



EPA Proposes Cleanup Plan For Polluted River Section

Tittabawassee River, Saginaw River and Bay Site Segment 1
Midland, Saginaw and Bay City, Michigan August 2011

Share your opinion

EPA invites comments on this proposed cleanup plan for Segment 1 of the Tittabawassee River. A **public comment period** runs from **Aug. 1 to Aug. 31, 2011**. A **public hearing** where you can submit oral or written statements will be held **Tuesday, Aug. 16, 2011**, 6:30 p.m., at Saginaw Valley State University, Curtiss Hall, Seminar Rooms D&E, 7400 Bay Road, Saginaw. Staff from EPA and the Michigan DEQ will also be available to talk to residents at an **informal session** on Aug. 16, 2–4 p.m., at the Grace A. Dow Memorial Library, 1710 W. St. Andrews St., Midland.

There are several ways to offer comments on the proposed plan: 1) orally or in writing at the public meeting; 2) fill out and mail the enclosed comment form or submit it at the meeting; 3) via the Internet at www.epa.gov/region5/cleanup/dowchemical/pubcomment.html; and 4) fax to EPA's Patricia Krause at 312-697-2568.

Contact EPA

If you need special accommodations at either the availability session or the public meeting or have questions contact:

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9:30 a.m. – 5:30 p.m., weekdays.

The U.S. Environmental Protection Agency, working with Michigan Department of Environmental Quality, is proposing a cleanup plan for contaminated sediment in a section of the Tittabawassee River designated as Segment 1. The sediment (river mud) is contaminated with a number of chemical pollutants, which are explained in detail under the heading *Segment 1 pollution* on Page 2.

EPA will not select a final cleanup plan until after it reviews comments received from the public at a meeting and public comment period (*see left-hand box for ways you can participate in the decision-making process*). EPA may modify the proposed cleanup plan or select another option based on new information or public comments so your opinion is important. The purpose of this proposed plan fact sheet is to give you background information, describe the proposed options to clean up Segment 1 and explain EPA's recommendations¹. More details can be found in a document called the *Tittabawassee River Segment 1 Response Proposal*. EPA is also seeking comment on this technical report, which can be found on our website and at the local document repositories listed on Page 7.

Sediment Management Areas

Distinct regions within Segment 1 are called Sediment Management Areas, or SMAs (*see Figure 1 on Page 3*). Here is a breakdown of the recommended cleanup steps for each SMA contained in EPA's proposed plan:

- SMA 1 – Place a clean cap over contaminated sediment to isolate and stabilize it.
- SMAs 2 and 3 – Remove and treat a pollutant called dense non-aqueous phase liquid or DNAPL; isolate contaminated sediment with sheet pile and a cap; and capture water within the sediment (hydraulic control) and treat it.
- SMAs 4 and 5 – Place a clean cap over contaminated sediment.
- SMA 6 – Dredge and dispose of sediment contaminated by a chemical called ethyl parathion; remove and treat DNAPL; isolate remaining contaminated sediment with sheet pile and a cap; and hydraulic control and water treatment.
- Treat and dispose of materials at approved locations.
- Monitor during and after cleanup work.
- Operate and maintain the cleanup systems.

¹ Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, known as the Superfund law) requires EPA to provide an opportunity for public input with a comment period. It also requires a newspaper ad announcing the proposed plan with a brief description. This fact sheet summarizes a document called the "Tittabawassee River Segment 1 Response Proposal," which is an engineering evaluation/cost analysis, and other site-related reports. All official site documents can be found at the repositories listed on Page 7 and at EPA's Chicago office.

Background

The Dow Chemical Co. has been operating at its Midland plant since the 1890s. Contaminants are found in and along the Tittabawassee and Saginaw rivers and in Saginaw Bay from the facility's past waste management practices. The chemicals got into the Tittabawassee River where they were deposited in sediment like the SMAs in Segment 1. It is believed that current waste management practices now control contaminant releases from Dow's facility.

A January 2010 legal agreement sets out requirements for Dow to perform investigations and develop and design cleanup options selected by EPA in consultation with MDEQ. This process should lead to a cleanup that will protect human health and the environment of the Tittabawassee River, Saginaw River and Saginaw Bay. The Tittabawassee River and upper Saginaw River have been divided into eight segments ranging in length from three to five miles each. Work will be conducted in stages from upstream to downstream, segment-by-segment. Segment 1 is the most upstream segment. It is about three miles in length and is next to Dow's Midland plant. Segment 1 is further divided into Reaches A through H.

Major cleanup work was previously done in Segment 1. In Reach B, dioxin-containing debris in the river and riverbank soil were removed and disposed of, and river sediment was capped. In Reach D, sediment containing dioxin and other contaminants was dredged and the area was capped. In Reach G, a sheet pile containment system was built to isolate a sand bar that contains DNAPL, and contaminated water within the sediment is being collected and treated. Extensive investigations have been done in Segment 1. These include thousands of chemical samples from hundreds of locations for more than 180 chemicals, including dioxins and furans. Other studies included evaluations of whether the sediment is stable, studying how it builds up or moves over time. There were also biological evaluations, including studies of how the contaminants might affect small animals living in the sediment and whether the pollutants build up in the food chain. Experts also looked for DNAPL pockets and whether that difficult substance can be captured.

Segment 1 pollution

Conditions in Segment 1 are unique when compared with the rest of the Tittabawassee River, Saginaw River and Bay site. Dioxins (primarily furans) are the major contaminant in the rest of the site, but are not the main focus in Segment 1 thanks to prior cleanups in Reaches B and D. Instead, six other chemicals or chemical groups are the key contaminants in Segment 1 sediment, including:

Arsenic is a naturally occurring metal. It has been widely used for wood preserving. Arsenic is also used in pesticides, animal food additives, medicines and production of metal alloys.

Chlorobenzenes are a group of organic (carbon-based) compounds produced by adding chlorine to benzene. They are commonly used in pesticides, degreasers and to make other chemicals.

Chlorophenols are a group of organic compounds produced by adding chlorine to phenol. They are commonly used to produce pesticides, disinfectants and to preserve wood.

Ethyl parathion is an organic phosphate pesticide that was applied to crops such as cotton, corn and soybeans. Its use has been banned in the U.S. since 2003.

o-phenylphenol is an organic compound used primarily as an agricultural fungicide and disinfectant.

PAHs or polycyclic aromatic hydrocarbons are a group of more than 100 different chemicals that are formed during the incomplete burning of coal, oil and gas and usually found as a mixture in coal tar, crude oil, creosote, and roofing tar.

These pollutants are not found everywhere in Segment 1 and are not always found together. Sometimes they are in surface sediment (the sediment zone closest to the overlying river water), and sometimes deeper, below the sediment surface but above the till. Till is a hard geologic deposit under the sediment in most of the Tittabawassee River. In some cases dioxins are located with these other contaminants. Also, DNAPL was found above the till in some areas. DNAPL is a liquid, tarry substance that is heavier than water and does not dissolve or mix easily in water. It forms a separate layer below the water. Many chlorinated solvents like the chlorobenzenes are DNAPLs.

EPA and MDEQ have currently identified six distinct areas within Segment 1 where high levels of pollution in sediment need to be cleaned up. These six areas have been designated as SMAs 1 through 6. Table 1 and Figures 2 through 5 show the key contaminants driving cleanup and their distribution within the SMAs. As the cleanups in Segment 1 proceed, EPA and MDEQ will continue to evaluate if other SMAs are present in Segment 1.

Why is this action important?

When surface sediment is polluted, contaminants like those found in Segment 1 can harm small animals that live in the sediment. These animals are important to the ecosystem. Some surface sediment contaminants can also build up in the food chain by "bioaccumulating" in animal tissue. Contamination in deeper sediment and DNAPL areas are a concern because if there is erosion in the future it might expose these pollutants or move them downstream. In addition, highly concentrated DNAPL can act as a contaminant source for a very long time.

Figure 1 - Segment 1 of the Tittabawassee River, Saginaw River and Bay Site.

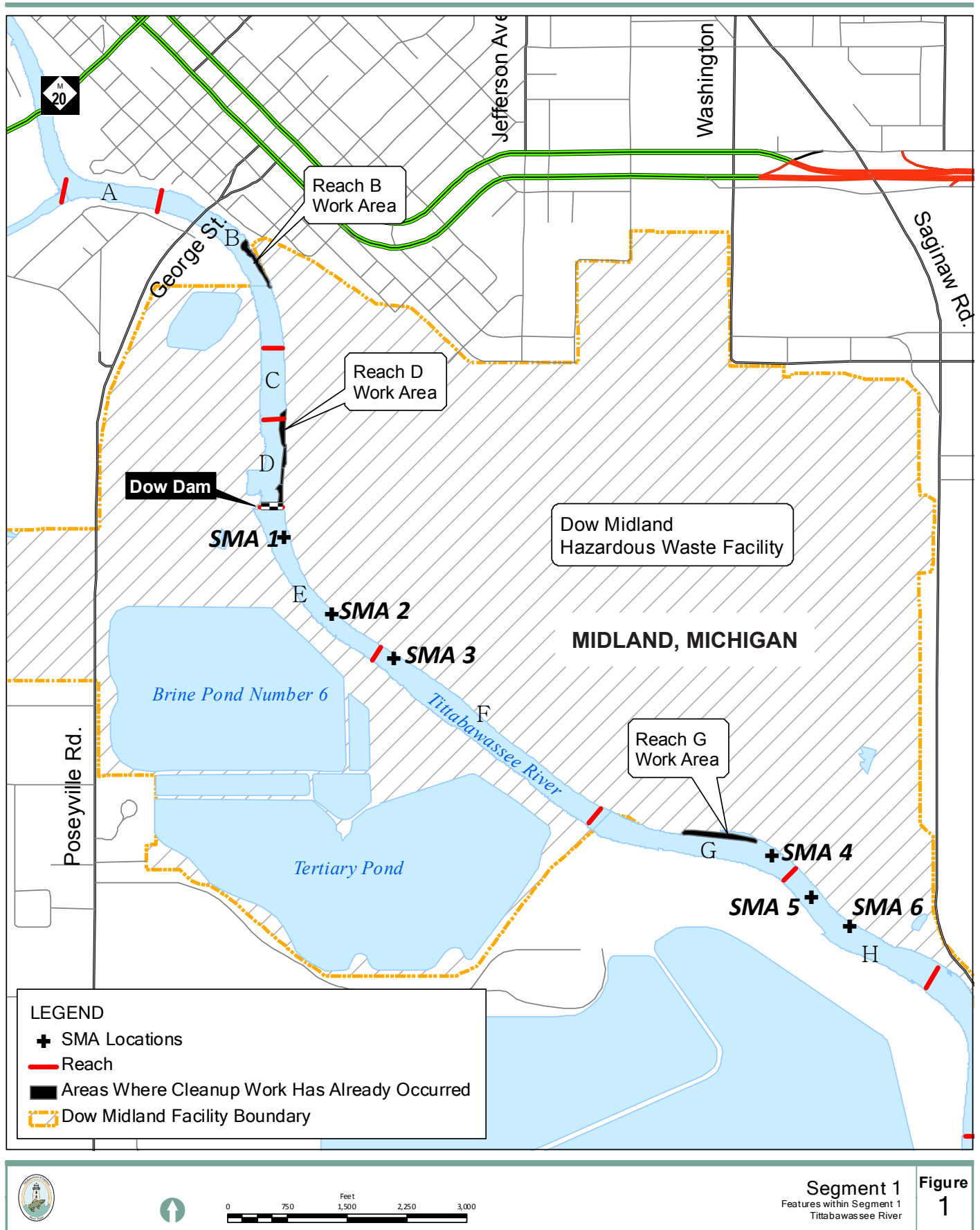


Table 1 – Key contaminants driving cleanup within SMAs and their distribution.

SMA	Surface Sediment	Deeper Sediment	DNAPL Above Till
1	Arsenic and PAHs	--	No
2	Mostly chlorobenzenes, also chlorophenols	Mostly chlorobenzenes and other volatile organics	Yes
3	Mostly chlorobenzenes, also chlorophenols, PAHs and o-phenylphenol	Mostly chlorobenzenes	Yes
4	--	Mostly chlorobenzenes	No, but additional investigations ongoing
5	--	Mostly chlorobenzenes	No, but additional investigations ongoing
6	Ethyl parathion in one area	Mostly chlorobenzenes	Yes

Summary of proposed cleanup alternatives

For developing cleanup options, EPA grouped SMAs 2 and 3 together, and 4 and 5 together due to similar characteristics. SMAs 1 and 6 are evaluated individually. EPA considered three alternatives for each SMA. Several cleanup techniques have been combined to develop the alternatives. Here is a brief description of the techniques.

Capping involves placing clean material like sand or gravel over contaminated sediment to isolate and stabilize it. Caps can include a layer to prevent erosion. Some caps also include compounds like organoclays or activated carbon to treat the contaminants.

Containment systems rely on isolating contaminated sediment within sheet pile walls and beneath a cap. This technology is combined with DNAPL removal and treatment and hydraulic control and treatment.

DNAPL removal and treatment involves capturing the DNAPL in wells or sumps, removing it from the river, and treating the DNAPL to destroy it.

Dredging involves removal of sediment using mechanical or hydraulic equipment. The sediment is moved to a staging area where water is removed. The removed sediment is tested, treated if necessary, and disposed of in an approved landfill.

Hydraulic control and treatment would rely on either a connection to the existing ground water (underground water) collection system at the Dow plant or pumping wells to capture the water located within the sediment. Removed water would be treated to destroy contaminants.

Monitored natural recovery relies on natural chemical, physical or biological processes such as decay, burial and dilution to reduce contaminant levels and health risks over time.

Table 2 summarizes the cleanup alternatives by SMA.

Common elements to all alternatives

Some features are common to each cleanup alternative. Additional evaluations will be conducted to better understand current conditions and identify the final footprint of the work area at each SMA. Access to the SMAs is likely to be from Dow’s Midland plant and may require temporary roads or work ramps into the river. Capping alternatives would require clean material to be shipped in to the work area. Dredging alternatives would require water be removed from the contaminated sediment before it is shipped to an approved landfill for disposal.

To the greatest extent possible, treatment of water, DNAPL and sediment will be done at the Dow plant. An operation and maintenance plan will be required to ensure long-term effectiveness. A health and safety plan will be required for the project. Institutional controls will be required for the SMAs. Institutional controls are things such as deed restrictions or covenants that help protect the cleanup work from future disturbance. Work is expected to require two construction seasons.

Evaluation of alternatives

EPA is required to evaluate these options against the criteria of effectiveness, implementability and cost (*see box on Page 6*). Table 3 compares each alternative against these criteria but here is a summary:

Effectiveness: All of the alternatives for each SMA are expected to protect public health and the environment and will comply, as needed, with laws, regulations and other criteria. The location within the sediment of the contaminants – surface or deeper – will influence the effectiveness of cleanup options. The presence of DNAPL will also influence effectiveness. The anticipated effectiveness of the alternatives differs, as described below.

Long-term effectiveness and permanence – All of the alternatives for each SMA are expected to provide long-term effectiveness. The time frame to attain protective

levels is more uncertain for options that rely entirely on monitored natural recovery. Long-term effectiveness is enhanced when the contaminants are removed and destroyed, as with the techniques that treat DNAPL and water. Dredging options would be effective in the long-term because they remove contaminated sediment from the river system. However, when there is DNAPL or contaminated sediment above till there is a risk of releasing some of the contamination to the river system during dredging and it is very difficult to completely remove all of the contaminated material. The materials left behind that cannot be removed by dredging are called residuals. To ensure long-term effectiveness, contaminated residuals would need to be managed by a cap or clean backfill. Options that isolate and safely contain the contamination provide an immediate benefit, but require long-term maintenance to make sure the containment works throughout time. Capping options at some SMAs offer the benefit of maintaining or enhancing habitat.

Reduction of toxicity, mobility, or volume through treatment – Alternatives 1 and 2 for SMAs 2, 3, and 6 reduce toxicity and volume through treatment of contaminated material. Alternative 2 provides much greater treatment than Alternative 1 for these SMAs and destroys the DNAPL – the most highly contaminated material. None of the other options meet this criterion through treatment.

Short-term effectiveness – All of the options except monitored natural recovery may have some short-term effects from construction of the cleanup plan. It will be important to understand and manage river flow conditions while the work is under way to minimize these effects. Capping options and alternatives where a containment system is built could result in short-term cloudy water. Dredging options could also result in short-term cloudiness, release of contaminants to surface water (especially DNAPL), and movement of contaminants downstream during construction. These short-term effects would be managed by construction practices.

Implementability: Actions similar to all the alternatives developed for the Segment 1 SMAs have been completed successfully at other areas along the Tittabawassee River, so the Segment 1 alternatives are expected to be implementable. All of the alternatives are expected to be administratively feasible. Necessary personnel and equipment are available for all options. Community acceptance will be evaluated after public comments are received. MDEQ generally supports EPA’s recommended options, but will evaluate its final recommendation after considering public comment and the results of ongoing evaluations.

The technical feasibility of the alternatives differs. There is a ground-water collection system at Dow’s plant near the river that is highly effective in providing hydraulic containment. Work on the SMAs will need to be done in a way that protects this system. DNAPLs are often difficult to locate and a challenge to clean up, especially by dredging. DNAPL

Table 2 – Cleanup alternatives for each Sediment Management Area.

Sediment Management Area for Alternatives	Alternative 1	Alternative 2 (EPA’s Recommended Options)	Alternative 3
1	<ul style="list-style-type: none"> Monitored natural recovery 	<ul style="list-style-type: none"> Cap 	<ul style="list-style-type: none"> Dredge sediment and dispose
2 and 3	<ul style="list-style-type: none"> Containment system (sheet pile and cap) Hydraulic control and treatment 	<ul style="list-style-type: none"> DNAPL removal and treatment Containment system (sheet pile and cap) Hydraulic control and treatment 	<ul style="list-style-type: none"> Dredge sediment and dispose Cap residuals
4 and 5	<ul style="list-style-type: none"> Monitored natural recovery 	<ul style="list-style-type: none"> Cap 	<ul style="list-style-type: none"> Dredge sediment and dispose Cap residuals
6	<ul style="list-style-type: none"> Dredge/dispose ethyl parathion sediment DNAPL removal and treatment 	<ul style="list-style-type: none"> Dredge/dispose ethyl parathion sediment DNAPL removal and treatment Containment system (sheet pile and cap) Hydraulic control and treatment 	<ul style="list-style-type: none"> Dredge sediment and dispose Cap residuals

removal is more feasible using wells. Sediment dredging similar to Alternative 3 has been done, but experience shows that sediment removal in the Tittabawassee River is likely to have difficulties. Challenges with implementing Alternative 3 include: 1) managing river flow conditions to perform underwater removal work; 2) avoiding unacceptable water effects from the removal; 3) managing the water removed from the dredged sediment; and 4) dredging above till. Buried logs and other debris may increase the amount of contaminated residuals remaining after dredging SMAs 2 - 6. The other technologies have been successful at other locations without major implementation issues.

Cost: Table 3 shows the estimated cost for each alternative by SMA or SMA group. The total estimated cost for EPA's recommended alternatives is \$5.8 million. The Alternative 1 options are the least costly and Alternative 3 options are the most costly. The range of costs for the Alternative 3 options is large because of uncertainties around the management of the dredged sediment prior to disposal and the dredging challenges discussed above.

EPA's recommendation

EPA in consultation with MDEQ recommends Alternative 2 for each of the SMAs because these options provide the best balance of effectiveness, implementability and cost. Alternative 2 provides long-term protectiveness and permanence by removing and destroying the most highly contaminated material while stabilizing and isolating remaining contaminated sediment. Alternative 2 will have minimal short-term effects. Alternative 2 is implementable because the technology, materials and services are available and reliable.

Explanation of evaluation criteria

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

Effectiveness evaluates whether an option protects human health and the environment. Other considerations are the option's compliance with laws, regulations, and other criteria, advisories, and guidance; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness.

Implementability evaluates how difficult the option will be to complete. Specifically considered are technical feasibility, administrative feasibility, availability of services and materials and state and community acceptance.

Cost includes the costs to construct the option (for example, equipment, materials and labor), as well as the long-term costs of monitoring and maintaining the option.

Table 3 – Compares how each SMA alternative meets the evaluation criteria, relative to other SMA alternatives.

Evaluation Criteria	Effectiveness	Implementability	Estimated Cost
Sediment Management Area 1			
SMA 1 - #1	Moderate	High	\$30,000
SMA 1 - #2	High	High	\$250,000
SMA 1 - #3	Moderate to High	High	\$490,000*
Sediment Management Area 2 & 3			
SMA 2 & 3 - #1	Moderate to High	High	\$1,200,000
SMA 2 & 3 - #2	High	High	\$1,800,000
SMA 2 & 3 - #3	Moderate	Moderate to High	\$2,300,000*
Sediment Management Area 4 & 5			
SMA 4 & 5 - #1	Moderate	High	\$60,000
SMA 4 & 5 - #2	High	High	\$600,000
SMA 4 & 5 - #3	Moderate	Moderate to High	\$1,700,000*
Sediment Management Area 6			
SMA 6 - #1	Moderate to High	High	\$2,200,000
SMA 6 - #2	High	High	\$3,100,000
SMA 6 - #3	Moderate	Moderate to High	\$3,800,000*

*Dredging alternatives could cost 2 to 3 times higher if sediment must be treated before disposal.

Figure 2 - SMA 1 conditions.

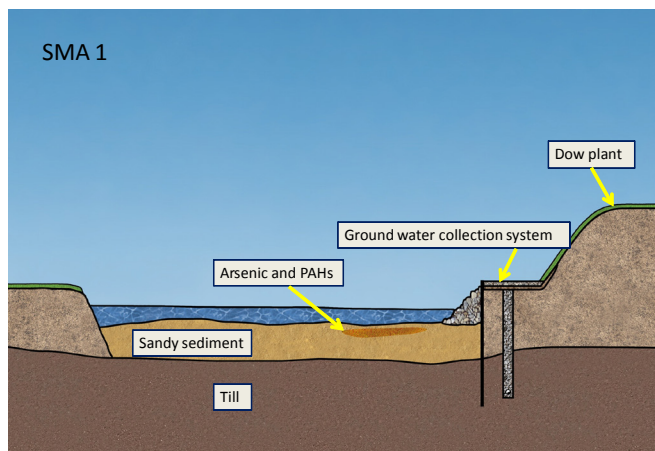


Figure 3 - SMA 2 and 3 conditions.

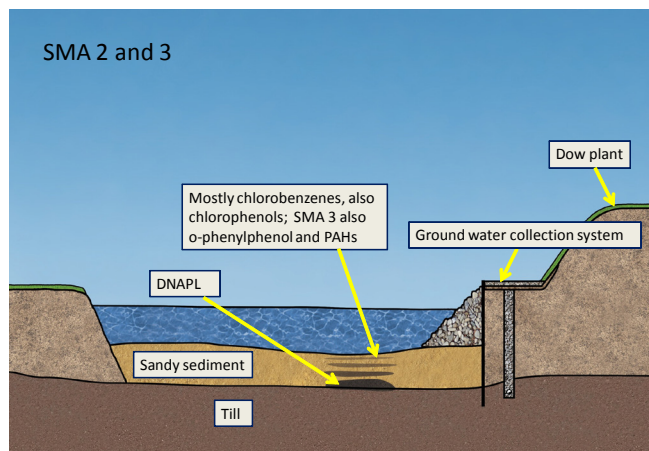


Figure 4 - SMA 4 and 5 conditions.

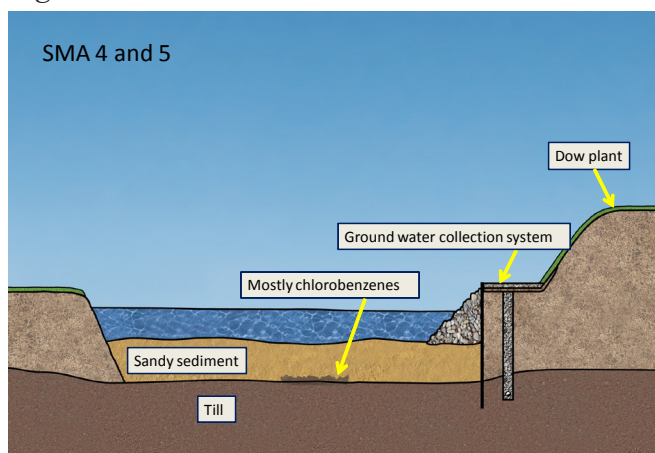
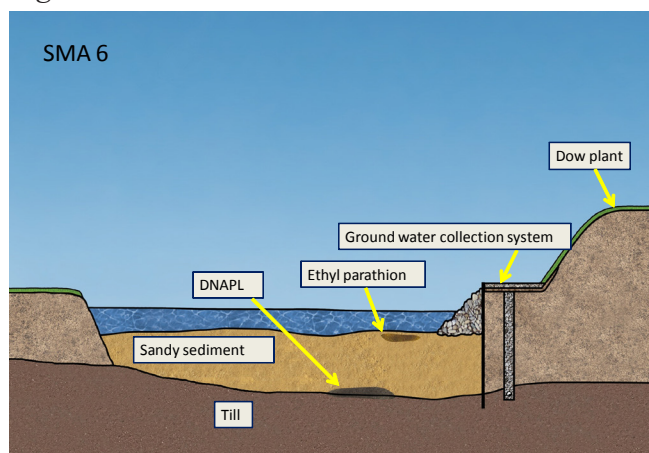


Figure 5 - SMA 6 conditions.



Next steps

Before the regulatory agencies make a final decision, EPA and MDEQ will review comments received during the public comment period and at the public meeting.

EPA encourages you to review and comment on this proposed cleanup plan. More details are available in the official documents on file at the information repositories and on EPA's website listed below. EPA will respond to the 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 selected. 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 selected, EPA expects Dow to implement the work in Segment 1. EPA and MDEQ will oversee Dow's actions. Work is expected to start in 2012 after detailed engineering designs are complete. If other SMAs are found in Segment 1, they will be cleaned up by similar methods.

For more information

EPA Field Office

EPA has opened an information office in the Saginaw County Courthouse, 111 S. Michigan Ave., Saginaw. Telephone: 989-790-5215.

View Site Documents


You can view documents related to the Tittabawassee River, Saginaw River and Bay site on the Web or at information repositories:

- At www.epa.gov/region5/cleanup/dowchemical.
- 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.

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Public Comment Period: Aug. 1 – Aug. 31, 2011
Public Meeting: Aug. 16, 2011
Availability Session: Aug. 16, 2011

(details inside)

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**TITTABAWASSEE RIVER, SAGINAW RIVER AND BAY SITE:
EPA Proposes Cleanup Plan For Polluted River Section**

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