Hard Boom X-Tex curtain; Abs boom both sides.	1	No comment
27.75	Bridge Backwater, left bank 27.5 to 27.53	Low	New site. To be Completed	3	Revisit in Spring 2011.
27.9	Backwater bay, left bank 27.9 to 27.94	High	New site. To be Completed - 200' reinforced silt fence plus Abs. boom.	1	Can be left alone until Spring 2011. Needs to be assessed for near-term containment.
28.25	Oxbow, right bank 28.08 to 28.22	High	200 ft 18" Hard Boom X-Tex curtain, Abs. boom. Completed	1	No comment

Table 1 - Potential Submerged Oil and Oil-Contaminated Sediment Priority Locations

Kalamazoo River Mile	Geomorphic Setting	Remobilization Potential	Near-Term Containment System	SOTF Priority Level	
				Priority Level	Comments
30	Small inlet, left bank 29.93	High	New site. To be Completed	2	Needs reassessment
30.25	Wider River channel, right bank 30.02 to 30.08	High	Complete by 9/24/10	1	Needs reassessment
33	Backwater channel, left bank 32.88 to 33.15	High	New site. To be Completed	1	Needs reassessment
33.25	Narrow side channel, right bank 33.26 to 33.29	High	New site. To be Completed	2	Needs reassessment
33.5	Wider River channel, right bank 33.56 to 33.69	Low	Complete by 9/24/10	3	Needs reassessment
34	Upstream of Bridge, right bank 33.98 to 34.04	Low	New site. To be Completed	3	Needs reassessment
35.75 to 36	Wider River channel, left bank 35.67 to 35.82	Low	Complete by 9/26/10	3	Needs reassessment
36	Cutoff Channel, right bank 35.79 to 36.04	Low	Complete by 9/16/10	3	Needs reassessment
36.25	Overflow Channel, left bank 36.15 to 36.25	Low	To be Completed	2	Needs reassessment
36.5 to 37.5	Morrow Lake Delta	High	1,000' X-Tex 8' curtain	2	Needs reassessment
37.75 - North	Shoreline, right bank 37.53 to 37.59	High	1,100' X-Tex 6' curtain	3	Needs reassessment
37.75 - South	Islands left bank 37.55 to 37.75	High		3	Needs reassessment
39.75 - North	Upstream of Dam, right bank 39.85	Low	Complete by 9/19/10	3	Needs reassessment
39.75 - South	Upstream of Dam, left bank 39.75	Low	Complete by 9/19/10	3	Needs reassessment
20.5	WWTP Spillway	--	--	Removed	Based on SOTF Assessment
21.25	Trib/backwater	--	--	Removed	Based on SOTF Assessment
21.75	Overflow Channel	--	--	Removed	Based on SOTF Assessment
24.75	Oxbow	--	--	Removed	Based on SOTF Assessment
25.5	Trib/backwater	--	--	Removed	Based on SOTF Assessment
31	Trib/backwater	--	--	Removed	Based on SOTF Assessment
32.75	North bank dock and wooden swing with inlet heading NE	--	--	Removed	Based on SOTF Assessment
33.5 Ponds South	Man-made ponds	--	--	Removed	Based on SOTF Assessment
33.75	Narrow channel downstream	--	--	Removed	Based on SOTF Assessment
33.75 Ponds South	Man-made ponds	--	--	Removed	Based on SOTF Assessment
Former 38	Lee side of island	--	--	Removed	Based on SOTF Assessment

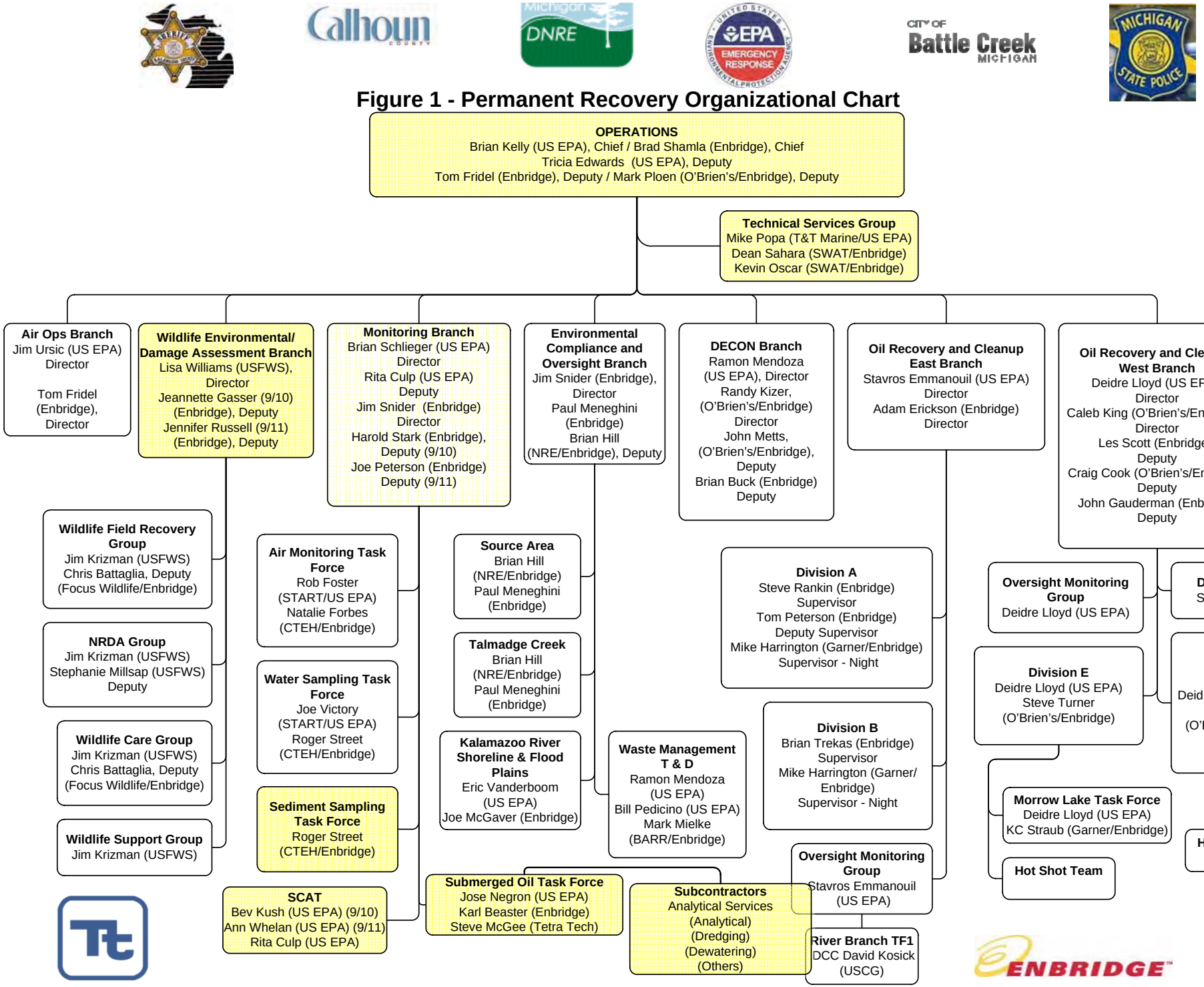
Submerged Oil Task Force

Table 2 - Analysis of Techniques Proposed for Recovery of Submerged Oil and Oil-Contaminated Sediment

Alternative Technique	Decision Criteria						
	Access	Limitations	Waste T&D	Effectiveness per EPA / MDNRE Guidelines	Impact to Wildlife / Environment / Community	Duration / Timing / Availability	Cost
Dredge / Dewatering / Discharge							
Hydraulic Dredge	* requires laydown areas for sed-geotubes * single in/out (crane required) * requires minimum water depth (~2-ft) * cabling anchor points for movement	* debris * limited mobility within river system if cables used * limited pumping distance w/o booster pump *generates large quantities of excess water	*sediments require dewatering * dried sediment waste *water treated with AC and discharged to river	* 95% removal	Turbidity, Noise concerns, T&D issues, established habitat issues	* Once established - relatively fast and effective	* High
AMPHIBEX	* can "walk" into area * no water depth restriction *requires laydown areas for sed-geotubes	* limited pumping distance w/o booster pump *generates large quantities of excess water	*sediments require dewatering * dried sediment waste *water treated with AC and discharged to river	* 95% removal	Turbidity, Noise concerns, T&D issues, established habitat issues	* relatively fast and effective/week	* High
Terra-SED-VAC	* single in/out (crane required) * requires minimum water depth (~2-ft) * cabling anchor points for movement * requires laydown areas for sed-geotubes	* low productivity * limited pumping distance w/o booster pump * generates large quantities of excess water * requires stable subgrade to support timber mats	*sediments require dewatering * dried sediment waste *water treated with AC and discharged to river	* 95% removal		* Weeks/Available on-site * speed and depth control * pilot test results	* High
Dam and Scrape (Excavation in the dry)	* limited in some areas for heavy equipment	*river flow *slow setup *limited access for equipment in some areas * requires stable subgrade to support timber mats	* sediments may require dewatering * dried sediment waste * water treated with AC and discharged to river	* 95% removal	* T&D issues	* Weeks	* High
In-Situ Recovery Alternatives							
Agitation and Recovery	* Access from main channel with hose * Can access all areas with boats (need big enough boat for generator and pump)	*slow production rate	* Collected oil, absorbents	* 75% removal	* Low	* Immediate	* Low to Medium
Vessel-Submerged Oil Recovery System (VSORS) - pom boom drag	* Can access all areas with boats, may need wire lines	*slow production rate	* Collected oil, absorbents, saturated boom	* TBD	* Low	* Immediate	* Low
Bioremediation	* Can access all areas with boats	*slow production rate *production of possible byproduct	* None	* TBD	* TBD	* Days to Weeks	* Moderate

Figures

Figure 1 - Permanent Recovery Organizational Chart



N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 2: Ceresco Dam Area

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

9/10/10 -- B. Schrotenboer

N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil Surface Sheen **Assessment Location**

Observed **Not Observed**

River Stationing (miles from source)

Existing or Proposed Containment (approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS
Figure 3: MP15.25

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

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N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil Surface Sheen **Assessment Location**

Observed **Not Observed**

River Stationing (miles from source)

Existing or Proposed Containment (approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 4: MP15.5

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

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N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 5: MP21.5

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

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N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 6: MP26 and MP26.25

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

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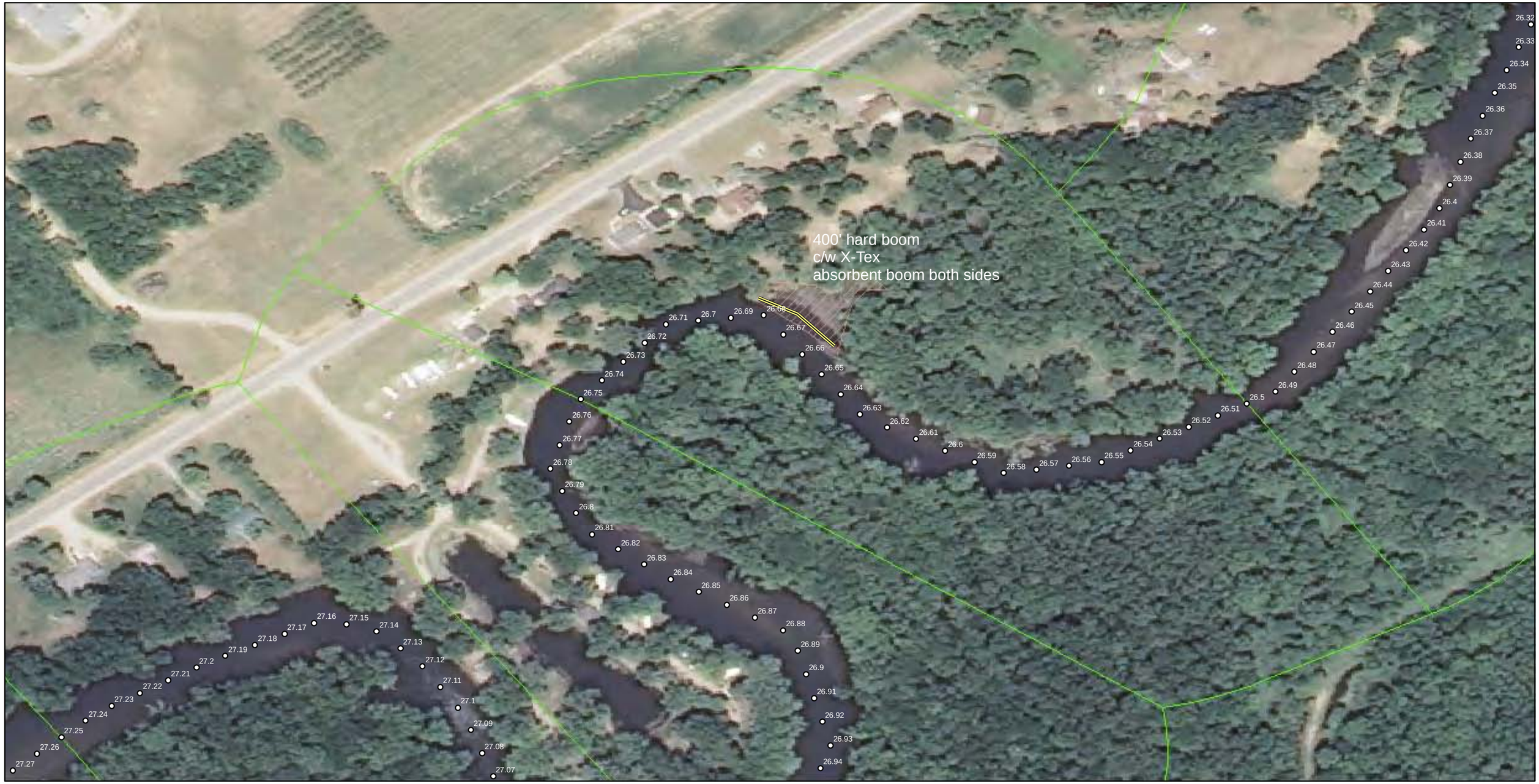

N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 7: MP26.65

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

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N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 8: MP27.9 and MP28.25

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

9/10/10 -- B. Schrotenboer

N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 9: MP30.25

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

9/10/10 -- B. Schrotenboer

N
W E
S

0 75 150 300 Feet

1 inch = 200 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

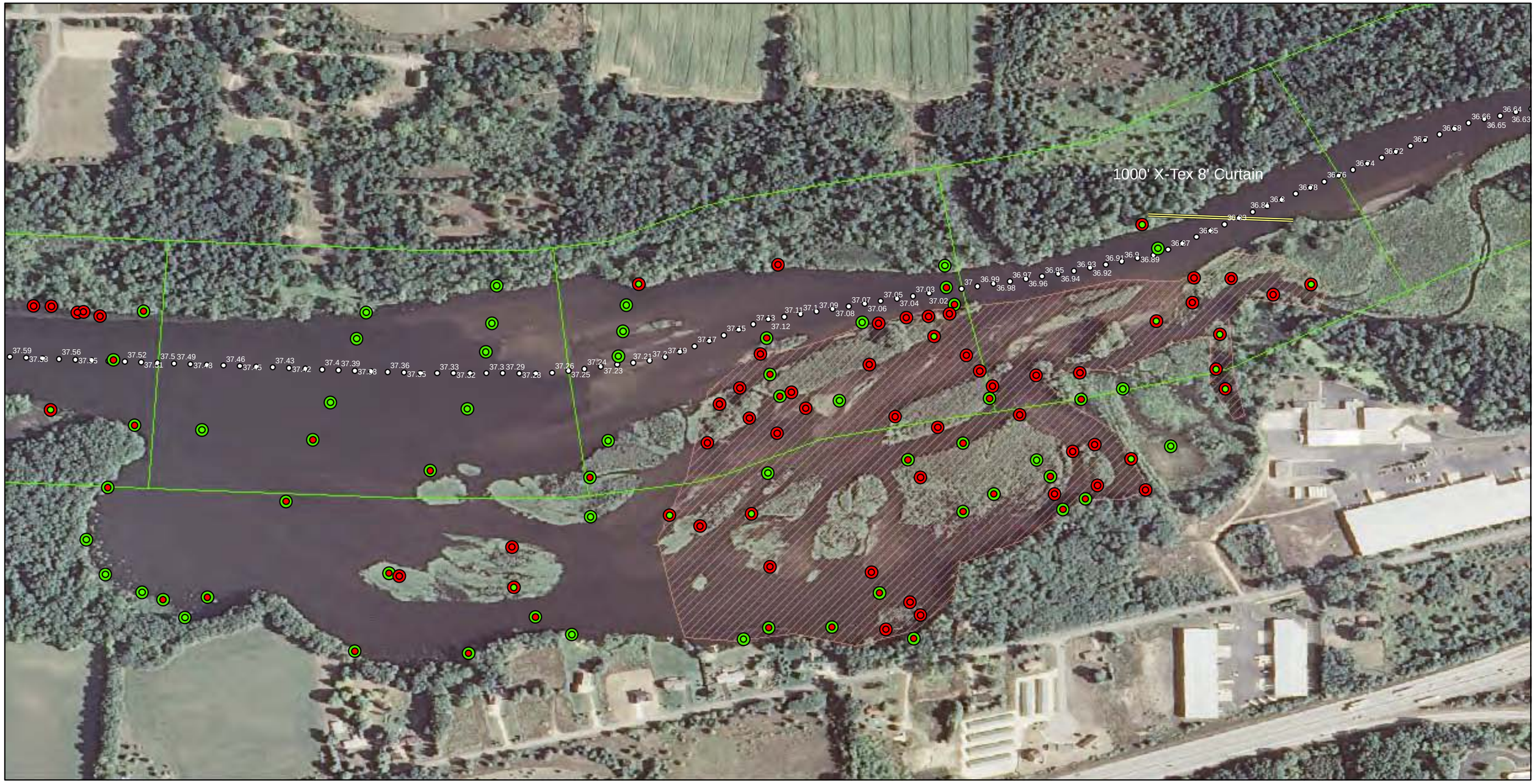
Figure 10: MP33

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

9/10/10 -- B. Schrotenboer



N
W E
S

0 150 300 600 Feet

1 inch = 400 feet

Submerged Oil
Surface Sheen
Assessment Location

Observed **Not Observed**

River Stationing
(miles from source)

Existing or Proposed Containment
(approximate)

Estimated Area of Highest Impact

Division Quarter Mile Sections

Coordinate System: Michigan State Plane South
Horizontal Datum: NAD83
Vertical Datum: NAVD88
Units: International Feet

SUBMERGED OIL PRIORITY LOCATIONS

Figure 11: Morrow Lake Delta

SUBMERGED OIL TASK FORCE
MARSHALL, KALAMAZOO AND
CALHOUN COUNTIES, MICHIGAN

Sep 11, 2010

TETRA TECH EC, INC.

9/10/10 -- B. Schrotenboer

Attachment A

Progress Tracking Log

Permanent Recovery Process	Percent Complete	Cum. Sections Completed						Total at Completion
		Date	Date	Date	Date	Date	Date	
Assessment (Step 1)								
Near Term Containment Completed (Step 2)								
Coordinate with Wildlife Environmental / Damage Assessment Branch (Step 3)								
Permanent Recovery Completed (Step 4)								
Enbridge/EPA Inspection Completed (Step 5)								
Follow-Up Items Completed (Step 6)								
EPA Division Supervisor Sign-Off (Step 7)								

Progress Tracking Log

		Division C																														
		Group 1 (4.00 mi)																	Group 2 (3.75 mi)														
	MP	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.25	6.50	6.75	7.00	7.25	7.50	7.75	8.00	8.25	8.50	8.75	9.00	9.25	9.50	9.75
	Priority Location															MP 5.55 North - Priority 1 MP 5.63 South - Priority 1 MP 5.75 Ceresco Dam - North - Priority 1 MP 5.75 Ceresco Dam - South - Priority 1						MP 7.0 South - Priority 3			MP 7.75 Priority 2											
Qualitative Assessment (Step 1)	Comments / Forecast Date / Completion Date																															
Near Term Containment Completed (Step 2)																																
Coordinate with Wildlife Environmental / Damage Assessment Branch (Step 3)																																
Permanent Recovery Completed (Step 4)																																
Enbridge/EPA Inspection Completed (Step 5)																																
Follow-Up Items Completed (Step 6)																																
EPA Division Supervisor Sign-Off (Step 7)																																

Progress Tracking Log

		Division C																														
		Group 3 (2.25 mi)									Group 4 (5.25 mi)																					
	MP	10.00	10.25	10.50	10.75	11.00	11.25	11.50	11.75	12.00	12.25	12.50	12.75	13.00	13.25	13.50	13.75	14.00	14.25	14.50	14.75	15.00	15.25	15.50	15.75	16.00	16.25	16.50	16.75	17.00	17.25
	Priority Location											MP 12.5 - Priority 2									MP 14.75 - Priority 3	MP 15.00 - Priority 3	MP 15.25 - Priority 1	MP 15.50 - Priority 1							
Qualitative Assessment (Step 1)	Comments / Forecast Date / Completion Date																														
Near Term Containment Completed (Step 2)																															
Coordinate with Wildlife Environmental / Damage Assessment Branch (Step 3)																															
Permanent Recovery Completed (Step 4)																															
Enbridge/EPA Inspection Completed (Step 5)																															
Follow-Up Items Completed (Step 6)																															
EPA Division Supervisor Sign-Off (Step 7)																															

Progress Tracking Log

		Division D																												
	MP	17.50	17.75	18.00	18.25	18.50	18.75	19.00	19.25	19.50	19.75	20.00	20.25	20.50	20.75	21.00	21.25	21.50	21.75	22.00	22.25	22.50	22.75	23.00	23.25	23.50	23.75	24.00
	Priority Location																	MP 21.50 - Priority 1					MP 22.75 - Priority 3						
Qualitative Assessment (Step 1)	Comments / Forecast Date / Completion Date																													
Near Term Containment Completed (Step 2)																														
Coordinate with Wildlife Environmental / Damage Assessment Branch (Step 3)																														
Permanent Recovery Completed (Step 4)																														
Enbridge/EPA Inspection Completed (Step 5)																														
Follow-Up Items Completed (Step 6)																														
EPA Division Supervisor Sign-Off (Step 7)																														

Progress Tracking Log

Division E

	MP	24.25	24.50	24.75	25.00	25.25	25.50	25.75	26.00	26.25	26.50	26.75	27.00	27.25	27.50	27.75	28.00	28.25	28.50	28.75	29.00	29.25	29.50	29.75	30.00	30.25	30.50	30.75	31.00	31.25	31.50	31.75	32.00	32.25	32.50	32.75	33.00	33.25
									MP 26.00 - Priority 1	MP 26.25 - Priority 1						MP 27.75 - Priority 1		MP 28.25 - Priority 1							MP 30.00 - Priority 2	MP 30.25 - Priority 1										MP 33.00 - Priority 1	MP 33.25 - Priority 2
Qualitative Assessment (Step 1)	**Comments / Forecast Date / Completion Date**																																					
Near Term Containment Completed (Step 2)																																						
Coordinate with Wildlife Environmental / Damage Assessment Branch (Step 3)																																						
Permanent Recovery Completed (Step 4)																																						
Enbridge/EPA Inspection Completed (Step 5)																																						
Follow-Up Items Completed (Step 6)																																						
EPA Division Supervisor Sign-Off (Step 7)																																						

Progress Tracking Log

Division E

	MP	Comments / Forecast Date / Completion Date
	33.50	MP 33.50 - Priority 3
	33.75	
	34.00	MP 34.00 - Priority 3
	34.25	
	34.50	
	34.75	
	35.00	
	35.25	
	35.50	
	35.75	MP 35.75 to 36.00 - Priority 3
	36.00	MP 36.00 - Priority 3
	36.25	MP 36.25 - Priority 2
	36.50	MP 36.50 to 37.50 - Priority 2
	36.75	
	37.00	
	37.25	
	37.50	
	37.75	MP 37.75 South - Priority 3 MP 37.75 North - Priority 3
	38.00	
	38.25	
	38.50	
	38.75	
	39.00	
	39.25	
	39.50	
	39.75	MP 39.75 North - Priority 3 MP 39.75 South - Priority 3
	40.00	
Qualitative Assessment (Step 1)		
Near Term Containment Completed (Step 2)		
Coordinate with Wildlife Environmental / Damage Assessment Branch (Step 3)		
Permanent Recovery Completed (Step 4)		
Enbridge/EPA Inspection Completed (Step 5)		
Follow-Up Items Completed (Step 6)		
EPA Division Supervisor Sign-Off (Step 7)		