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November 17, 2010

Ms. Mary Logan  
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Chicago, IL 60604

**Re: Task 1.4 Report-Revision 1-Settlement Agreement No. V-W-10-C-942 for  
The Tittabawassee River/Saginaw River & Bay Site  
Dow Submittal Number 2010-073**

Ms. Logan:

Attached please find the Task 1.4 Report-Revision 1. The document is being submitted under AOC CERCLA Docket No. V-W-10-C-942 and Appendix A, Statement of Work Schedule. Please feel free to contact me with any questions or concerns.

Sincerely,  
The Dow Chemical Company

A handwritten signature in cursive script that reads "Todd Konechne".

Todd Konechne  
Project Coordinator

cc: Al Taylor, MDNRE  
Diane Russell, U.S. EPA  
Joseph Haas, U.S. Fish and Wildlife  
Steve Lucas, Dow  
Peter Wright, Dow  
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**Task 1.4 Engineering Evaluation/Cost  
Analysis for Early Response Action to  
Address Potential Acute or Near Term  
Exposure Risks  
The Tittabawassee River/  
Saginaw River & Bay Site**

Prepared by:  
**The Dow Chemical Company**

Date:  
**November 17, 2010**  
**Dow Submittal Number 2010.073**  
**Revision 1**

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## ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirements
AOC	Administrative Order on Consent
CERCLA	Comprehensive Environmental Response and Compensation and Liability Act
DNRE	Department of Natural Resources and Environment
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EU	exposure units
IRA	interim response activities
NCP	National Contingency Plan
NTCRA	Non-Time Critical Removal Action
ROD	Record of Decision
SOW	Statement of Work

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# 1 Introduction

This Task 1.4 Engineering Evaluation/Cost Analysis (EE/CA) Report evaluates potential response actions in exposure units (EUs). This report was prepared in accordance with the requirements contained in Section IX (Work To Be Performed), Paragraph 29.a. of the Administrative Settlement Agreement and Order on Consent (AOC) for The Tittabawassee River/Saginaw River & Bay Site (Site) (Settlement Agreement No. V-W-10-C-942), and Section 1 of the Statement of Work (SOW, Appendix A of AOC), effective January 21, 2010.

The draft Task 1.1 Technical Memorandum was submitted by The Dow Chemical Company (Dow) to the U.S. Environmental Protection Agency (EPA) and the Michigan Department of Natural Resources and Environment (DNRE) (collectively, the Agencies) on March 22, 2010. A revised Task 1.1 Technical Memorandum was submitted by Dow on June 2, 2010 (Dow 2010a). Task 1.4 evaluates potential alternative response actions for those EUs and/or properties targeted (either in Task 1.1 or 1.3) for possible early action.

On May 3, Dow received comments from the Agencies on the Task 1.1 Technical Memorandum and partial approval to proceed with activities in EU010 and EU011 (EPA 2010). Specifically, the Agencies approved sequencing one EU010 parcel and seven EU011 parcels into Task 1.4. These eight Task 1.4 parcels were also characterized and assessed as part of the Task 1.3 work and the results were presented in the *Task 1.3 Report, Determination of the Need for Early Response Actions in EU010 and EU011-Revision 0* (Task 1.3 Report), which was submitted on August 2, 2010 and the Task 1.3 Report-Revision 1 which was submitted on October 29, 2010 (Dow 2010b). Information gathered under Task 1.3 was used to support this Task 1.4 EE/CA. EU010 and EU011 locations are presented in Figure 1.

## 1.1 Background on Settlement Agreement and Task 1 Process

The AOC for the Tittabawassee River/Saginaw River & Bay Site and associated SOW set forth requirements for conducting evaluations of current conditions and assessments of response options at the Site. Task 1 of the SOW is part of the general site-wide tasks that characterize and assess potential acute or near-term exposure risks in advance of the segment-specific response proposal required under Task 8.

Task 1 is comprised of six sub-tasks as described below:

- Task 1.1 – Sequencing of areas of potential acute or near-term exposure risk
- Task 1.2 – Identify and fill data gaps
- Task 1.3 – Characterize and determine the need for early response action
- Task 1.4 – Development of mitigation measures for acute or near-term exposure risks
- Task 1.5 – Early response action design
- Task 1.6 – Identification of new areas of potential acute or near-term exposure risks

Task 1.1 sequences areas within the Tittabawassee and Saginaw River floodplains based on currently available data to the next step in the process to start in either Task 1.2, 1.3, or 1.4. A flow chart depicting the overall Task 1.2 through 1.4 sequencing process, as described in the Settlement Agreement, is shown on Figure 2. Task 1.2 is intended for areas where additional data is needed to determine if there is a potential acute or near-term exposure risk. Task 1.3 characterizes and assesses areas to determine if there are areas that warrant consideration of early response actions. Response actions under Task 1.4 (this document) are developed for those areas where an action prior to the segment specific response proposal may be warranted based on evaluations of existing information about property conditions and use. Task 1.5 will develop a streamlined remedial design when the EPA, in consultation with DNRE, has signed an Action Memorandum for a Non-Time Critical Removal Action (NTCRA) selecting mitigation measures to address potential acute or near-term risks.

## **1.2 *Prior Work***

Dow and the Agencies have been performing early response actions to address residential properties located within the 8-year Tittabawassee River floodplain. Interim Response Activities (IRAs) were conducted for the Tittabawassee River floodplain under the regulatory authority of Dow's Hazardous Waste Operating License (License) as issued under the authority of Michigan's Part 111. The 8-year floodplain is defined by the March 2004 flood event. Priority areas were identified where floodwater touched residential properties during the March 2004 flood event.

Residential properties along the Tittabawassee River were subdivided into Priority 1 (P1) and Priority 2 (P2); based on the proximity of the March 2004 flood waters to structures, in order to sequence the implementation of mitigation measures under the State-approved IRA Work Plan, dated January 20, 2005. Mitigation activities conducted as part of the IRAs included the installation of control barriers for bare soil areas actively used by an owner movement/replacement of gardens and flower beds to reduce flooding frequency, and house cleaning. Following subsequent flood events and upon request by the property owner, P1 and P2 properties are provided replacement/repair of mitigation activities if they are damaged during a flood event.

IRAs also addressed public properties located within the floodplain including several parks, playgrounds, parking lots, roads, boat launches, sidewalks, and decking systems. Mitigation activities for these areas included placement of clean topsoil layers, decking systems to provide access to the river, new asphalt for parking areas, relocation of a dog park to an area outside of the 8-year floodplain, and replacement of gravel parking areas with asphalt. Dow also provides local municipalities with hand washing stations for parks.

Additional response actions were performed between 2008 and 2009 to mitigate potential acute or near-term exposure risks at EU001 and EU002 located along Riverside Drive and West Michigan Avenue. EU001 included residential and non-residential properties and EU002 included residential properties and West Michigan Park.

In accordance with the terms and conditions of the Settlement Agreement, it is intended that the IRAs described above will transition into work required under the Settlement Agreement as described in the SOW.

### **1.3 Background on Exposure Units**

In 2008, the EPA and DNRE identified EUs as areas with the potential for both high human use and high surface soil furan/dioxin concentrations. After the early actions at EU 001 and EU002, 18 EUs (comprised of approximately 260 property parcels) remain to be assessed in Task 1.3. Additionally, the Settlement Agreement allows new areas to be identified, as needed. Dow has proposed the remaining 18 EUs to be assessed in four phases. Phase 1 includes two exposure units (EU010 and EU011) along the Tittabawassee River where property assessments are nearing completion, while Phase 2 includes four exposure units (EU004, EU006, EU007, and EU008) where property assessments are ongoing. Property assessments for Phases 3 and 4 are proposed to be conducted in 2011. This Task 1.4 Report addresses Phase 1 exposure units, EU010 and EU011, but is expected to be utilized to address other properties which are identified for early response under Task 1.

### **1.4 Property Descriptions**

Following the Task 1.3 Assessments of EU010 and EU011 properties the following properties were sequenced into Task 1.4:

- EU010: 10-01; 10-02; 10-03, 10-05
- EU011: 11-03, 11-04; 11-05; 11-06; 11-07; 11-09; 11-10; 11-11; 11-17; 11-21; 11-22, 11-23, 11-24, 11-25; 11-26; 11-27; 11-28

As noted above, following the proposed phased approach for Task 1.3 assessments, the identification of additional properties for early response actions under Task 1.4 will be incorporated into this EE/CA. In an effort to consider the privacy of the property owners and residents, detailed descriptions of the parcels are not included herein. The properties typically include residential structures (e.g. houses) and a large and/or acreage. The property lot size and configuration varies widely within and outside of the 8 year floodplain. The use of the properties within the 8 year flood elevation varies widely ranging from some use to no use. The general land-use features and locations identified for evaluation in this EE/CA include trails, lawns with bare soil areas, fire pits, recreation areas, and gardens.

### **1.5 Basis (or Bases) for Action**

As part of a NTCRA Action Memorandum, EPA in consultation with DNRE will review the factors and determine which of the regulatory bases for removal actions apply.

### **1.6 Trigger Criteria and Subsequent Incorporation of Additional Task 1.4 Properties**

The criteria utilized for Task 1.3 to determine if early response actions are necessary prior to segment-specific work incorporates and builds upon certain aspects of the previously established IRA criteria, which identified the potential need for interim response activities on

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properties flooded by the March 2004 flood event and assumed that those properties contain furan/dioxin levels above the IRA action level unless established otherwise by sampling. The Task 1.3 characterization and assessment process, which establishes detailed property-specific information including current land-use activities and the presence of bare soils builds upon the presumptive IRA approach, to establish the criteria used to identify properties for consideration under Task 1.4. In summary, the criteria for including residential properties or portions of residential properties for potential early action under Task 1.4 are: the presence of bare soil; and areas actively used by the residents of the property; and generally within the 8-year floodplain. In addition, residential properties that meet the Task 1 trigger criteria, but have previously received adequate IRA mitigation measures, are also sequenced into Task 1.4 for potential periodic maintenance. The criteria that would make a property eligible for early action under Task 1.4 are performance based, therefore no conclusions about actual exposure or risk have been made for any individual property.

This EE/CA has been developed to initially address those residential parcels identified for early action in the Task 1.1 Technical Memorandum and during the Task 1.3 assessments provided in the Task 1.3 report for EU010 and EU011; however, if additional properties are identified for early action through further evaluation under Task 1.2 and additional Task 1.3 evaluations, this EE/CA will be utilized to develop early response actions to address these additional parcels. EU010 and EU011 were evaluated as Phase 1 of the Task 1.3 assessments. Subsequent Task 1.3 assessments would be conducted during the proposed Phases 2 through 4 assessments proposed to be completed by the end of 2011. Residential properties along the Tittabawassee River included in Task 1.3 assessments will be evaluated based upon the criteria identified above; but other performance-based criteria may need to be considered for different property use and/or along the Saginaw River.

## 2 Characterization and Assessment

As described in the Task 1.3 Report, data and information used in the Task 1.3 assessment and characterization of EU010 and EU011 were obtained from the following sources.

- *Final GeoMorph Site Characterization Report, Tittabawassee River and Floodplain Soils, Midland, Michigan. Ann Arbor Technical Services, Inc. June 15, 2009*
- *Electronic data from EPA sampling events at EU properties in 2008*
- *P1/P2 Action Database for EU010 and EU011*
- *The EU010 and EU011 boundaries and the property boundaries for parcels within EU010 and EU011 that were included in the Task 1.1 Technical Memorandum*

The characterization and assessment process of EU properties involved three steps:

1. Property owner notification to perform a Task 1.3 property land-use assessment visit.
2. Characterization and assessment of EU properties through property inspections and interviews with property owners or residents to document existing land-use activities and to evaluate property conditions within and proximal to the 8-year flood elevation and the presence of soils that have been relocated out of the 8-year floodplain.
3. Determination of the need for an early response action prior to segment-specific work, Task 1.4.

The Task 1.3 characterization and assessment results for parcels proposed for early action are summarized in Table 1. For the eight parcels proposed for early action in the Task 1.1 Technical Memorandum, the property owners of four of the parcels had been contacted and property visits were completed in time for this Task 1.4 Report. Best efforts for the purposes of Task 1 are underway to obtain permission to complete property assessments for the remaining four parcels. As part of the characterization and assessment process, the EU010 property parcel (10-06) was removed from sequencing to this Task 1.4 EE/CA due to the absence of bare soil within the 8-year floodplain.

As discussed above, land-use features and locations identified during the characterization and assessment process typically included trails, lawns with bare soil areas, fire pits, recreation areas, and gardens. This Task 1.4 EE/CA addresses these land-use features and locations.

### **3 Response Option Goals and Objectives**

The goal of this EE/CA is to evaluate response options for early response actions for use in addressing the Task 1.4 property parcels prior to the Segment Specific Response Proposal. This EE/CA focuses on those response options that are most appropriate considering site-specific factors (e.g., land-use), and that meet the response action objectives of Task 1.4 as set forth in the SOW.

#### **3.1 Determination of Scope**

The purpose of Task 1 is described in Section 1 of the SOW. Under Task 1, the response actions are intended to be early actions, limited in scope, and focused on controlling the potential for acute or near-term risks. The Task 1 interim actions will be evaluated again under Task 8 and, depending on the results of that evaluation, additional response action activities may or may not be necessary as part of the final remedial activities.

#### **3.2 Determination of Schedule**

As described above, the Task 1 response actions are intended to be early actions that are limited in scope. Implementation of the Task 1 response actions ideally can be completed quickly with an estimated construction schedule of less than two weeks for each property. In an effort to avoid inclement weather and potential flooding, the construction season would likely begin in May following the spring thaw and end in late October. It is anticipated that the response actions for EU010 and EU011 properties could be completed in one construction season.

#### **3.3 Identification and Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)**

Any response actions implemented under Task 1 must comply with substantive elements of ARARs, in accordance with EPA's National Contingency Plan. Though a response action performed under formal CERCLA authorities would be exempt from the procedural requirements of federal, state and local environmental laws, the action must nevertheless comply with the substantive requirements of such laws.

ARARs may be categorized as: 1) chemical-specific; 2) action-specific; or 3) location-specific. Chemical-, action-, and location-specific ARARs that may be applicable to Task 1 response actions are identified below. These ARARs (particularly action-specific ARARs) may be further refined during the design of property-specific response actions as part of Task 1.5 based on localized conditions.

##### **3.3.1 Chemical-Specific Requirements**

No chemical-specific requirements are applicable for the Task 1 activities as the response actions are interim, near-term actions, and are performance- based.

##### **3.3.2 Action-Specific Requirements**

Since the proposed Task 1 response actions are comprised of interim isolation and relocation actions with minimal disturbance to surrounding areas, no action-specific requirements have

been identified at this time. Action-specific requirements may be further refined during the design based on localized conditions.

### **3.3.3 Location-Specific Requirements**

Two location-specific requirements were identified as potential ARARs for Task 1 response actions and are presented in Table 2. Location-specific requirements within the floodplains may be applicable for alternatives that propose placement of control barriers (or fill) within the floodplain. Location-specific requirements within or adjacent to wetlands may also be applicable to activities occurring within or near wetlands.

### **3.4 *Integration with Anticipated Future Response Actions***

Task 1 response actions are intended to be early actions prior to segment specific actions; therefore, proposed early response actions will not impede any further response actions that may be necessary in the future.

## **4 Identification of Technologies and Development of Response Action Alternatives**

### **4.1 Identification of Technologies**

This EE/CA relies on previously implemented and proven technologies. The identified early action technologies that have been successfully implemented to date to provide barrier controls within the 8-year floodplain include physical isolation (e.g., soil contact control barriers) and movement of land-use features. Each of the retained technologies as well as “No Action” was developed into alternatives for evaluation in this EE/CA. The “No Action” alternative was included for comparison with the other, proven technologies, consistent with National Contingency Plan (NCP) requirements.

### **4.2 Development of Response Action Alternatives**

#### **4.2.1 Alternative 1: No Action**

Under the No Action alternative, no physical response action would be performed. Taking no action is an alternative that will be considered as a baseline that all other alternatives can be measured against. Education for mitigating potential contact with potentially affected soil may be an element of this alternative.

#### **4.2.2 Alternative 2: Control Barrier and Maintenance of Existing and New Barrier Controls**

The physical isolation or control barrier alternative would consist of placing a physical barrier over bare 8-year floodplain soils to limit contact with potentially affected underlying soil. The control barrier would consist of a layer (nominally 2 inches) of gravel/stone, wood chips, or soil. If a soil cover is chosen, the soil would be revegetated. Control barriers would be placed over actively used trails, lawns with bare soil areas, and recreation areas. The type of control barrier chosen for a particular area would be determined in the field based on land-use and resident input. A maintenance program would be developed and initiated by Dow, but may also include self-reporting on the part of the property owners, to repair damages to the control barriers. This maintenance program would encompass repair of new EU control barriers as well as control barriers installed as part of the P1/P2 work. Additionally, education for maintaining the control barrier and mitigating potential contact with potentially affected soil would be an element of this alternative.

#### **4.2.3 Alternative 3: Movement of Land-use Feature**

Under the movement of land-use feature alternative, a land-use feature would be moved out of the 8-year flood elevation to reduce or eliminate the effect of floods and contact to potentially affected soil. Potential land-use features that may be relocated include gardens (vegetable or flower), recreation equipment, or burn/fire pits. Education for maintaining the relocated structure outside of the floodplain (including keeping new land-use features outside of the floodplain) and mitigating potential contact with potentially affected soil would be an element of this alternative.

## 5 Analysis for Response Action Alternatives

The three retained response action alternatives listed in Section 4.2 were assessed both individually and through a comparative analysis relative to the three EE/CA criteria: effectiveness, implementability, and cost.

The evaluation criteria used for this Task 1.4 EE/CA are presented below as required by Section GVIII.G.3 of the SOW:

### Effectiveness

- **Overall Protection of Human Health and the Environment:** Addresses the ability of the proposed alternative to be protective of human health and the environment under present land-use conditions until final remedial measures are implemented.
- **Compliance with ARARs:** Assesses whether the alternative attains the identified chemical-specific, action-specific, and location-specific ARARs. As discussed in Section 3.3, all response action alternatives will comply with identified ARARs; therefore, this criterion will not be discussed as part of the individual and comparative analyses.
- **Long-term Effectiveness:** Evaluates the alternative for the long-term effectiveness and permanence with respect to the ability to achieve response option objectives. Barrier controls will be constructed and maintained to ensure effectiveness until final remedial measures are implemented under Task 8; therefore, this criterion will not be discussed as part of the individual and comparative analyses.
- **Reduction of Toxicity, Mobility, or Volume through Treatment:** Addresses the degree to which an alternative reduces the toxicity, mobility, or volume of chemical constituents through treatment. Reduction in toxicity, mobility, or volume through treatment would not occur for any of the response action alternatives because none of the alternatives include a treatment component. However, reduction in mobility would be achieved by isolation of the potentially affected soils.
- **Short-term Effectiveness:** Addresses the effects of a proposed alternative during the construction and implementation phase until the response option objectives are met. This criterion includes the time with which the remedy achieves protectiveness and the potential to create adverse impacts during construction and implementation.

### Implementability

- **Implementability:** Evaluates the implementability of the alternative by considering technical feasibility (evaluation of construction and operational considerations), administrative feasibility (activities needed to coordinate with other local and state offices and agencies), and availability of services and materials required for implementation. All action alternatives will be conducted on-site under CERCLA; therefore, permits will not be required and the substantive technical provisions of any permits will be met. There are no administration items impeding implementability and this part of the

implementability criterion will not be discussed as part of the individual and comparative analyses.

- Evaluation of acceptance of the proposed alternative by the property owners or residents.

### **Cost**

- **Cost:** Assesses direct and indirect construction costs. For the purposes of this EE/CA, the proposed alternatives were evaluated based on estimated costs, including labor, equipment, maintenance, and materials used during installation. Maintenance costs are anticipated to be low for Alternatives 2 and 3, and will be further developed as part of an operations and maintenance plan.

### **5.1 Individual Analysis of Response Action Alternatives**

Each response action alternative was evaluated relative to effectiveness, implementability, and cost criteria in the sections below. A summary of the individual analysis of response action alternatives is provided in Table 3.

#### **5.1.1 Alternative 1: No Action**

Under the No Action alternative, no physical response actions or controls will be implemented. The soil areas will remain “as is.” However, education for mitigating potential contact with potentially affected soil may be an element of this alternative.

**Effectiveness:** Since no physical response action activities would be implemented to control contact with potentially affected bare floodplain soils this alternative will not be effective at meeting the objectives of Task 1. Educational materials can be provided to residents on measures they can take to minimize contact with potentially affected soils. There are no workers involved and no reduction in mobility under this alternative.

**Implementability:** The no action alternative is easily implementable, since no additional construction activities would be conducted. The availability of services, materials, and/or technologies is not applicable to this alternative. Acceptance of this alternative may be achieved if the property owners or residents refuse an alternative early action.

**Cost:** There is minimal cost associated with this alternative.

#### **5.1.2 Alternative 2: Control Barrier and Maintenance of Existing and New Barrier Controls**

Under the control barrier alternative, a physical isolation barrier will be placed over the bare 8-year floodplain soils where land-use occurs to limit contact with potentially affected bare soil.

**Effectiveness:** Under this alternative, the control barrier would be effective at reducing human contact with potentially affected soils by providing a physical isolation barrier. Experience at other properties with similar conditions (e.g., previous IRAs) indicates that placing wood chips, stone, or other protective covers of approximately 2 inches in thickness provides an effective

near-term human barrier control that typically retains its integrity through flooding. Minor maintenance of the protective covers, as needed after flooding events, will ensure continued effectiveness. As discussed above, a maintenance program would be developed and initiated by Dow, but may also include self-reporting on the part of the property owners, to repair damages to the control barriers.

Control barriers can be designed to suit the range of conditions and specific land-use features that exist at a particular property. For example, a gravel/stone barrier on a frequently used trail may be more durable than trying to revegetate those soils.

Although a control barrier would not reduce toxicity or volume through treatment, the control barrier would achieve a reduction in mobility by isolation of the potentially affected soils.

In the short-term, construction workers may contact potentially affected soils during installation of the control barrier; however, this contact will be mitigated through measures specified in a site-specific health and safety plan and by making sure that workers have the appropriate equipment and training to implement the remedy. Installation of the control barrier could be completed quickly and therefore, the timeframe for the remedy to reach protectiveness goals is minimized.

**Implementability:** This alternative is a readily implementable response option that has been applied successfully as part of the earlier IRAs. Contractors capable of installing the control barriers and the equipment and materials used during installation are readily available in the area. The type of control barrier would be selected, designed, and installed in cooperation with each resident and thus is expected to meet the acceptance criteria.

**Cost:** The estimated construction costs (expressed in terms of a unit cost per type of material, inclusive of labor, equipment, and material costs) for installing a gravel/stone barrier, wood chip barrier, or vegetated soil barrier are provided below.

- Stone Barrier (\$/square yard) = approximately \$3.50
- Wood Chip Barrier (\$/square yard) = approximately \$2.00
- Vegetated Soil Barrier (\$/square yard) = approximately \$3.25

### **5.1.3 Alternative 3: Movement of Land-use Feature**

Under this alternative, a land-use feature would be moved out of the 8-year floodplain to reduce or eliminate the effects of floods and human contact with potentially affected soils. Additionally, a control barrier would be installed over any bare soil after the land-use feature is relocated.

**Effectiveness:** The movement of the land-use feature would be effective at reducing human contact with potentially affected soils, because the land-use feature would be relocated to a suitable part of the property. Alternatively, as in the case of a garden, the land-use feature may be raised to an elevation outside of potential frequent flooding impacts.

In the short-term, construction workers may contact potentially affected soils during installation of the control barrier; however, this contact will be mitigated through measures specified in a site-specific health and safety plan and by making sure that workers have the appropriate training to implement the remedy. Installation of the control barrier could be completed quickly and therefore, the timeframe for the remedy to reach protectiveness goals is minimized.

**Implementability:** The movement of a land-use feature is generally a readily implementable response option and has been successfully applied as part of the IRA. Contractors capable of moving and potentially reinstalling the land-use feature and the equipment and materials used during movement/installation are readily available in the area. The movement of a land-use feature would be conducted in cooperation with each resident and thus is expected to meet the acceptance criteria.

**Cost:** The estimated construction costs (expressed in terms of unit cost per land-use feature) for moving and installing an elevated garden, recreation area, and fire pit will vary depending on size and location. Some typical costs are provided below:

- Elevated garden (\$/100 square feet with 1 foot of cover material) = approximately \$100
- Recreation area (Relocation of existing recreation area - \$/recreation area) = \$800 to \$900
- Fire pit (Installation of a new fire pit with pavers around it - \$/fire pit) = \$800 to \$900

## **5.2 Comparative Analysis of Action Alternatives**

In Section 5.1, each alternative was analyzed independently without consideration of other alternatives. In this section, a comparative analysis is completed to evaluate the relative performance of each alternative in relation to effectiveness, implementability, and cost. The purpose of this comparative analysis is to identify the basic advantages and disadvantages of the selected alternatives. Each property may exhibit specific characteristics that may weigh into a comparative analysis, and selection of the specific action alternative (or, as appropriate, multiple alternatives) for specific properties cannot be determined at this time. During the final selection of the action alternative for each property, the specific characteristics and property owner or resident input will be considered.

### **5.2.1 Effectiveness**

Both Alternatives 2 and 3 would be effective at reducing contact with potentially affected bare soils by providing a physical isolation barrier or relocating the feature. Alternative 1 would not be effective at preventing contact with potentially affected soil thus would not meet the objectives of Task 1.

As there is no physical response action activities associated with Alternative 1 (No Action), there are no increased short-term potential contact issues for workers. There may be minimal contact with potentially affected soils by construction workers when implementing Alternatives 2 and 3; however, this contact will be mitigated through measures specified in a site-specific health and safety plan and by making sure that workers have the appropriate equipment and training to

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implement the remedy. Both Alternatives 2 and 3 could be installed quickly and therefore, the timeframe for the remedy to reach protectiveness goals is minimized.

Alternatives 2 and 3 are considered to be effective for meeting the objectives of Task 1.

Ongoing monitoring is being performed at EU001 and EU002 to help inform the likelihood of redeposition of sediments following flood events. As information becomes available, the continued effectiveness of the barrier controls will be reevaluated.

### **5.2.2 Implementability**

Alternative 1 is easily implemented because it requires no actions to change or affect the current site conditions. Both Alternatives 2 and 3 are well proven to be readily implementable response options with capable contractors and necessary supplies.

The desire to implement an action and the type of response option implemented at a property will be conducted in cooperation with the resident. Therefore, all three alternatives are expected to meet the acceptance criteria.

### **5.2.3 Cost**

The costs to implement Alternative 1 is minimal, while the costs for implementing Alternatives 2 and 3 are generally low depending upon the land-use feature.

## 6 Conclusions

Based on the comparative analysis presented in Section 5, Alternatives 2 and 3 are carried forward as recommended alternatives for properties under this Task 1.4 EE/CA. Both Alternatives 2 and 3 are acceptable action alternatives that meet the response option objective in areas of current residential or high use. Alternative 1 (No Action) is not being carried forward as an acceptable recommended alternative. However, if a property owner refuses an early action, the property would be reevaluated as part of the relevant segment-specific response. Best efforts will be used to obtain participation in Task 1 activities.

Dow will work in cooperation with each property owner or resident to select, design, and install one of these acceptable action alternatives.

## 7 References

Ann Arbor Technical Services, Inc. 2009. Final GeoMorph Site Characterization Report, Tittabawassee River and Floodplain Soils, Midland, Michigan. June 15, 2009.

The Dow Chemical Company (Dow). 2010a. Task 1.1 Technical Memorandum-Revision 1, The Tittabawassee River/Saginaw River & Bay Site. Prepared by The Dow Chemical Company. June 2, 2010.

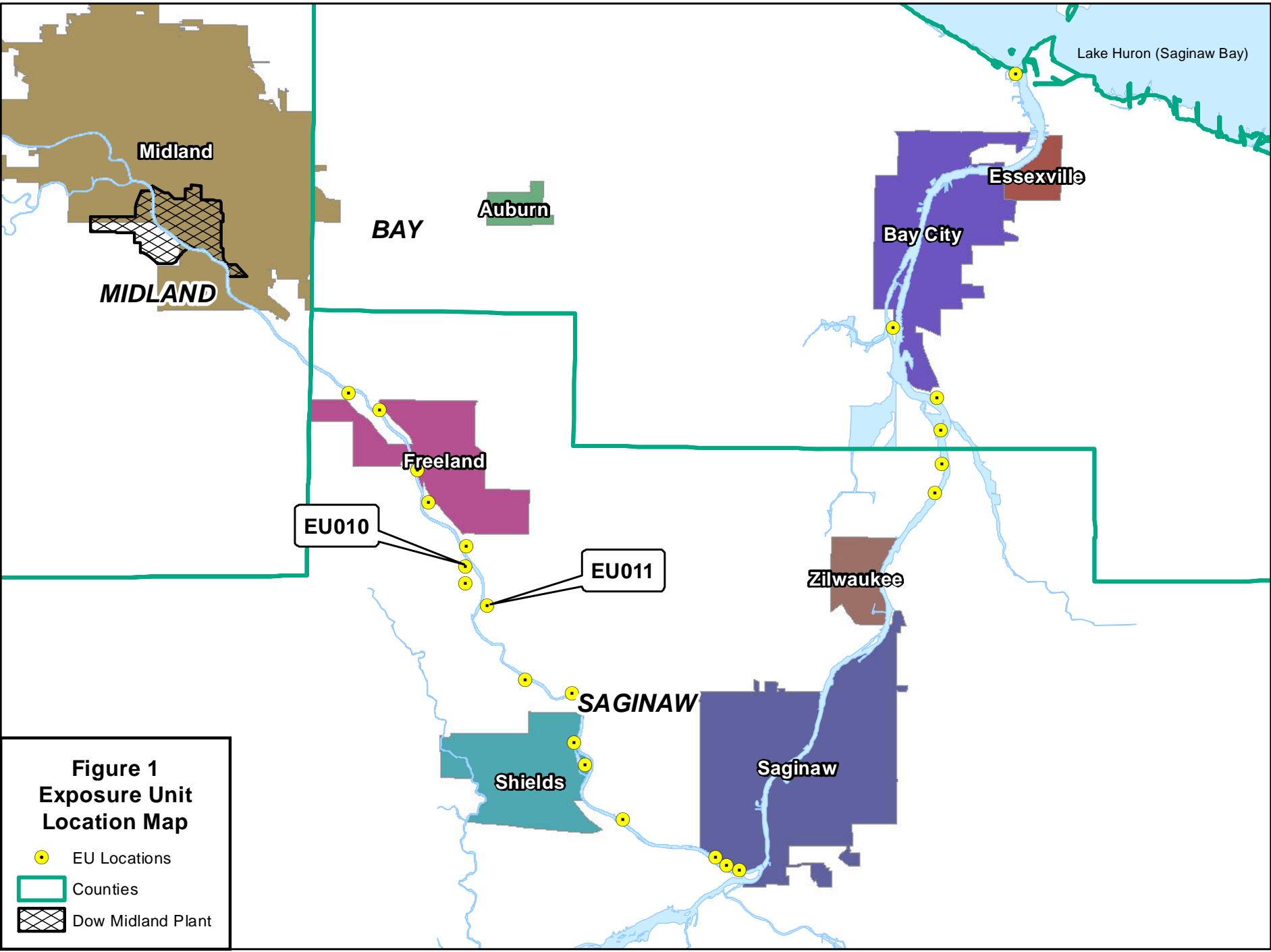
Dow. 2010b. Task 1.3 Determination for the Need for Early Response Actions in EU010 and EU011-Revision 1, The Tittabawassee River/Saginaw River & Bay Site. Prepared by The Dow Chemical Company. October 29, 2010.

U.S. Environmental Protection Agency (EPA). 2010. Letter to: Todd Konechne, Dow. Regarding: DRAFT Task 1.1 Technical Memorandum. May 3, 2010.

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Figure 1: Exposure Unit Location Map

Figure 2: Task 1 Characterization and Sequencing



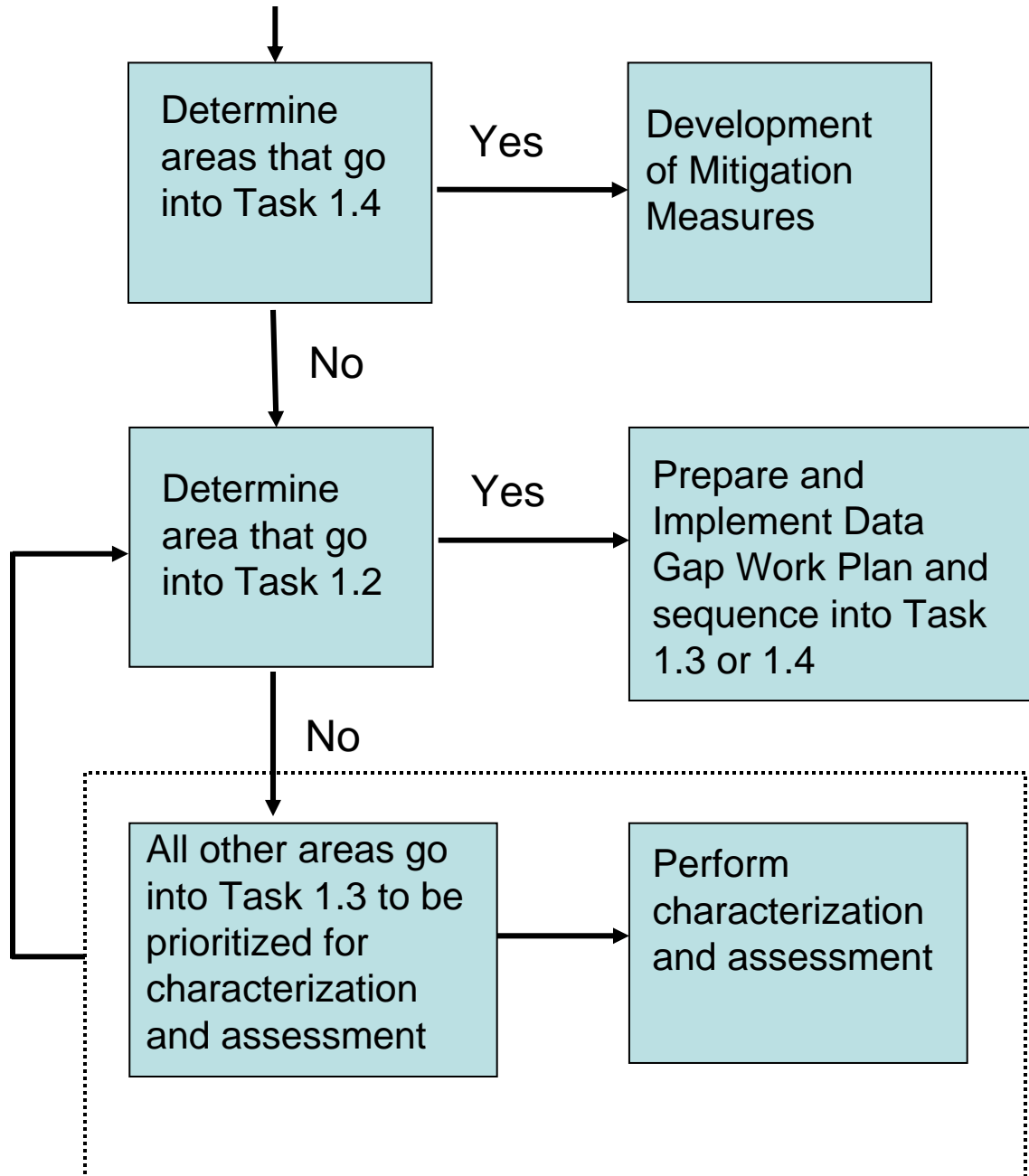
**Figure 1**  
**Exposure Unit**  
**Location Map**

- EU Locations
- Counties
- Dow Midland Plant

# Figure 2:

## Task 1 Characterization and Sequencing

### Task 1.1 Sequencing



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Table 1: Summary of Task 1.3 Results

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**Table 1  
Summary of Task 1.3 Results  
EU010 and EU011**

Property #	Home Visit Completed	Task 1.3 Assessment Criteria Evaluation				Sequence to Task 1.4
		Property Use within Floodplain	Bare Soil Area	Previous Mitigation Measure Adequate based upon Current Use	Meets the IRA Presumptive Criteria	
<b>EU10 Properties</b>						
10-01	Yes	Yes	Yes	NA	Yes	Yes
10-02	Yes	Yes	Yes	NA	Yes	Yes
10-03	Yes	Yes	No	Yes	Yes	Yes <sup>1</sup>
10-05	Yes	Yes	Yes	NA	Yes	Yes
10-06	Yes	Yes	No	NA	Yes	No
<b>EU11 Properties</b>						
11-03	Yes	Yes	Yes	NA	Yes	Yes
11-04	Yes	Yes	Yes	NA	Yes	Yes
11-05	Yes	Yes	Yes	NA	Yes	Yes
11-06	Yes	Yes	Yes	NA	Yes	Yes
11-07	Yes	Yes	Yes	No	Yes	Yes
11-09	Yes	Yes	Yes	Yes	Yes	Yes
11-10	Yes	Yes	Yes	NA	Yes	Yes
11-11	Yes	Yes	Yes	NA	Yes	Yes
11-13	Not Yet	Assessment Not Yet Completed				
11-14	Not Yet	Assessment Not Yet Completed				
11-15	Not Yet	Assessment Not Yet Completed				
11-16	Not Yet	Assessment Not Yet Completed				
11-17	Yes	Yes	Yes	NA	Yes	Yes
11-21	Yes	Yes	Yes	NA	Yes	Yes
11-22	Yes	Yes	Yes	NA	Yes	Yes
11-23	Yes	Yes	Yes	NA	Yes	Yes
11-24	Yes	Yes	Yes	NA	Yes	Yes
11-25	Yes	Yes	Yes	NA	Yes	Yes
11-26	Yes	Yes	Yes	NA	Yes	Yes
11-27	Yes	Yes	Yes	NA	Yes	Yes
11-28	Yes	Yes	Yes	NA	Yes	Yes <sup>1</sup>

**Notes:**

NA = not applicable

The Presumptive Criteria are presented in the Tittabawasee River Interim Response Activities Work Plan.

<sup>1</sup> Property with areas outside of the 8-year flood boundary that were identified as potentially having soils relocated from within the floodplain.

**Table 2**  
**Potential Location-Specific ARARs for Task 1**

Location	Standard or Requirement	Regulatory Citation	Comment
Within Floodplain	Requirements to avoid adverse impacts, minimize potential harm, and restore and preserve natural and beneficial values	Executive Order 11988, Protection of Floodplains (40 CFR 6, Appendix A); FEMA National Flood Insurance Program Regulations (44 CFR 60.3 (d)(3)).	Applicable to construction activities within a floodplain, including any dredge or fill operations
Within/Adjacent to Wetlands	Requirements for no net loss and to minimize destruction or degradation of wetlands	Executive Order 11990; Protection of Wetlands (40 CFR 6, Appendix A)	May be applicable if selected remedy involves activities in or adjacent to wetlands

**Table 3  
Summary of Analysis of Response Action Alternatives**

Alternative Description	Qualitative Ranking		
	Effectiveness	Implementability	Cost
<b>Alternative 1: No Action</b> - Under this alternative, no physical response action would be performed.	<b>LOW</b> - Since no physical response action activities would be implemented to control potential contact with potentially contaminated bare floodplain soils, this alternative will not be effective at meeting the objectives of Task 1. There would be no physical barrier in place to reduce potential contact with bare floodplain soils. Educational materials can be provided to residents on measures they can take to minimize soil contact with potentially contaminated soils. No reduction in mobility under this alternative.	<b>MODERATE to HIGH</b> - This alternative is a readily implementable response option and has been utilized under previous IRAs.	<b>LOW</b> - Cost would be minimal for this alternative.
<b>Alternative 2: Control Barriers and Maintenance of Existing and New Contact Controls</b> - Under this alternative, a physical barrier will be placed over the bare floodplain soils to limit contact with underlying soil. A maintenance plan will be developed which outlines a proactive approach to maintenance and also include self-reporting on the part of the property owner.	<b>HIGH</b> - Control barriers will be effective at reducing human contact with potentially contaminated bare soils by providing a physical isolation barrier.	<b>HIGH</b> - This alternative is a readily implementable response option and has been successfully applied as part of the previous IRAs.	<b>LOW</b> - Unit costs per type of material (including labor, equipment, and materials) installed range from \$2 to \$3.50 per square yard.
<b>Alternative 3: Movement of Land Use Feature</b> - Under this alternative, a land use feature would be moved out of the 8-year floodplain to reduce or eliminate the potential for flooding. A control barrier would be installed over any bare soil after the land-use feature is relocated.	<b>HIGH</b> - The movement of the land use feature will be effective at reducing human contact with potentially contaminated bare soils, as the land-use feature will be relocated outside of the 8-year floodplain.	<b>HIGH</b> - This alternative is a readily implementable response option and has been successfully applied as part of the previous IRAs.	<b>LOW</b> - Unit costs per land use feature (including labor, equipment, and materials) range from \$100.00 to \$900.00 depending upon the land use feature.