The U.S. Environmental Protection Agency, working with the Michigan Department of Environmental Quality, plans to cleanup dioxin-contaminated sediment and riverbanks in Segment 3 of the Tittabawassee River. Segment 3 is a 4-mile stretch of the river starting about seven miles below where the Chippewa River meets the Tittabawassee River, downstream of the Dow Chemical Co. plant in Midland.

There are distinct areas in Segment 3 that require cleanup called Sediment Management Areas, or SMAs, and Bank Management Areas, or BMAs (see map, Page 2). Since each area is different, EPA’s plan calls for a combination of steps. Here is what EPA proposes for each area:

- SMA 3-1 – Dig up contaminated sediment and remove it.
- SMA 3-2 – Cover contaminated sediment to keep it safely in place.
- BMAs 3-1 through 3-10 – Apply cleanup technologies that stabilize the bank and stop erosion of contaminated riverbank soil.

Your comments are needed

EPA will select a final cleanup plan after reviewing comments received during the public comment period. This proposed plan fact sheet gives you background information, describes cleanup options and explains EPA’s recommendations. You can find more details in the Tittabawassee River Segment 3 Response Proposal. EPA wants your comments on this technical report, which you can find on our website and at the local information repositories listed on Page 71 (see box, left, for ways you can participate in the decision-making process).

1 EPA expects that the public may want more than the normal 30-day public comment period and therefore is providing in advance a 15-day extension to the public comment period pursuant to Section 300.415 (n) (4)(iii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).
Plan builds on previous work
Segment 3 is the next stretch of the Tittabawassee River to be cleaned up. This proposed plan is similar to previous cleanup work done successfully upstream in areas of Segments 1 and 2. EPA studied Segment 3 extensively, taking many samples and evaluating sediment and riverbanks to see how they change or erode over time. EPA also studied how contaminants build up in the food chain.

Not all of the Segment 3 sediment and riverbank soil is contaminated. EPA identified two SMAs in Segment 3. These areas include deposits that contain higher levels of dioxins that built up over time. Each of the SMAs is a little under half an acre. EPA identified 10 BMAs because these riverbanks are the least stable, and they could be a significant way for dioxins to get back in the river if the banks erode. The BMAs range in length from about 100 feet to 2,000 feet. EPA identified a total of about one and one-third miles of the Segment 3 banks as BMAs.

EPA will have Dow begin cleanup in these distinct sediment and riverbank areas, and continue to evaluate other places in Segment 3 where cleanup may be needed.

Why is this cleanup important?
Dioxin in the top layer of sediment can build up, or bioaccumulate, in the food chain. When people or animals eat fish from the river they are exposed to small amounts of dioxin. The contamination in deeper sediment and in the riverbanks is a concern because erosion of these areas can move contamination into surface sediment or downstream.

EPA has two main cleanup goals for these Segment 3 actions. First, reduce the spread of dioxin-contaminated riverbank soil and sediment to keep dioxin levels low in Segment 3 and farther downstream. Second, help keep dioxin from building up in fish in the Tittabawassee River.
Background
The Dow Chemical Co. has been operating at its Midland plant since the 1890s. Dioxin (primarily furans) is found in and along the Tittabawassee and Saginaw rivers and in Saginaw Bay from former waste management practices at Dow’s Midland plant. In the past, chemicals got into the Tittabawassee River where they settled in some sediment and built up in some riverbanks, like the SMAs and BMAs in Segment 3. Current waste management practices now control contaminant releases from Dow’s facility.

The term “dioxin” refers to a large family of similar chemicals, including furans. EPA has concluded that dioxin may cause cancer or other health effects such as skin problems, liver damage and reproductive issues, depending on exposures. Dioxin is not created intentionally but can be formed by human activity or naturally – by fires, for example. In this case, dioxin formed as a byproduct of Dow’s early manufacturing processes. Dioxin binds strongly to particles of soil or sediment and does not readily dissolve in water.

EPA, working with MDEQ, is directing Dow’s investigation and cleanup of the river. EPA divided the Tittabawassee River into seven segments ranging from three to four miles each. River work is being done in stages from upstream to downstream, segment-by-segment. Segment 1, a 3-mile stretch next to Dow’s Midland plant, is the most upstream segment. Dow started cleanup of Segment 1 in 2012 and largely completed work in 2013. Dow started cleanup of Segment 2, a 4-mile stretch, in 2014 and EPA expects completion later this year.

Evaluation and cleanup of properties in the adjacent Tittabawassee floodplain started this year and will be a multi-year project.

Summary of cleanup alternatives
SMA cleanup alternatives: There are three alternatives to clean up the SMAs. The alternatives may be applied singly, or in combination. Here is a brief description of the sediment technologies:

- **SMA Alternative 1:** Monitored natural recovery relies on natural processes to reduce contaminant levels and risks over time.
- **SMA Alternative 2:** Capping places clean material such as sand or gravel over contaminated sediment. An innovative sediment cleanup approach used in earlier cleanups is called a cellular confinement system cap, or CCS cap. The CCS cap fills naturally to isolate and contain the sediment and to prevent erosion.
- **SMA Alternative 3:** Removal involves taking contaminated sediment out of the river with heavy equipment. It can be done in either wet or dry conditions. Water is managed, and the sediment is hauled off-site to an approved location for disposal.

BMA cleanup alternatives: There are two alternatives to clean up the BMAs. These alternatives may be applied singly or in combination. Here is a brief description of the riverbank soil technologies:

- **BMA Alternative 1:** Stabilization relies on natural or engineered approaches to reduce or prevent riverbank erosion. Stabilization technologies can be as simple as using natural processes to maintain the existing bank soils and slopes by encouraging native, deep-rooted plants to enhance the bank’s natural stability. Or, the
technologies can include more constructed approaches like bank reshaping or installing bank stabilization products that control erosion, followed by replanting with native plants.

- **BMA Alternative 2**: Removal involves using heavy equipment to remove targeted bank deposits and haul them off-site for disposal at an approved location. All existing vegetation is removed. After contaminated soil is removed, the area is re-graded and replanted.

### Evaluation of alternatives

EPA is required to evaluate these options against the criteria of effectiveness, implementability and cost (see box below). These three criteria are used to help compare how the alternatives will meet cleanup goals.

**Explanation of evaluation criteria**

For this type of action, EPA uses three criteria to evaluate and compare cleanup options.

- **Effectiveness** evaluates the ability of an alternative to meet project objectives, and whether it is protective and reliable.
- **Implementability** evaluates how difficult the option will be to complete, whether materials and services are available in the area and whether it is acceptable to the community.
- **Cost** includes the estimated costs to construct the option (for example, equipment, materials and labor), as well as the long-term costs of monitoring and maintaining the option.

**SMA alternatives**

Table 1 on Page 5 compares each SMA alternative against the criteria of effectiveness, implementability and cost.

**Effectiveness**: All SMA alternatives are expected to help protect human health and the environment, meet the cleanup goals, and comply with laws and regulations. The location of contaminants within the sediment – either closer to the surface or deeper – can influence the effectiveness of cleanup options. The potential effectiveness of the alternatives differs because of:

- **Long-term effectiveness and permanence** – All of the alternatives for each SMA are expected to be effective in the long term.
  - The time frame to attain protection is uncertain for monitored natural recovery (SMA Alternative 1), especially for SMA 3-1 where elevated dioxin levels are close to the sediment surface. This alternative must be closely monitored to make sure it is working on an acceptable timeframe.
  - Capping (SMA Alternative 2) provides an immediate benefit by isolating and safely containing the
Use this space to write your comments

EPA is interested in your comments on the proposed cleanup plan for Segment 3 of the Tittabawassee River. Comments provided by the public are valuable in helping EPA select a cleanup plan.

You may use the space below to write your comments. To submit, you may detach, fold, stamp and mail the form; turn in at the Sept. 23 public meeting; fax to 989-401-5508; or use the public comment form at www.epa.gov/region5/cleanup/dowchemical. Comments must be submitted or postmarked by Oct. 15. If you have any questions, please contact Diane Russell at 989-401-5507, or russell.diane@epa.gov, 9:30 a.m. – 5:30 p.m. weekdays.

Name ____________________________________________
Address __________________________________________
City __________________________ State ________
Zip ________________________________
EPA Proposes Cleanup Plan for Tittabawassee River’s Segment 3
Public Comment Sheet

Diane Russell
Community Involvement Coordinator
U.S. EPA Region 5 Superfund Division
Saginaw Community Information Office
804 S. Hamilton St., Suite 111
Saginaw, MI 48602
contamination. Capping options at the SMAs may offer the benefit of maintaining or enhancing habitat. Caps have to be monitored and may need maintenance to make sure they are reliable in the long term.

- Removal (SMA Alternative 3) would be effective in the long term because it permanently removes contaminated sediment from the river system, preventing erosion and downstream movement. When the contamination extends to the bottom of the sediment or when there is debris, it is difficult to completely remove all the contaminated material. This is especially difficult when the removal is performed in wet conditions. The materials left behind that cannot be removed are called residuals. After removal is complete, EPA expects cleaner sediment moving through the system to quickly cover any residuals.

**Short-term effectiveness** – All options except monitored natural recovery would have some short-term effects that would temporarily disrupt areas in and along the river during construction. It is important to understand and work around river flow conditions while the work is underway to lessen short-term effects. Short-term effects would be managed by construction practices.

- Capping takes less time to complete than removal does. Capping could result in short-term turbidity, or a cloudy appearance, in the water.

- Removal could also result in short-term turbidity, release of contaminants to surface water and movement of contaminants downstream during construction, especially when the work is performed in wet conditions. If removal is performed in dry conditions, care is needed to prevent erosion in nearby areas.

- If capping is done using sand or gravel, there would be truck traffic to deliver the clean cover materials. Removal would require truck traffic to take the contaminated sediment to an approved landfill. Construction also may require clearing areas that obstruct access to the site. Removal affects a larger nearby work area than capping using sand or gravel, and significantly more area than a CCS cap.

**Implementability:** All of the SMA alternatives can be carried out. Dow successfully completed similar actions at other areas in the Tittabawassee River. All equipment, personnel and material necessary to implement the alternatives should be locally available. EPA will evaluate community acceptance after public comments are received. MDEQ generally supports EPA’s recommended options, but will make a final recommendation after considering public comments.

- There are no implementation challenges with monitored natural recovery.

- Both capping and removal are easier during lower-flow conditions. Typically this work is planned later in the summer, but unexpected high flows can bring challenges.

- Capping using both sand and gravel and the CCS has been done with no major challenges.

- Implementability differs between alternatives because of the need for access to the river. Capping may require access roads and staging areas on privately held land, particularly for sand and gravel caps. CCS caps provide more flexibility in river access because heavy equipment is not used and the SMAs could be approached by water. Removal would require the greatest degree of site access, including temporary roads and staging areas for heavy equipment, contaminated sediment staging and transport, and water management equipment.

### Table 1 – Compares how each SMA alternative meets the evaluation criteria, relative to other SMA alternatives.

<table>
<thead>
<tr>
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<th>Effectiveness</th>
<th>Implementability</th>
<th>Estimated Cost</th>
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<tr>
<td><strong>Sediment Management Area 3-1</strong></td>
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<td>Moderate to High</td>
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<td>$110,000 – 330,000</td>
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<tr>
<td>Removal</td>
<td>High</td>
<td>Moderately difficult to implement</td>
<td>$990,000 – 1,080,000</td>
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<td><strong>Sediment Management Area 3-2</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MNR</td>
<td>Low to Moderate</td>
<td>Easy to implement</td>
<td>$28,000</td>
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<tr>
<td>Capping</td>
<td>Moderate to High</td>
<td>Moderately difficult to implement</td>
<td>$150,000 – 390,000</td>
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<tr>
<td>Removal</td>
<td>High</td>
<td>High difficult to implement</td>
<td>$1,350,000 – 1,440,000</td>
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</table>
Cost: Table 1 shows the estimated cost for each alternative by SMA. Monitored natural recovery is the least costly and removal is the most costly. The range of costs for capping reflects different cap designs. The range of costs for removal reflects different expected costs for work in dry versus wet conditions. The total estimated cost for EPA’s recommended SMA alternatives ranges from $1.1 million to $1.5 million.

BMA alternatives

Effectiveness: Both BMA alternatives are expected to help protect human health and the environment, meet the cleanup goals and comply with laws and regulations. The potential effectiveness of the alternatives differs because of:

Long-term effectiveness and permanence – Both alternatives for each BMA are expected to be effective in the long term.
- Stabilization (BMA Alternative 1) is effective in the long term and ensures that contaminated banks do not erode into the river. Along-term plan to monitor and maintain the banks would be needed.
- Removal (BMA Alternative 2) would be effective in the long term because it removes contaminated riverbank soil from the river system.

Short-term effectiveness – Both BMA alternatives would have short-term effects that would temporarily disrupt areas along the river during construction.
- Stabilization takes less time to do than removal does.
- Removal is expected to have the greatest short-term effects on workers and the community. It requires heavy construction equipment along the riverbank during excavation and re-grading and also truck traffic as contaminated bank soil is transported from the area. Stabilization may also require some construction traffic but it is expected to be significantly less.
- Stabilization would cause the least change to existing riverbank conditions. With stabilization the riverbank habitat would remain or be improved. The materials or approach needed to prevent erosion may change the look of some bank faces and surfaces. Some trees may be pruned to improve light. Also, small vegetation may be removed and replaced with native plants.
- More extensive changes to existing habitats are associated with removal. Removal requires clearing areas of all vegetation before work begins, including mature trees. Efforts to restore disrupted areas are part of the removal alternative. However, some habitats require decades to return to their pre-construction condition.

Implementability: All of the BMA alternatives can be carried out. Dow successfully completed similar actions along the Tittabawassee River in Segment 2. Necessary personnel and equipment are available for both options. EPA will evaluate community acceptance after public comments are received. MDEQ generally supports EPA’s recommended options, but will make a final recommendation after considering public comments.
- Landowner access is required to implement any of the BMA alternatives and will require access roads and staging areas through privately held land.
- The access requirements and need for staging areas are far less for stabilization, easing the ability to implement this alternative. Extremely high or steep banks may pose unique challenges for the placement of certain slope stabilization materials under BMA Alternative 1, and reshaping the banks may be necessary.
- Removal would require the greatest degree of site access, including roads and staging areas for heavy equipment, contaminated soil staging and transport, and equipment decontamination. In areas of dense vegetation or areas where access is limited, the BMA and surrounding areas would require extensive clearing and preparation to allow equipment access to the bank, making implementation of removal more difficult.

Cost: The riverbank stabilization alternative is less costly than the removal alternative. Stabilization costs about $50,000 per 100 feet of bank and removal costs about $150,000 per 100 feet. There are also costs associated with setting up and taking down each work area. The total estimated cost if all of the Segment 3 BMAs were removed is $11.1 million. The total estimated cost for stabilizing all of the BMAs, EPA’s recommended alternative, is about $3.9 million. If a combination of removal and stabilization is used, the cost will be in between.
**EPA's recommendation**

EPA, in consultation with MDEQ, recommends the following because these alternatives provide the best balance of effectiveness, implementability and cost:

**Segment 3 SMAs.** For SMA 3-1 EPA is proposing SMA Alternative 3, removal, because SMA 3-1 has high dioxin levels close to the sediment surface in a stretch where the sediment can move or erode with varying river flows. SMA 3-1 has sufficient clear area nearby for the heavy equipment and staging areas needed for removal. For SMA 3-2 EPA is proposing SMA Alternative 2, capping, because this area seems to be stable and clean sediment already covers the contamination. SMA 3-2 is near heavily wooded areas, so access will be challenging. CCS caps require less area for access and are more easily implemented than other types of caps. A cap will enhance the sediment stability and habitat, while short-term effects are minimized.

**Segment 3 BMAs.** For all BMAs 3-1 through 3-11 EPA proposes BMA Alternative 1, stabilization, because these bank stretches have characteristics that indicate stabilization will be effective and affect the existing natural habitat much less than removal. There are several technologies included in the stabilization alternative. The design process would examine key characteristics on a bank-by-bank basis, and would allow EPA to select the best suited technologies at each BMA. EPA will work with each property owner to design and install an acceptable stabilization approach.

EPA’s estimated costs for all of the cleanups proposed in this fact sheet for Segment 3 range from about $5 million to $5.4 million. Cost estimates will be refined as the cleanups are designed.

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**Next steps**

Before making a final decision, EPA will review comments received during the public comment period. Based on the comments, EPA, working with MDEQ, may modify the Agency’s recommended alternatives or choose another, so your opinion is important. EPA encourages you to review and comment on this proposed cleanup plan and the Tittabawassee River Segment 3 Response Proposal. More details are available in the official documents on file at the information repositories and on EPA’s website (see box, right).

EPA will respond to comments in a document called a “Responsiveness Summary.” This will be part of another document called an “Action Memorandum” that describes the final cleanup plan. The Agency will announce the final plan in local newspapers and will place a copy in the information repositories and the website.

Once the plan is final, EPA expects Dow to implement the work in Segment 3. Dow’s work will be done with oversight by EPA and MDEQ. EPA expects the work to start in 2016, after Dow completes detailed engineering designs. EPA expects work to require one or two construction seasons with completion expected in 2016 or 2017. If EPA finds other SMAs or BMAs in Segment 3, similar cleanup methods will be initiated.

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**For more information**

You can see documents related to the Tittabawassee River, Saginaw River & Bay site at www.epa.gov/region5/sites/dowchemical, or at:

- EPA Community Information Office
  804 Hamilton
  Saginaw

- Grace A. Dow Memorial Library
  1710 W. Saint Andrews St.
  Midland

- Hoyt Main Library
  505 Janes Ave.
  Saginaw

- Alice and Jack Wirt Public Library
  500 Center Ave.
  Bay City
EPA Proposes Cleanup Plan
For Tittabawassee River’s Segment 3
Tittabawassee River, Saginaw River & Bay Site
Midland, Saginaw, Bay Counties, Michigan

Public Comment Period: Sept. 1 - Oct. 15
Public Meeting: Sept. 23
(details inside)