US EPA RECORDS CENTER REGION 5
461778

FIVE-YEAR REVIEW REPORT FOR FOX RIVER NRDA/PCB RELEASES SUPERFUND SITE

BROWN, DOOR, MARINETTE, OCONTO, OUTAGAMIE, KEWAUNEE, AND WINNEBAGO COUNTIES, WISCONSIN, AND DELTA AND MENOMINEE COUNTIES, MICHIGAN

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LIST OF ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIC	Community Involvement Coordinator
C.F.R.	Code of Federal Regulations
cy	cubic yards
ESD	Explanation of Significant Differences
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICIAP	Institutional Control Implementation and Assurance Plan
ICs	Institutional Controls
MNR	Monitored Natural Recovery
NCP	National Contingency Plan
ng/L	nanograms per liter
NPL	National Priorities List
OU	Operable Unit
PCBs	Polychlorinated Biphenyls
ppb	parts per billion
ppm	parts per million
PRPs	Potentially Responsible Parties
RAL	Remedial Action Level
RAOs	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
SQT	Sediment Quality Threshold
SWAC	Surface-Weighted Average Concentration
UAO	Unilateral Administrative Order
U.S.C.	United States Code
UU/UE	Unlimited Use and Unrestricted Exposure
WDNR	Wisconsin Department of Natural Resources

Executive Summary

The Fox River NRDA/PCB Releases site, also known as the Lower Fox River and Green Bay Superfund site, includes 39 miles of river and 2,700 square miles of Green Bay. The major contaminants are polychlorinated biphenyls (PCBs) located in the sediments of the river channel and Green Bay. The site poses risks to humans and ecological receptors via consumption of PCB-contaminated fish. Fish consumption advisories have been in effect since 1976.

The Wisconsin Department of Natural Resources (WDNR) is the lead technical agency at the site, and the United States Environmental Protection Agency (EPA) is the lead enforcement agency at the site. (Collectively, EPA and WDNR are referred to in this document as "Response Agencies.") The Response Agencies issued Records of Decision (RODs) in 2002 and 2003, ROD Amendments in 2007 and 2008, and an Explanation of Significant Differences (ESD) in 2010. These decision documents divide the site into five operable units (OUs) and select remedies consisting of a combination of dredging, capping and covering of contaminated sediments, monitored natural recovery (MNR), and long-term monitoring/maintenance.

In 2004, under a federal Consent Decree, the WTM I and P.H. Glatfelter companies started the cleanup of PCB-contaminated sediments in OU 1 (a.k.a., "Little Lake Butte des Morts") at the site. Cleanup actions included dredging, capping with sand and armor stone, and sand covering. EPA approved the completion of the construction of the remedial action in 2010.

The remedial action work in OUs 2 – 5 is currently underway and is being performed under a Unilateral Administrative Order (UAO) that EPA issued in November 2007. Dredging work began in 2009 and construction of the remedial action in OUs 2 – 5 is expected to be completed in 2017.

This five-year review (FYR) found that the remedy at OUs 1 – 5 is not protective of human health and the environment. While the remedy is currently being implemented and constructed in accordance with the requirements of the decision documents and design specifications, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not protective. Although there are fish consumption advisories in place and warning signs posted along the river, fishing has been observed and the Response Agencies believe that fish are being consumed. Ecological receptors are still exposed to unacceptable risks posed by PCB contamination in fish, sediments and surface water. In order for the remedy to be protective, the following actions need to be taken: the remedy needs to be fully implemented; monitoring data needs to show that PCB concentrations in sediments, surface water, and fish are decreasing to meet the remedial action objectives (RAOs) as intended in the decision documents; and effective institutional controls (ICs) need to be fully implemented. Compliance with ICs will be ensured by maintaining, monitoring, and enforcing ICs, as well as maintaining the remedy components (i.e., caps) at the site. It will take some time following completion of the remedial activities to see the fish concentrations decrease to protective levels.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Fox River NRDA/PCB Releases		
EPA ID: WID0001954841		
Region: 5	**State:** WI/MI	**City/County:** Brown, Door, Marinette, Oconto, Outagamie, Kewaunee, and Winnebago Counties, Wisconsin, and Delta and Menominee Counties, Michigan

SITE STATUS	
NPL Status: Proposed	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: State
Author name (Federal or State Project Manager): James Hahnenberg
Author affiliation: EPA
Review period: 09/19/2013 – 07/17/2014
Date of site inspection: 11/19/2013
Type of review: Statutory
Review number: 2
Triggering action date: 07/17/2009
Due date *(five years after triggering action date)*: 07/17/2014

Five-Year Review Summary Form (continued)

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 1 - 5	**Issue Category:** Monitoring			
	Issue: Current PCB concentrations in fish tissue, sediments, and surface water indicate that the remedy in not currently protective and RAOs have not been met.			
	Recommendation: Complete implementation of the remedy to address PCB-contaminated sediments and address ongoing unacceptable exposures.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	PRPs	EPA/State	12/31/2017

OU(s): 1 - 5	**Issue Category:** Institutional Controls			
	Issue: Approved ICIAP has not been fully implemented.			
	Recommendation: Implement the portions of the ICIAP that have not yet been implemented.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRPs	EPA/State	12/31/2018

Protectiveness Statement(s)
Operable Unit: 1 – 5 *Protectiveness Determination:* Not protective
Protectiveness Statement: This FYR found that the remedy at OUs 1 – 5 is not protective of human health and the environment. While the remedy is currently being implemented and constructed in accordance with the requirements of the decision documents and design specifications, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not protective. Although there are fish consumption advisories in place and warning signs posted along the river, fishing has been observed and the Response Agencies believe that fish are being consumed. Ecological receptors are still exposed to unacceptable risks posed by PCB contamination in fish, sediments and surface water. In order for the remedy to be protective, the following actions need to be taken: the remedy needs to be fully implemented; monitoring data needs to show that PCB concentrations in sediments, surface water, and fish are decreasing to meet the RAOs as intended in the decision documents; and effective ICs need to be implemented. Compliance with ICs will be ensured by maintaining, monitoring, and enforcing ICs, as well as maintaining the remedy components (i.e., caps) at the site. It will take some time following completion of the remedial activities to see the fish concentrations decrease to protective levels.

I. INTRODUCTION

The purpose of a FYR is to evaluate the implementation and performance of the remedy at a site in order to determine whether the remedy is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and recommendations to address them.

EPA prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121 and the National Contingency Plan (NCP). CERCLA § 121 states:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

EPA interpreted this requirement further in the NCP; 40 C.F.R. § 300.430(f)(4)(ii) states:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."*

EPA conducted a FYR of the remedial actions implemented at the Lower Fox River and Green Bay Superfund Site in northeastern Wisconsin. The WDNR is the lead technical agency at the site and EPA is the lead enforcement agency. EPA took the lead on this FYR. The WDNR has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the second FYR for the site. The triggering action for this statutory review is the signature date of the previous FYR. This FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The site consists of 5 OUs, all of which are addressed in this FYR.

II. PROGRESS SINCE THE LAST REVIEW

Table 1. Protectiveness Determinations/Statements from the 2009 FYR

OU #	Protectiveness Determination	Protectiveness Statements
OUs 1 – 5 Sitewide	Will be Protective	The remedial action being implemented at OU 1 (i.e., dredging, capping and covering) is expected to be protective, although it may take some additional time for fish tissue concentrations to decrease. Although construction work in OU 1 was completed on May 19, 2009, additional required long-term monitoring has not yet been conducted. The remedial actions being implemented at OU 2 and OU 3 (i.e., dredging, capping and covering) are expected to be protective after they are completed, although it may take some time after completion of remediation for fish tissue concentrations to decrease. It is expected that the remedial actions for OUs 2 and 3 will be completed by 2012, after which construction confirmation, follow-up sampling and long-term monitoring will be conducted. The remedial actions being implemented at OU 4 and OU 5 (i.e., dredging, capping and covering) are expected to be protective after they are completed, although it may take some time after completion of remediation for fish tissue concentrations to decrease. It is expected that the remedial actions for OUs 4 and 5 will be completed by 2017, after which construction confirmation, follow-up sampling and long-term monitoring will be conducted. Completion of the remedial actions in OU 4 – 5 should complete cleanup work at the site. Following the completion of the remedial action and after evaluation of additional information, EPA will make a site-wide protectiveness determination. Long-term protectiveness of the remedy will require compliance with effective ICs. Compliance with ICs will be ensured by maintaining, monitoring and enforcing ICs, as well as maintaining the site remedy components.

Table 2. Status of Recommendations from the 2009 FYR

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
1	Remedy is not yet complete	Complete remedial actions and confirm that remedial actions have met requirements in the RODs and ROD Amendments	PRPs	EPA/State	2017 for entire site	Completed for OU 1	May 19, 2009 (OU 1 river work)
2-5	Remedy is not yet complete	Complete remedial actions and confirm that remedial actions have met requirements in the RODs and ROD Amendments	PRPs	EPA/State	2017	Ongoing	N/A
1	Long-term monitoring of fish and surface water has not begun	Conduct monitoring of fish and surface water upon completion of remedial actions	PRPs	EPA/State	2012 for OU 1	Completed	2010 (initiation of OU 1 long-term monitoring)
2-5	Long-term monitoring of fish and surface water has not begun	Conduct monitoring of fish and surface water upon completion of remedial actions	PRPs	EPA/State	2014 for OU 3; 2019 for OU 4 and OU 5	Ongoing	N/A
1-5	ICs have not been evaluated	Complete ICIAP and implement as set forth in RODs and ROD Amendments	PRPs	EPA/State	1/17/2010	Ongoing	N/A

1st and 2nd Recommendations

The construction of the remedial action at OU 1 is now complete. EPA approved the *Lower Fox River Operable Unit 1, Remedial Action Certification of Completion Report* on December 15, 2010. The remedial action work at OUs 2 – 5 is ongoing and the cleanup work in those OUs is expected to be completed in 2017.

3rd and 4th Recommendations

Long-term monitoring is underway for some of the OUs but has not yet started for other OUs. Long-term monitoring began in 2010 for OU 1, following completion of the construction of the remedial action in that OU. Long-term monitoring for OU 2 and OU 3 began in 2012, but will not begin for OU 4 and OU 5 until after 2017 (following completion of the construction of the remedial action in those OUs). Since the remedial action work for OUs 2 – 5 is being completed

collectively under the 2007 UAO, the initiation of long-term monitoring for those OUs will not be considered complete until monitoring has begun in each of those OUs.

5th Recommendation

The potentially responsible parties (PRPs) completed an Institutional Control Implementation and Assurance Plan (ICIAP) in 2012. Institutional controls have not been fully implemented at the site, although fish advisories are in effect. The remaining ICs may not be fully in place until the remedies are fully constructed at the site.

Remedy Implementation Activities

Background information about the site and the selected remedial actions is contained in Appendix A. Figures and photographs depicting the site location and various aspects of the remedy are contained in Appendix B. Dredging, capping, and covering remedial activities have been underway at the site since 2004. Previously, demonstration projects and a time-critical removal action were undertaken. Table 3 below summarizes remedial action activities through 2013.

Table 3. Remedial Action Work Completed Through 2013

Action	OU 1 (2004 – 2009)	OUs 2 – 4 (2009 – 2012)	OU 4 (2013)	TOTAL
Dredging – cubic yards (cy)	**371,600[1]**	**2,103,800[2]**	**584,600[3]**	**3,060,000**
Capping – acres	**114[1]**	**34[2]**	**13[3]**	**161**
Capping – cy	**275,900[5]**	**109,700[6]**	**62,900[7]**	**448,500**
Covering – acres	**107[1]**	**62[2]**	**13[4]**	**182**
Covering – cy	**86,300[8]**	**50,300[8]**	**10,500[8]**	**147,100**

Table 3 Information sources:

[1] Foth and CH2MHILL, November 2010, Remedial Action Certificate of Completion, Table 1-1, page 3.

[2] Tetratech, et al, October 2012, Lower Fox River Remedial Design 100 percent Design Report for 2010 and Beyond Remedial Actions, Tables 9-1, 9-2, and 9-3.

[3] Tetratech EC Inc., Week Ending November 15, 2013.

[4] Tetratech EC Inc., Week Ending October 18, 2013. Sand placed reported was for incomplete caps or sand cover over residual sediments remaining after dredging (i.e., no covering was completed).

[5] Volume of sediment capped for OU 1 is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 1.5 feet) / 27 FT^2/cy = total cubic yards.

[6] Volume of sediment capped for OU 2 – 4 is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 2 feet) / 27 FT^2/cy = total cubic yards.

[7] Volume of sediment capped for OU 4 is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 3 feet) / 27 FT^2/cy = total cubic yards.

[8] Volume of sediment covered is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 0.5 feet) / 27 FT^2/cy = total cubic yards.

Table note: Volumes are rounded to the nearest hundred cubic yards.

By the end of the 2013 dredging season, approximately 3.8 million cy of PCB-contaminated sediment were removed or contained, while about 3.2 million cy remain to be remediated. The construction of the remedial action is expected to be completed by 2017. Figures 1, 2, and 3 below show the work completed through 2013, as well as the work remaining.

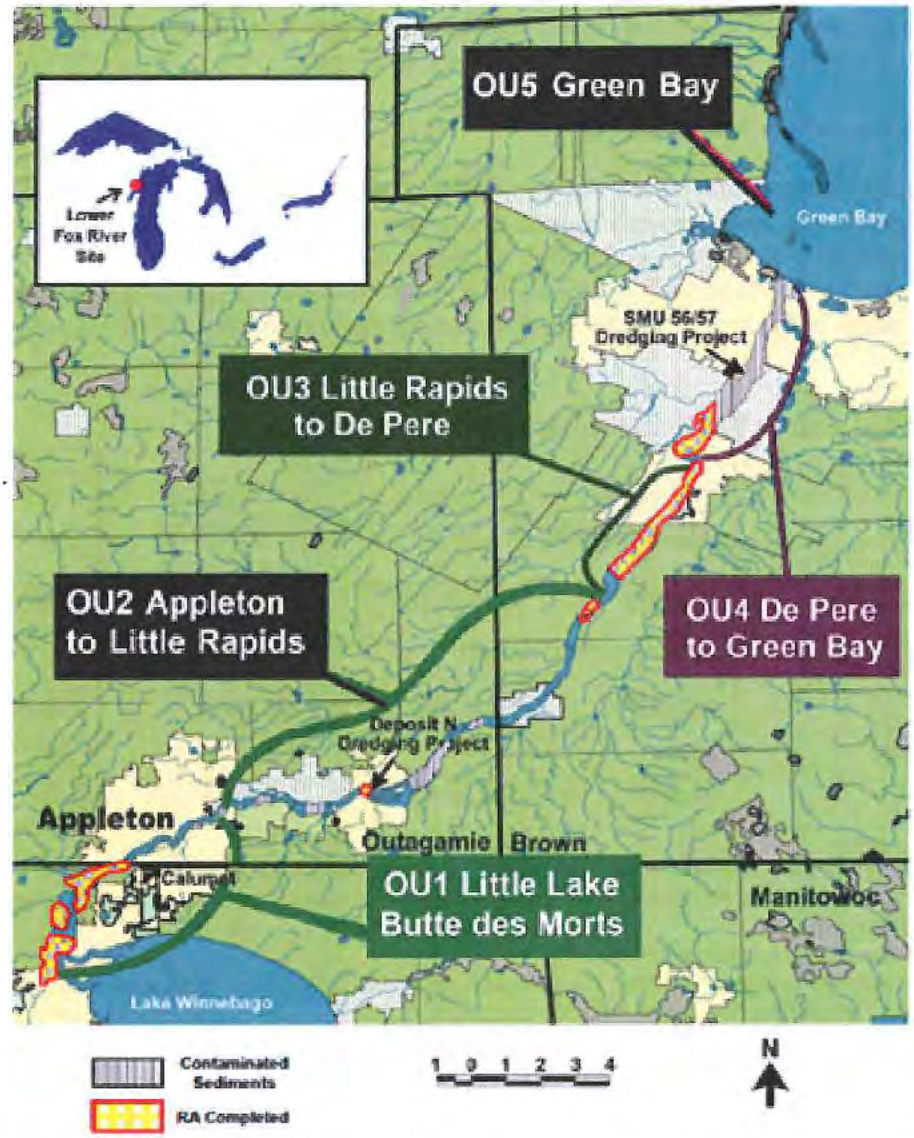

Figure 1. Work Completed and Planned at Fox River NRDA/PCB Releases Site

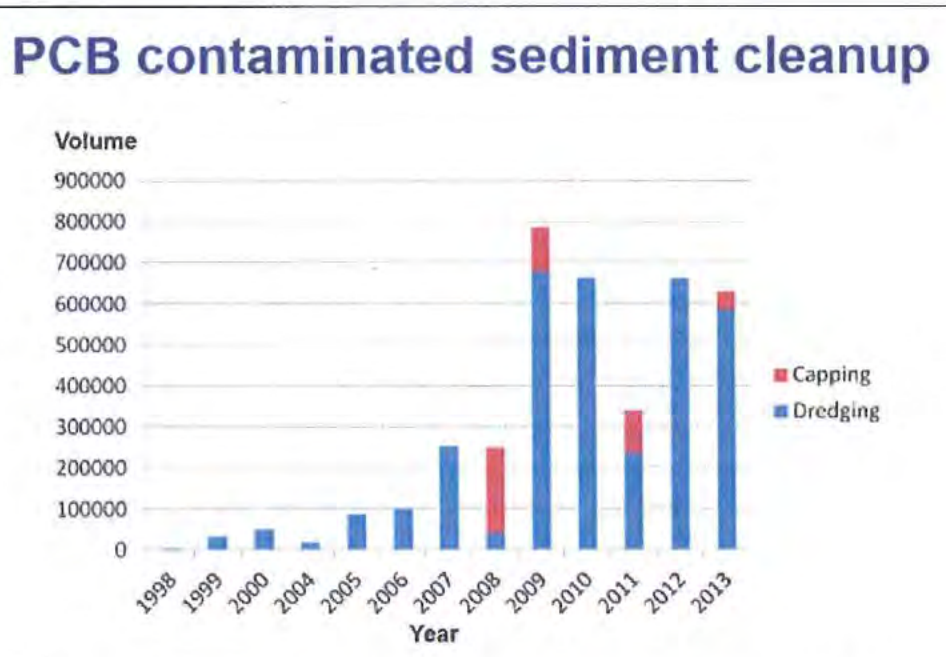

Figure 2. Dredging and Capping Work Completed Through 2013

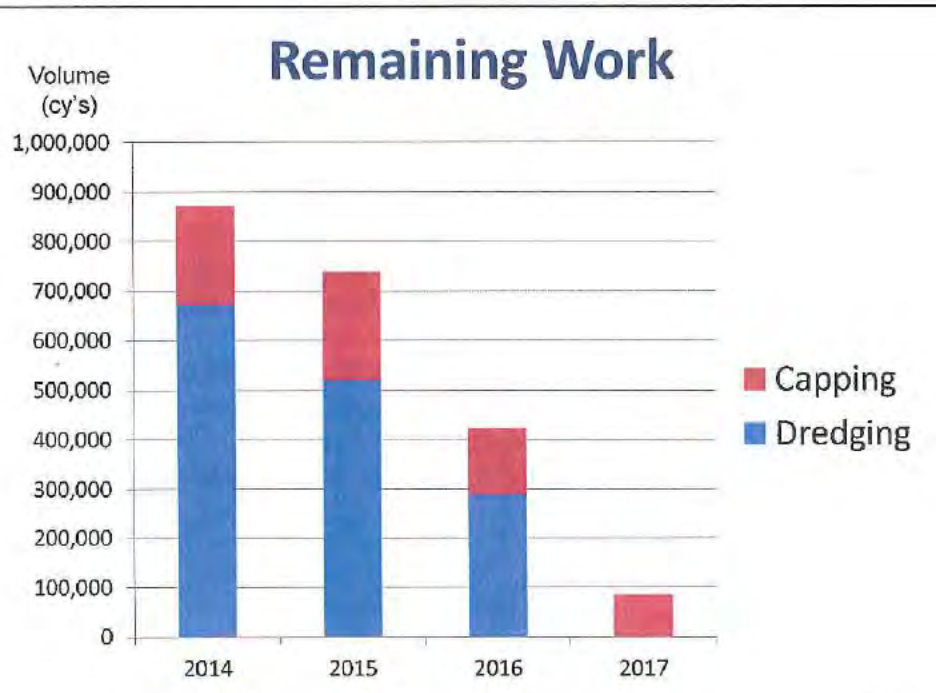

Figure 3. Dredging and Capping Work Remaining After 2013

The Response Agencies issued an ESD in February 2010 which addressed modifications to the monitoring requirements for OU 2, cap design modifications for OUs 2 – 5, and cost increases for OUs 2 – 5. All of the remedial action work has been conducted consistent with the site decision documents, including the 2002 and 2003 RODs, 2007 and 2008 ROD Amendments, and the 2010 ESD.

During the ongoing cleanup, it was determined that the partially submerged hulls of two steam-powered tugboats – the *Bob Teed* and *Satisfaction* – and debris from what is believed to be three old barges needed to be removed from the river within OU 4 and disposed offsite. The tugboats and barges were located within contaminated sediment targeted for remedial action. The vessels were declared historical artifacts and cultural resources under the National Historic Preservation Act. A Memorandum of Agreement among EPA, WDNR, the Wisconsin State Historical Preservation Office, the Neville Museum, and certain PRPs was finalized in September 2013, and removal of the shipwrecks started in November 2014. The MOA requires the creation of an interpretive display at Brown County's Neville Museum. The display will be completed by December 2014 and will explain the history of the vessels and other interesting facts about river commerce in the late 1800s and early 1900s. Shipwreck removal activities were completed on May 9, 2014. See Figures 7, 8, 9, and 10 in Appendix B.

Institutional Controls

Institutional controls are required to ensure the protectiveness of the remedy. ICs are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and that protect the integrity of the remedy. ICs are required to assure the long-term protectiveness for any areas which do not allow for UU/UE and to maintain the integrity of the remedy. ICs are required at the Fox River site because PCB contamination remains at the site above levels that would allow for UU/UE.

Table 4 and the narrative below summarize the ICs that are in place and/or needed for the areas of the site that do not allow for UU/UE. A map showing the area in which the ICs apply is included in Appendix G of the 2012 final Remedial Design.

ICs have not been fully implemented at the site as the remedy is not yet complete. An ICIAP was approved in 2012 as part of the final 100% Remedial Design for OUs 2 – 5.

The ICIAP specifies the types and details of the ICs required at the site and provides a schedule for implementation. Fish advisories, currently in place, would likely be required until contaminant concentrations in fish are reduced such that unrestricted consumption would not present an unacceptable risk (i.e., when PCB fish tissue concentrations are at or below 50 parts per billion (ppb)).

Table 4. Summary of Planned and/or Implemented ICs

Media, Engineered Controls, and Areas that do Not Support UU/UE Based on Current Conditions	ICs Needed?	ICs Called for in the Decision Documents?	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or Planned)
Fish	Yes	Yes	Entire Site	Prevent ingestion of PCB-contaminated fish by humans	Wisconsin Fish Advisories (in effect since 1976)
Sediments	Yes	Yes	Entire Site	Prevent damage to caps through limitations on anchoring, dredging, spudding or dragging, or conducting salvage operations, and by establishing "no wake" areas and construction limitations	Chapter 30, Wisconsin Statutes (existing); Section 404 of the Clean Water Act, 33 U.S.C. §1344 (existing); Sections 9 and 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. §401 and 403 (existing); and Memoranda of Agreement (planned for 2018)

The effectiveness of the fish advisories will be evaluated as part of the ICIAP. Compliance with ICs will be required to assure long-term protectiveness for any areas which do not allow for UU/UE and will ensure the remedy continues to function as intended. Once ICs are implemented, long-term stewardship procedures will be developed to ensure that the ICs are maintained, monitored and enforced. A long-term stewardship plan is included in the ICIAP.

Various Memoranda of Agreement are envisioned in the ICIAP and would have three key objectives: 1) provision of notices, in accordance with a schedule, to riparian owners advising them of the presence of caps offshore from their property; 2) provision of geographical coordinates for all caps so that they may be placed in Wisconsin's GIS Registry; and 3) inspections to check for disturbances to the caps with subsequent reporting to the WDNR.

System Operation/Operation and Maintenance

After construction completion and verification that the 2007 and 2008 ROD Amendments' remedial action level (RAL) and/or surface-weighted average concentration (SWAC) standards have been met, the site will be monitored on a regular basis. For OU 1, the construction of the remedial action was approved in 2010 with the approval of the *Lower Fox River Operable Unit 1, Remedial Action Certification of Completion Report.* There will also be a final construction report for OUs 2 – 5 following completion of the construction work in those OUs.

A long-term monitoring plan identifies the long-term monitoring activities to be conducted at the site. Completion of the remedial action construction work in 2017 in OUs 4 - 5 should

complete cleanup work at the site. Following the completion of remedial action construction work, additional information to be obtained will consist of the following:

• Post-remediation sampling of residual sediments in dredged areas that do not have a cap or sand cover will be performed immediately after dredging. The long-term monitoring plan requires long-term sediment monitoring of the MNR areas only (OU 2 and OU 5). EPA's FIELDS Team performed post-remediation sediment sampling in OU 1 and OU 3 in only the soft sediment areas (not in capped areas).

• Post-construction monitoring to determine if caps and covers are installed as designed.

• Long-term monitoring of caps to confirm their containment effectiveness. If necessary, additional maintenance of caps will be conducted.

• Long-term monitoring of surface water and fish for confirmation of environmental improvements.

These same monitoring activities will also be done at OU 1 and OU 2, with post-construction monitoring having begun in 2010 (OU 1) and 2012 (OU 2) and other monitoring activities to follow.

System operation and maintenance is not required, as the remedy is dredging (i.e., removal) and capping (containment). As discussed above, a long-term monitoring plan has been developed for sampling and analysis of surface water and fish, and will be implemented as long as PCBs are present at the site.

III. FIVE-YEAR REVIEW PROCESS

Administrative Components

The PRPs were notified of the development of the FYR on June 23, 2014. The FYR was led by James Hahnenberg, EPA Remedial Project Manager (RPM) for the site, with assistance from Susan Pastor, EPA Community Involvement Coordinator (CIC). Beth Olson of the WDNR assisted in the review as the representative for the State of Wisconsin.

The review, which began on September 19, 2013, consisted of the following components:

- Community Notification and Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Interviews; and
- FYR Report Development and Review.

Community Notification and Involvement

Activities to involve the community in the FYR process were initiated with a meeting in November 2013 between the RPM and CIC for the site. A notice was published on the EPA webpage on June 26, 2014, inviting the public to submit any comments to EPA. An ad will run in a local newspaper announcing the completion of the FYR, and the final FYR report will be made available at the site information repositories listed below:

Appleton Public Library
225 N. Oneida St.
Appleton, WI
920-832-6173

Brown County Library
515 Pine St.
Green Bay, WI

Door County Library
107 S. Fourth Ave.
Sturgeon Bay, WI

Oneida Community Library
201 Elm St.
Oneida, WI

Oshkosh Public Library
106 Washington Ave.
Oshkosh, WI

Further information regarding recent site construction and remediation-related activities can be found at the following EPA Region 5 website:
http://www.epa.gov/region5/sites/foxriver/index.html

Additionally, the PRPs currently doing work at OUs 2 – 5 have posted photos and site construction updates at the following website, maintained by the PRPs:
http://www.foxrivercleanup.com/

Document Review

EPA's document review was completed for analytical results, design evaluations, post-remediation sampling, and progress reports of volumes removed and acres capped. EPA reviewed analytical results (i.e., from confirmation sampling), bathymetric surveys, and design evaluations.

Data Review

Current levels of PCBs at OUs 1 – 5 still exceed remediation goals for fish tissue, sediments, and surface water, thus affecting protectiveness of human health and the environment.

Fish Tissue

Long-term monitoring of fish was conducted in 2006, 2010, and 2012. PCB concentrations in fish during the 2012 monitoring event are shown in Table 5 below. The Sediment Quality Thresholds (SQTs) developed during the feasibility study for humans and ecological receptors are provided in Figures 5 and 6 in Appendix A. In general, fish consumption advisories are needed if fish tissue concentrations exceed 50 ppb.

Table 5. Lower Fox River Mean PCB Concentrations (ppb), 2012 Fish Sampling

OU	Carp	Gizzard Shad	Walleye	Smallmouth Bass
1*	1261.1	26.2	84.2	208.7
2A**	825.3	67.5	-	141.5
2B**	598.9	26.7	184.5	-
2C**	707.3	66.9	650.3	-
3**	549.4	184.3	928.3	-

Table 5 Data Sources
* OU 1 2013 Long-Term Monitoring Summary Report, Table 4-3.
** OU 2 – 3 2012 Long-Term Monitoring Summary Report, Table 4-6.
Note: Smallmouth Bass substituted for Walleye in OU 2A.

Surface Water

PCB surface water monitoring results from sampling conducted in OUs 1 – 3 in 2012 are shown in Table 6 below. The two columns at the far right show the human health and ecological water quality criteria contained in RAO 1 for the site, as described in the site decision documents. RAO 1 specifies that the objective is to "achieve, *to the extent practicable*, surface water quality criteria throughout the Lower Fox River and Green Bay" [emphasis added]. Other sections of the site decision documents clearly state that these water quality criteria are "To Be Considered" criteria and not "Applicable or Relevant and Appropriate Requirements," and that the principal measure of management and/or cleanup success is achieving protective levels of PCBs in fish tissue. For this reason, RAO 1 included the phrase, "to the extent practicable" regarding achievement of the water quality criteria.

Table 6. 2012 Monitoring Results for Surface Water

OU	2012 Concentrations (nanograms per liter) (ng/L)	Human Health Water Quality Criterion (ng/L)	Ecological Water Quality Criterion (ng/L)
Lake Winnebago	0.2*	0.18	0.003
1	1.2*		
2A	2.1**		
2B	2.6**		
2C	2.1**		
3	3.3**		

Table 6 Data Sources:
* 2012 Long-Term Monitoring Summary Report, Lower Fox River Operable Unit 1, November 2013, Table 3-12.
** 2012 Long-Term Monitoring Summary Report, Lower Fox River Operable Units 2 – 3, October 2013, Table 3-18.

Sediments

Post-remediation sediment confirmation sampling was completed for OU 1 in 2009 and 2010, and for OU 3 in 2012. This sampling showed that the PCB sediment cleanup standards specified in the 2008 and 2009 ROD Amendments were met. Specifically, these PCB cleanup standards are SWACs of 0.25 parts per million (ppm) for OU 1 and 0.28 ppm for OU 3.

Site Inspection

PRP and WDNR representatives were present at the FYR site inspection conducted by the EPA RPM on November 19, 2013. The inspection examined the river to determine if site conditions had changed and to confirm the status of ongoing remedial activities. The Site Inspection Checklist is included as Appendix C.

Interviews

During the FYR process, interviews were conducted with WDNR and oversight personnel involved in site cleanup activities. The purpose of the interviews was to document any perceived problems or successes with remedy implementation to date, as well as progress made to date and remaining work. These interviews were conducted by the EPA RPM on November 19, 2013, and May 21, 2014.

IV. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

No. The remedy is currently under construction and is being constructed in accordance with the requirements of the RODs, ROD Amendments, ESD, and design specifications. However, current levels of PCBs still exceed remediation goals for fish tissue, sediments, and surface water, thus affecting the protectiveness of the remedy. Once the Response Agencies determine that the RAL performance standard (i.e., SWAC goal) is achieved in an OU, construction of the remedy is deemed complete, although monitoring and maintenance requirements continue to apply. Only OU 1 is currently considered "construction complete," while all other OUs are still under construction. Monitoring has begun for OUs 1 – 3. Upon

completion of construction of all remedial actions, site-wide long-term monitoring will be conducted. Fish consumption advisories are in place and will be reevaluated as deemed appropriate by WDNR. ICs have been implemented to the extent feasible given that the remedy is still underway. In addition, full implementation of the ICIAP will begin upon completion of the construction of the remedy at the site.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?

Yes. Site conditions are essentially unchanged and there are no new cleanup standards applicable to the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. At this time, no other information has come to light that would call into question the protectiveness of the remedy.

Technical Assessment Summary

The remedy is currently being implemented and constructed in accordance with the requirements of the RODs, ROD Amendments, ESD, and design specifications. However, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not yet protective of human health and the environment. EPA will determine whether the remedy is functioning as intended once the construction of the remedy is completed. This evaluation will measure PCB concentrations in dredged/uncovered areas, and will evaluate whether the caps and covers have been installed as required by the site decision documents.

V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 7. Issues/Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Current PCB concentrations in fish tissue, sediments, and surface water indicate that the remedy in not currently protective and RAOs have not been met	Complete implementation of the remedy to address PCB-contaminated sediments and address ongoing unacceptable exposures	PRPs	EPA/State	12/31/2017*	Yes	Yes
Approved ICIAP has not been fully implemented	Implement the portions of the ICIAP that have not yet been implemented	PRPs	EPA/State	12/31/2018	No	Yes

* All areas are anticipated to have remedial action construction activities completed by 2017. Remedial action construction activities for OU 1 were completed in May 2009 and long-term monitoring started in 2010. Remedial action construction activities for OUs 2 – 5 are expected to be completed by the end of 2017, with long-term monitoring for OUs 4 – 5 starting in 2018. Long-term monitoring for OU 2 and OU 3 began in 2012.

VI. PROTECTIVENESS STATEMENT(S)

This FYR found that the remedy at OUs 1 – 5 is not protective of human health and the environment. While the remedy is currently being implemented and constructed in accordance with the requirements of the decision documents and design specifications, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not protective. Although there are fish consumption advisories in place and warning signs posted along the river, fishing has been observed and the Response Agencies believe that fish are being consumed. Ecological receptors are still exposed to unacceptable risks posed by PCB contamination in fish, sediments and surface water. In order for the remedy to be protective, the following actions need to be taken: the remedy needs to be fully implemented; monitoring data needs to show that PCB concentrations in sediments, surface water, and fish are decreasing to meet the RAOs as intended in the decision documents; and effective ICs need to be fully implemented. Compliance with ICs will be ensured by maintaining, monitoring, and enforcing ICs, as well as maintaining the remedy components (i.e., caps) at the site. It will take some time following completion of the remedial activities to see the fish concentrations decrease to protective levels.

VII. NEXT REVIEW

The next FYR report for the Lower Fox River and Green Bay site is required five years from the completion date of this review.

APPENDIX A – EXISTING SITE INFORMATION

APPENDIX A – EXISTING SITE INFORMATION

A. SITE CHRONOLOGY

Table 1: Chronology of Site Events

Event	Date
Fish advisories issued by Wisconsin Department of Natural Resources (WDNR)	1976
NPL listing proposal	July 28, 1998
Deposit N dredging demonstration	1998-1999
Remedial Investigation/Feasibility Study made available to the public	March 1999
Dredging demonstration project and removal actions (SMU 56/57)	1999-2000
Proposed Plan identifying EPA's preferred remedy issued to the public for review and comment	October 5, 2001
Remedial Investigation/Feasibility Study complete	December 20, 2002
Record of Decision (ROD) signature – OUs 1 – 2	December 20, 2002
Site restoration plan completed by U.S Fish and Wildlife Service	June 2003
ROD signature – OUs 3 – 5	June 30, 2003
Administrative Order on Consent for OU 1 design	July 1, 2003
Administrative Order on Consent for design for OU 2 (Deposit DD), OU 3, OU 4, and OU 5 (river mouth)	March 5, 2004
Judicial Consent Decree for OU 1 design and remediation	April 12, 2004
Remedial action start (OU 1)	September 9, 2004
OU 1 remediation	2004-2009
Judicial Consent Decree for "Phase 1" remediation	November 3, 2006
ROD Amendment for OU 2 (Deposit DD), OU 3, OU 4, and OU 5 (river mouth)	June 26, 2007
Unilateral Administrative Order (UAO) for OU 2 – 5 remediation	November 13, 2007
ROD Amendment for OU 1	June 12, 2008
Remedial action start (OU 2, OU 3, and OU 4)	April 28, 2009
First Five-Year Review signed	July 17, 2009
Explanation of Significant Differences for OUs 1 – 5	February 26, 2010
Remedial Action Certification of Completion Report	November 15, 2010
Memorandum of Agreement regarding shipwreck removal	September 4, 2013
Completion of shipwreck removal	May 9, 2014

B. BACKGROUND

Physical Characteristics

The site comprises a 39-mile stretch of the Lower Fox River as well as the bay of Green Bay. The river portion of the site extends from the outlet of Lake Winnebago and continues downstream to the mouth of the river at Green Bay, Wisconsin. The bay portion of the site includes all of Green Bay from the city of Green Bay to the point where Green Bay enters Lake Michigan. The site has been divided into five discrete operable units (OUs) by the Response Agencies. An OU is a geographical area designated for the purpose of analyzing and implementing remedial actions, and is defined on the basis of similar features and characteristics (e.g., physical and geographic properties). The river and the bay OUs are depicted in Figure 1 and are as follows:

- OU 1 – Little Lake Butte des Morts
- OU 2 – Appleton to Little Rapids
- OU 3 – Little Rapids to De Pere
- OU 4 – De Pere to Green Bay
- OU 5 – Green Bay

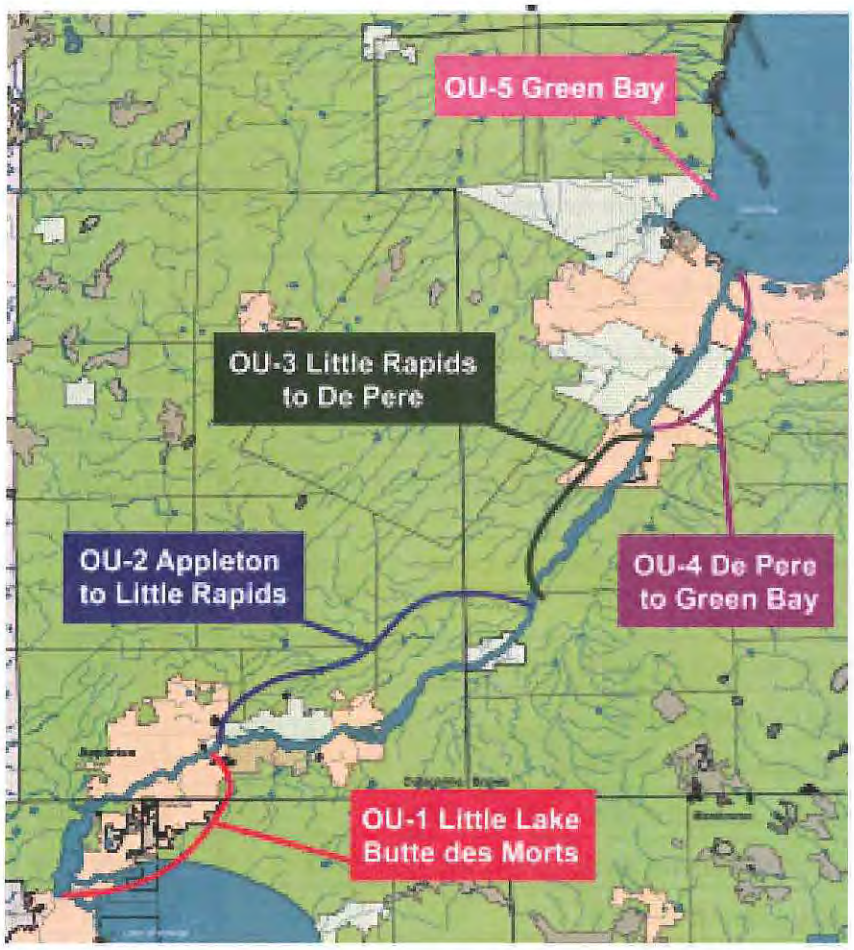

Figure 1. Fox River Operable Units

Hydrology

This is a contaminated sediment site. Groundwater is not a media of concern and was not investigated during the remedial investigation/feasibility study (RI/FS).

Land Resource and Use

The river and areas bordering the river include the following uses: recreational (with likely subsistence fishing), residential, commercial, agricultural, and industrial. Residential areas are concentrated in the upriver (Neenah/Menasha and Appleton areas) but are also present from De Pere to Green Bay. Industrial use is present in the Neenah/Menasha and Appleton area, and is scattered along the river up to and including Green Bay. Agricultural use is located mainly between Appleton and De Pere.

History of Contamination

For many years, a large number of paper production facilities have been and continue to be concentrated along the river. Some of the facilities manufactured and/or recycled PCB-containing carbonless copy paper from 1954 to 1971. PCBs were released from the paper production facilities to the Fox River directly, or after passing through municipal wastewater treatment plants. PCBs were then transported within the river system, as PCBs have a tendency to sink and adhere to sediments in the river bottom. PCBs have contaminated areas in the 39-mile length of the Lower Fox River, and Green Bay.

Initial Response

The site was proposed for the National Priorities List (NPL) on July 28, 1998. The site's placement on the NPL was deferred, pending cooperation of the potentially responsible parties (PRPs).

The Response Agencies conducted extensive evaluations, particularly beginning in 1989 with the Green Bay Mass Balance Study, as well as demonstration projects in two discrete areas of the river (known as Deposit N/O and Sediment Management Unit 56/57 [SMU 56/57]) from 1998 – 2000. Details of these projects are discussed in the 2003 ROD. In 2000, the SMU 56/57 project was completed as a time-critical removal action. A total of 90,000 cubic yards (cy) of PCB-contaminated sediments were removed and disposed off-site during these dredging projects.

In March 1998, WDNR began an RI/FS and Risk Assessment with funding and technical assistance from the U.S. Environmental Protection Agency (EPA). After extensive public comment on the draft documents, a proposed plan was released for public comment in October 2001.

The construction of an interim action identified as "Phase 1" was completed in 2007. This dredging project was located in OU 4 just downstream of the De Pere Dam, and removed 130,000 cy of PCB contaminated sediments, consistent with the 2003 ROD and 2007 ROD Amendment, which are discussed in the "Remedy Selection" section below.

Basis for Taking Action

The site is contaminated with PCBs, a hazardous substance and probable human carcinogen. Other contaminants of concern (COCs) include dioxins/furans, the pesticide DDT

and its metabolites (DDD and DDE), the pesticide dieldrin, and metals including arsenic, lead, and mercury. These non-PCB contaminants were found to present substantially less risk compared to PCBs. Additionally, some of the other contaminants identified in sediment have similar fate and transport properties, and are generally found with PCBs. For this reason, a remedy that effectively addresses PCB exposure will also address the other COCs (with lesser toxicities) in the sediment. It has been estimated that the 14 million cy of contaminated river sediments contain over 65,000 pounds of PCBs, and at least several hundred million cy of sediments in Green Bay are contaminated with as much as 150,000 pounds of PCBs. Because fish and wildlife are contaminated with PCBs, people who eat contaminated fish or waterfowl may suffer adverse health effects. Fish consumption advisories for the site were first issued in 1976 and 1977 by WDNR and the State of Michigan, respectively. The advisories are still in effect. Wildlife also has documented adverse impacts.

In conjunction with the RI/FS, an ecological risk and exposure assessment for the site was completed in December 2002. The results of the risk assessment are summarized in the 2002 and 2003 RODs. The conclusions of the evaluations (which are still valid, since site conditions are relatively unchanged since the 2002 ROD) are:

- Human health and ecological receptors are at risk in each operable unit.
- Fish consumption is the exposure pathway representing the greatest level of risk for human and ecological receptors, other than the direct risks posed to benthic invertebrates via direct exposure to contaminated sediments.
- The primary COC is PCBs.

C. REMEDIAL ACTIONS

Remedy Selection

In December 2002, the Response Agencies signed the ROD for OU 1 and OU 2 which called for active remediation in OU 1 and Monitored Natural Recovery (MNR) in most of OU 2. In June 2003, the Response Agencies issued a ROD for OU 3, OU 4, and OU 5 which called for active remediation in OU 2 (deposit DD), OU 3, and OU 4, and MNR for OU 5.

The Response Agencies subsequently modified the remedies described in the 2002 and 2003 RODs. A ROD Amendment signed on June 26, 2007, modified certain aspects of the 2003 ROD for all or part of the following OUs: OU 2 (Deposit DD), OU 3, OU 4, and OU 5 (near the mouth of the river). A second ROD Amendment, signed on June 12, 2008, made changes to parts of the remedy described in the 2002 ROD for OU 1. In general, the ROD Amendments changed the selected remedies from all-dredging to a combination of dredging, capping, and covering.

The Response Agencies issued an ESD on February 26, 2010, which addressed modifications to the monitoring requirements for OU 2, cap design modifications for OUs 2 – 5, and cost increases for OUs 2 – 5.

More details about the selected remedy for each OU is provided in the "Remedies Summary" section below.

Remedial Action Objectives

The RODs and ROD Amendments adopted the same site-wide remedial action objectives (RAOs).The following five RAOs were established for the site:

- RAO 1: Achieve, to the extent practicable, surface water quality criteria throughout the Lower Fox River and Green Bay. This RAO is intended to reduce PCB concentrations in surface water as quickly as possible. The current water quality criteria for PCBs are 0.003 nanograms per liter (ng/L) for the protection of human health, and 0.012 ng/L for the protection of wild and domestic animals. Water quality criteria incorporate all routes of exposure assuming the maximum amount is ingested daily over a person's (or animal's) lifetime.

- RAO 2: Protect humans who consume fish from exposure to COCs that exceed protective levels. This RAO is intended to protect human health by targeting removal of fish consumption advisories as quickly as possible. The Response Agencies defined the expectation for the protection of human health as recreational and high-intake fish consumers being able to safely eat unlimited amounts of fish within 10 years to 30 years, respectively, following remedy completion.

- RAO 3: Protect ecological receptors from exposure to COCs above protective levels. This RAO is intended to protect ecological receptors such as invertebrates, birds, fish, and mammals. The Response Agencies defined the ecological expectation of achieving safe ecological thresholds for fish-eating birds and mammals within 30 years following remedy completion. Although the Feasibility Study did not identify a specific time frame for evaluating ecological protection, the 30-year figure was used as a measurement tool.

- RAO 4: Reduce transport of PCBs from the Lower Fox River into Green Bay and Lake Michigan. The objective of this RAO is to reduce the transport of PCBs from the river into the bay and Lake Michigan as quickly as possible. The Response Agencies defined the transport expectation as a reduction in PCB loading to Green Bay and Lake Michigan to levels comparable to the PCB loading from other Lake Michigan tributaries. This RAO applies to each OU encompassing part of the river.

- RAO 5: Minimize the downstream movement of PCBs during implementation of the remedy. This objective would minimize, as much as feasible, the release of contaminants during remedial activities such as dredging, capping, or placing sand covers.

Remedies Summary

<u>OU 1 (a.k.a. Little Lake Butte des Morts)</u>

Operable Unit 1 consists of the first six upstream miles of the Lower Fox River, commonly known as Little Lake Butte des Morts. The 2008 ROD Amendment for OU 1 was based on new information compiled and analyzed in the OU 1 Design Supplement, Lower Fox River Operable Unit 1, dated November 16, 2007 (Design Supplement). The remedy consists of the following actions for all sediments with PCB concentrations greater than 1 part per million (ppm):

- Dredging and off-site disposal.
- 7-inch thick engineered cap of sand and armor stone.
- 3- to 6-inch-thick sand cover for areas with PCB concentrations less than 2 ppm and where the contaminant interval is less than 8-inches in thickness.
- Long-term monitoring and maintenance. Monitoring will consist of monitoring fish and surface water, and cap integrity and containment effectiveness. If cap integrity is compromised, either cap repair or removal (along with removal of underlying contamination) would be conducted.

The Remedial Action Level (RAL) for the major COC, PCBs, is 1 ppm, with a goal for a PCB surface-weighted average concentration (SWAC) of 0.25 ppm. This compares to a pre-remediation SWAC of 1.9 ppm.

OU 2

The remedy for OU 2 consists of MNR, including measuring PCB levels in water, sediment, and fish. Baseline monitoring has been completed and long-term monitoring has begun.

OU 2 (Deposit DD), OU 3, OU 4 and OU 5 (river mouth)

Remedial actions for OUs 2 – 5 are currently underway.

The 2007 ROD Amendment for OUs 2 – 5 was based on new information compiled and analyzed in the Basis of Design Report for OUs 2 – 5, dated June 16, 2006. Additionally, the 2010 ESD modified monitoring requirements for OU 2, and remedy cost and cap thickness requirements for OUs 2 – 5. The remedy consists of the following actions for all sediments with PCB concentrations greater than 1 ppm:

- Dredging and off-site disposal.
- An engineered cap of sand and armor stone with a minimum thickness of 7 inches ("A Caps"), 10 inches ("B Caps"), or 21 inches ("C Caps"), depending on the level of PCB contamination and location relative to the navigation channel, with "targeted" thicknesses of 13 inches, 16 inches, or 33 inches, respectively.
- A 6-inch-thick sand cover for areas with PCB concentrations less than 2 ppm, and where the contaminant interval is less than 6 inches in thickness.
- Long-term monitoring and maintenance. This will consist of monitoring fish, surface water, and cap integrity. If cap integrity is compromised, either cap repair or removal (with removal of underlying contamination) will be conducted.

The RAL for the major contaminant, PCBs, is 1 ppm. There is a post-remediation goal for a PCB SWAC of 0.25 ppm for OU 3 and OU 4, compared to a pre-remediation SWAC of 1.8 ppm for OU 3 and 3.6 ppm for OU 4.

OU 5 (except near river mouth)

The selected remedy for OU 5 is MNR with institutional controls (ICs). Activities will include monitoring to confirm long-term recovery of Green Bay through reliance on natural processes, primarily dispersion.

Table 2. Site Decision Documents Summary

Operable Units	RODs		ROD Amendments	
	Remedy	Signature Date	Remedy Amendment	Signature Date
1	Dredging/disposal; Capping contingency	December 20, 2002 (2002 ROD)	Dredging/disposal Capping Covering	June 12, 2008 (2008 ROD Amendment)
2	Monitored Natural Recovery[1]		Monitored Natural Recovery[1]	
3	Dredging/disposal; Capping contingency	June 30, 2003 (2003 ROD)	Dredging/disposal Capping Covering	June 26, 2007 (2007 ROD Amendment)
4				
5	Monitored Natural Recovery[2]		Monitored Natural Recovery[2]	

[1] Except for Deposit DD

[2] Except near the mouth of the Fox River

Table Note: The 2010 ESD is not included in this table because it did not fundamentally alter the selected remedy for any of the OUs.

Remedy Implementation

OU 1

From 2004 to 2009, 371,600 cy of PCB-contaminated sediment in OU 1 were dredged, and 260 acres were capped with sand and armor stone or covered with sand. Dredged sediments were disposed offsite. Table 3 and Figures 2, 3, 4, and 5 summarize these actions. Final remedial action construction activities for OU 1 were completed on May 19, 2009. These actions provided a final PCB SWAC concentration of 0.22 ppm, less the 2008 ROD Amendment goal of 0.25 ppm.

Table 3. Summary of OU 1 Remedial Action Work

Remedial Activity	Years Completed	Volume Removed (cy)	Areas Addressed (acres)
Dredging	2004 – 2008	371,600	220
Capping	2007 – 2009	--	110
Covering*	2007 - 2008	--	150
All activities (dredging, capping and covering)	2004 - 2009	371,600	480

* Includes areas with sand covers that still had PCB concentrations greater than 1 ppm after dredging (i.e., "residual" contaminated sediments).

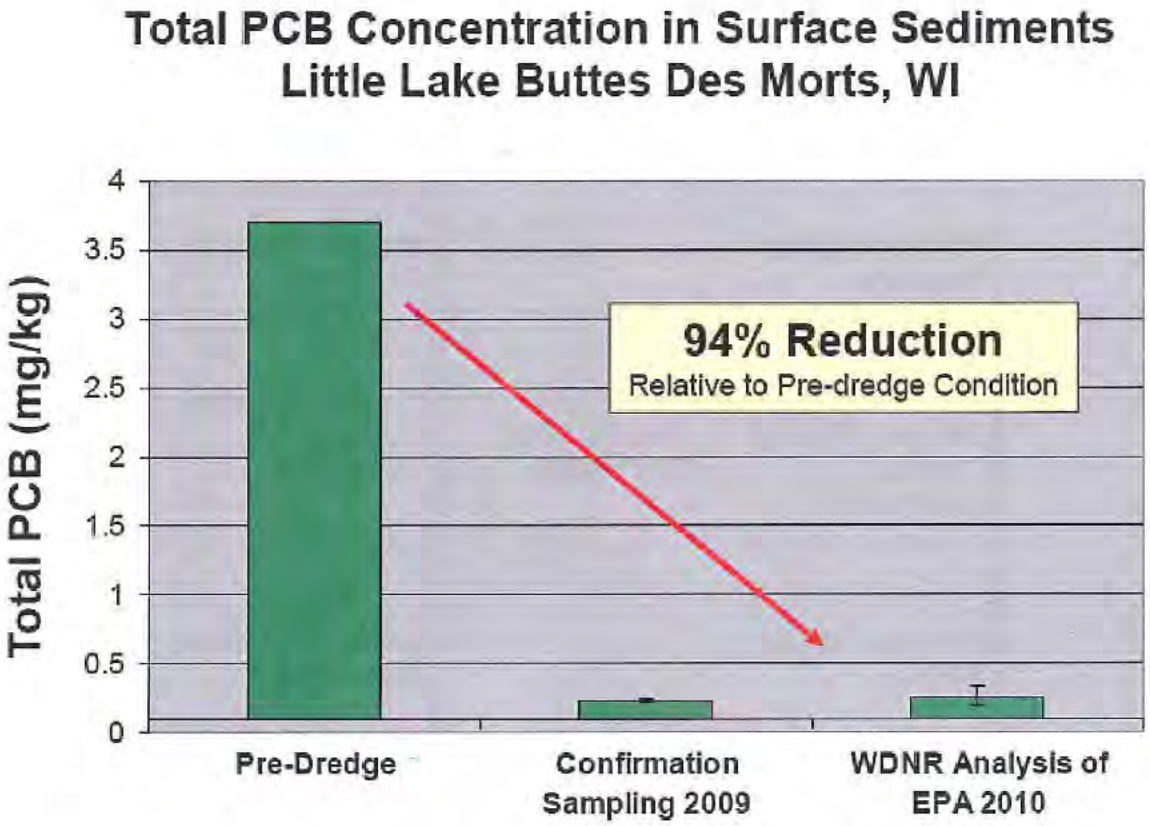

Figure 2. Pre-remedial (i.e., pre-dredge) PCB surface sediment concentration, and surface sediment PCB concentration in 2010 after remediation (i.e., 2009 Confirmation Sampling and "WDNR Analysis of EPA Data, 2010") for Little Lake Butte des Mort (OU 1).

Figures 3, 4, and 5 below show areas where dredging, capping, and sand covering, respectfully, were completed in OU 1 through May 19, 2009.

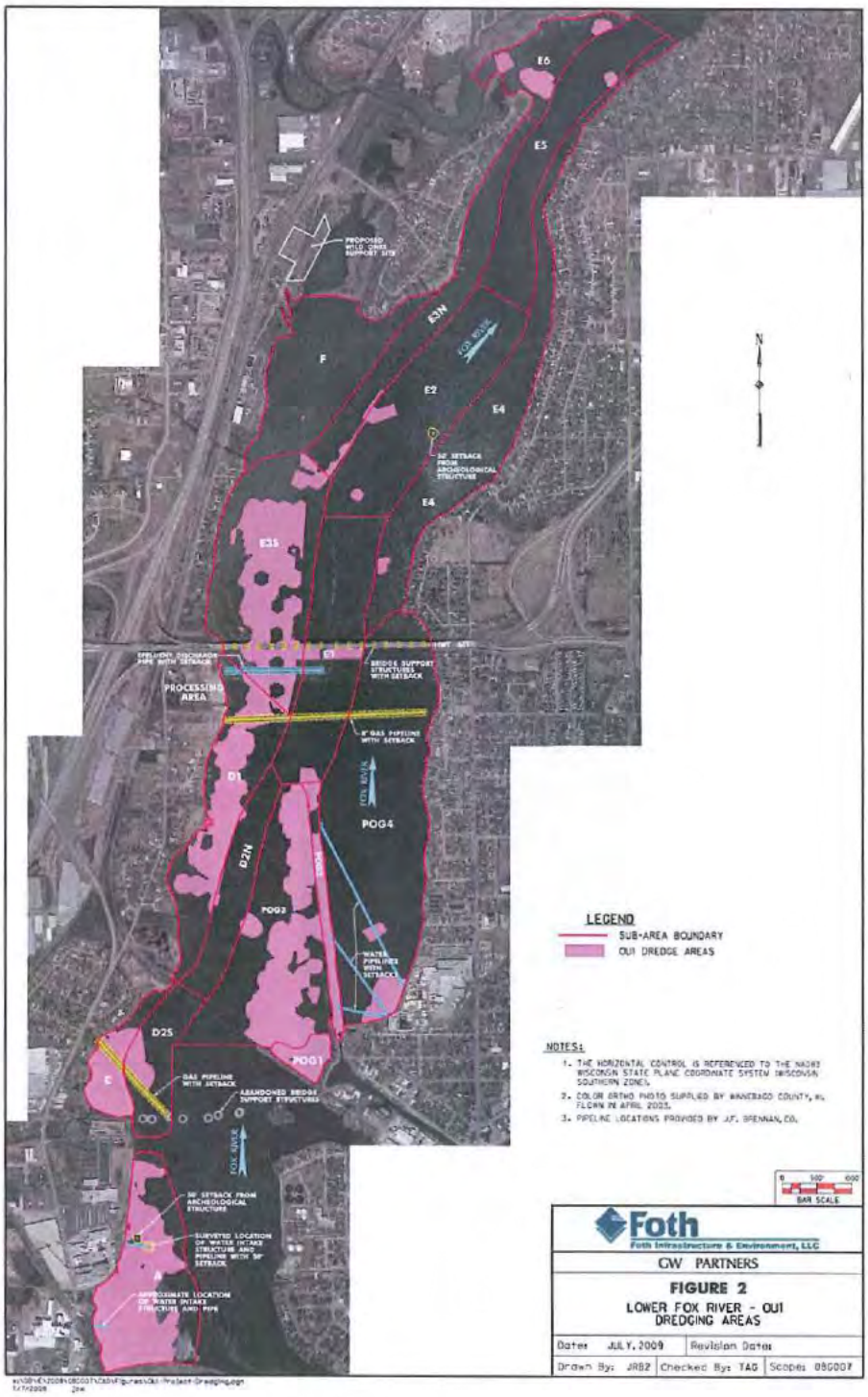

Figure 3. OU 1 Dredged Areas

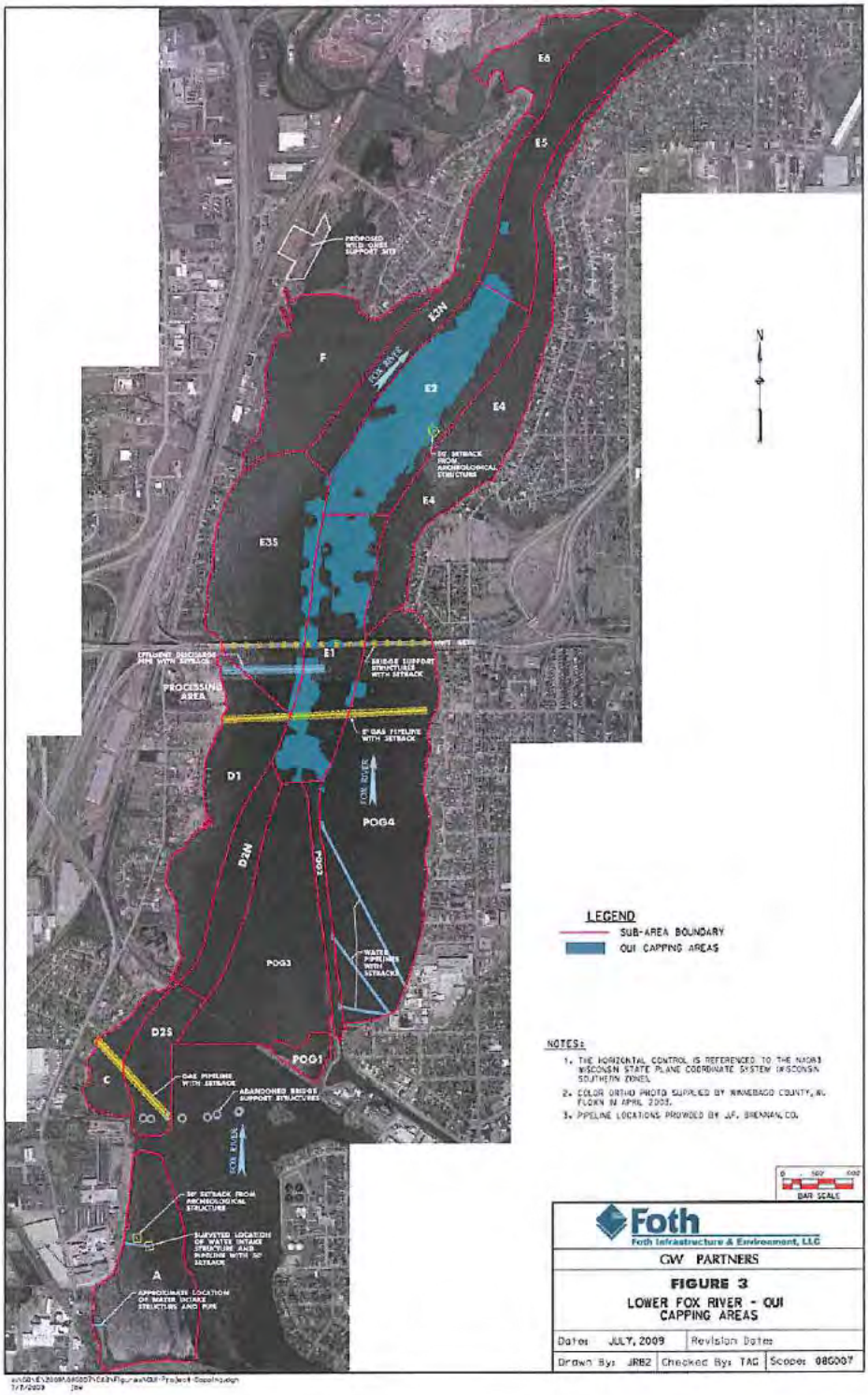

Figure 4. OU 1 Capped Areas

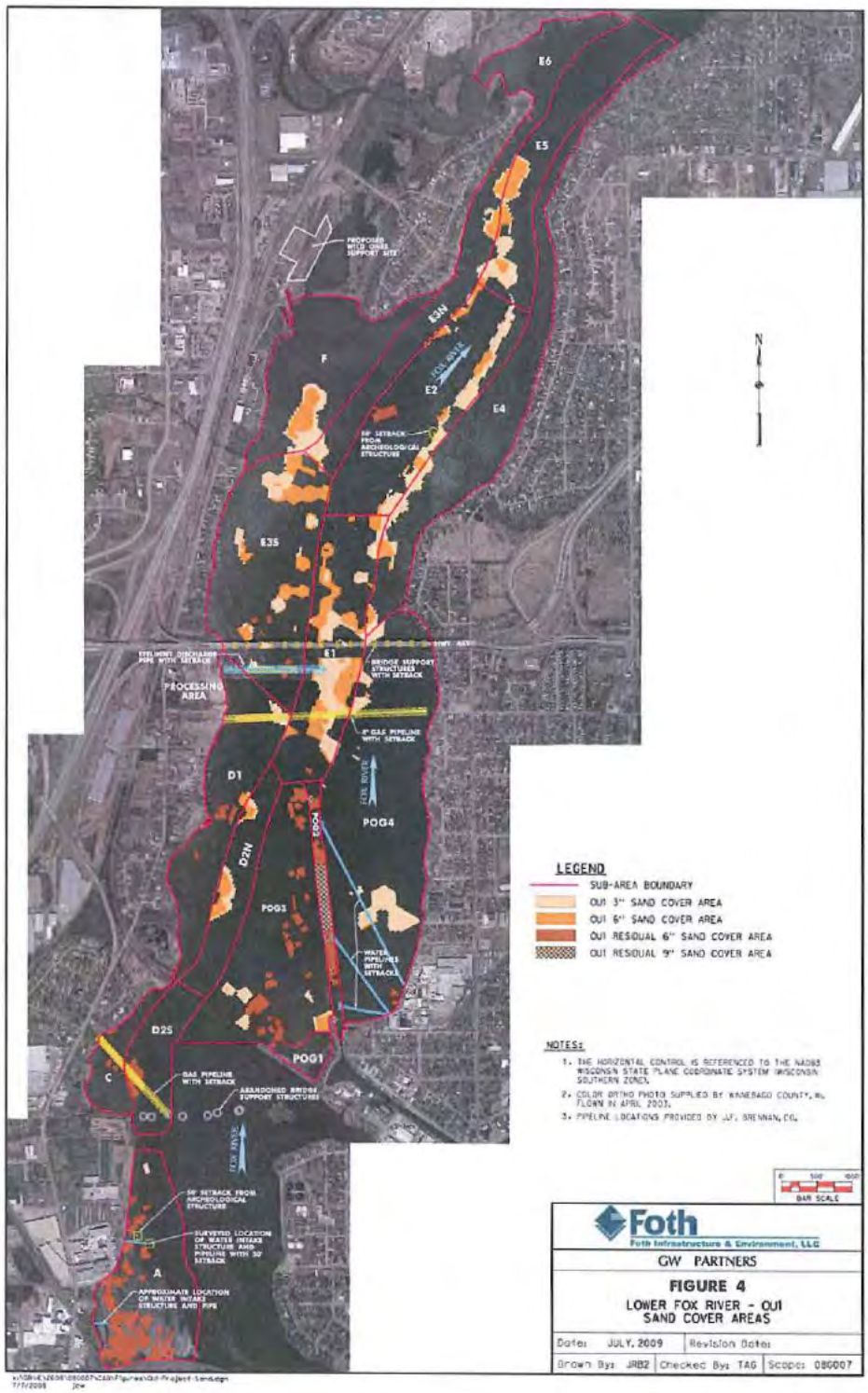

Figure 5. OU 1 Sand-Covered Areas

OU 2 (excluding Deposit DD)

The OU 2 remedy includes a monitoring program for measuring PCBs in surface water, sediment and fish tissue.

OU 2 (Deposit DD), OU 3, OU 4 and OU 5 (near river mouth)

80,000 cy of PCB-contaminated sediment were removed in the SMU 56/57 project and 130,000 cy of PCB-contaminated sediment were removed in the Phase 1 project. These two dredging projects addressed the highest PCB concentrations in the river, with PCB concentrations as high as 3,000 ppm in Phase 1.

Remedial activities for OUs 2 – 5, pursuant to the 2007 UAO, began in late April 2009 in OU 2, OU 3 and OU 4. These activities will continue through 2017 when remedial construction activities for the Fox River will be complete. Long-term monitoring will continue until the PCB concentrations in sediment, surface water, and biota no longer present an unacceptable risk to human health and the environment.

Table 4 summarizes all actions (i.e., demonstration projects, time-critical removal action, OU 1 remedial actions, Phase 1 remedial action, and OUs 2 – 5 remedial actions through 2013) taken at the site.

Table 4. Dredging Completed Through 2013

Project Name and Operable Unit	Years	Volume Removed (cy)	Project Type
Deposit N (OU 2)	1998-1999	10,000	Demonstration
SMU 56/57 (OU 4)	1999	30,000	Demonstration
	2000	50,000	Time-critical removal
Phase 1 (OU 4)	2007	130,000	Remedial action
OU 1	2004-2008*	371,600	Remedial action
OUs 2 – 5	2009-2013	2,688,400	Remedial Action
TOTAL through 2013	1998-2013	3,280,000	Demonstrations, removal and remedial actions

*Dredging work in OU1 was completed in 2008, although capping work continued through 2009 as noted in Table 3.

Table 5 below summarizes all the remedial action work conducted in OUs 1 – 5 through 2013.

Table 5. Remedial Action Work Completed Through 2013

Action	OU 1 (2004 – 2009)	OUs 2 – 4 (2009 – 2012)	OU 4 (2013)	TOTAL
Dredging – cy	**371,600[1]**	**2,103,800[2]**	**584,600[3]**	**3,060,000**
Capping - acres	**114[1]**	**34[2]**	**13[3]**	**161**
Capping – cy	**275,900[5]**	**109,700[6]**	**62,900[7]**	**448,500**
Covering – acres	**107[1]**	**62[2]**	**13[4]**	**182**
Covering – cy	**86,300[8]**	**50,300[8]**	**10,500[8]**	**147,100**

Table 5 Information sources:

[1] Foth and CH2MHILL, November 2010, Remedial Action Certificate of Completion, Table 1-1, page 3.

[2] Tetratech, et al, October 2012, Lower Fox River Remedial Design 100 percent Design Report for 2010 and Beyond Remedial Actions, Tables 9-1, 9-2, and 9-3.

[3] Tetratech EC Inc., Week Ending November 15, 2013.

[4] Tetratech EC Inc., Week Ending October 18, 2013. Sand placed reported was for incomplete caps or sand cover over residual sediments remaining after dredging (i.e., no covering was completed).

[5] Volume of sediment capped for OU 1 is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 1.5 feet) / 27 FT^2/cy = total cubic yards.

[6] Volume of sediment capped for OU 2 – 4 is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 2 feet) / 27 FT^2/cy = total cubic yards.

[7] Volume of sediment capped for OU 4 is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 3 feet) / 27 FT^2/cy = total cubic yards.

[8] Volume of sediment covered is estimated based on the following formula:
(Acres x 43,560 FT^2/acre x 0.5 feet) / 27 FT^2/cy = total cubic yards.

Table note: Volumes are rounded to the nearest hundred cubic yards.

OU 5

The selected remedy for OU 5 is MNR with ICs for most of Green Bay, with dredging, capping, or covering of PCB-contaminated sediments near the mouth of the Lower Fox River (discussed above). Long-term monitoring and cap maintenance in OU 5 will be initiated upon completion of dredging, capping, and covering actions near the mouth of the river.

Remaining Work

Table 6 shows the active remediation work remaining to be completed at the site.

Table 6. Volumes, Acreages and Areas Remaining to be Remediated for OUs 2 – 5

	Dredging		Capping		Sand Covering*	
Year	Volume (cy)	OU(s)	Acres	OU(s)	Acres	OU(s)
2014	673,000	4	66	4	47	4
2015	520,000	4 and 5	63	4	31	4
2016	275,000	---	28	4	3	4
2017	0	---	94	4 and 5	55	4 and 5
Total Remaining	1,468,000	4 and 5	415	4 and 5	459	4 and 5

* Includes both sand cover as the primary remedial action and, where necessary, for residuals over dredge areas.

Targets

Sediment Quality Thresholds (SQTs) for human health and ecological effects are shown in Table 7 and Table 8, respectively, below.

Table 7. Human Health SQTs from Table 3-2 of the Lower Fox River and Green Bay Feasibility Study

Table 3-2 Sediment Quality Thresholds Estimated for Human Health Effects at a 10^{-5} Cancer Risk and a Noncancer Hazard Index of 1.0

	Fish Parameters	Sediment Quality Thresholds			
		Recreational Anglers: Average of Michigan Studies (West et al., 1989; West et al., 1993)		High-Intake Fish Consumers: Average of Low-Income Minority Anglers and Hmong Anglers (West et al., 1993 and Hutchison and Kraft, 1994)	
	Fillet-to-Whole Fish Ratio	RME µg/kg	CTE µg/kg	RME µg/kg	CTE µg/kg
*Sediment Quality Thresholds for Risk of 10^{-5} **					
Carp	0.53	*16*	*180*	*11*	*57*
Walleye	0.13	*21*	*143*	*14*	*75*
Yellow Perch	0.13	*105*	*677*	*68*	*356*
Sediment Quality Thresholds for HI of 1.0					
Carp	0.53	*44*	*180*	*28*	*90*
Walleye	0.13	*58*	*238*	*37*	*119*
Yellow Perch	0.13	*276*	*1,128*	*175*	*564*

Notes:
* SQTs for cancer risks of 10^{-4} and 10^{-6} are an order of magnitude higher and lower, respectively.
RME indicates reasonable maximum exposure and CTE indicates central tendency exposure.
Sediment quality thresholds are bolded and in italics.

Table 8. Ecological SQTs from Table 3-3 of the Lower Fox River and Green Bay Feasibility Study

Table 3-3 Sediment Quality Thresholds Estimated for Ecological Effects

Species	Effect	Whole Fish Concentration (µg/kg ww)	Estimated SQT (µg/kg)
Benthic Invertebrates	Threshold Effect Concentration (TEL)	—	31.6
Walleye	NOAEC - fry growth and mortality LOAEC - fry growth and mortality	760 7,600	176 1,759
Carp	NOAEC - fry growth and mortality LOAEC - fry growth and mortality	760 7,600	363 3,633
Common Tern	NOAEC - hatching success LOAEC - hatching success NOAEC - deformity LOAEC - deformity	2,508 4,055 427 4,269	3,073 4,969 523 5,231
Forster's Tern	NOAEC - hatching success LOAEC - hatching success NOAEC - deformity LOAEC - deformity	2,399 3,879 408 4,083	2,940 4,753 500 5,003
Double-crested Cormorant	NOAEC - hatching success LOAEC - hatching success NOAEC - deformity LOAEC - deformity	814 1,317 139 1,386	997 1,614 170 1,698
Bald Eagle	NOAEC - hatching success LOAEC - hatching success NOAEC - deformity LOAEC - deformity	709 1,147 121 1,207	339 548 58 577
Mink	NOAEC - reproduction and kit survival LOAEC - reproduction and kit survival	50 500	24 239

APPENDIX B – ADDITIONAL FIGURES / PHOTOGRAPHS

Figure 1. Site location.

Figure 2. 8-inch hydraulic dredge.

Figure 3. Plate and frame presses for dewatering sediments from OU 2 – 5.

Figure 4. Geotextile tubes for dewatering sediments at OU 1.

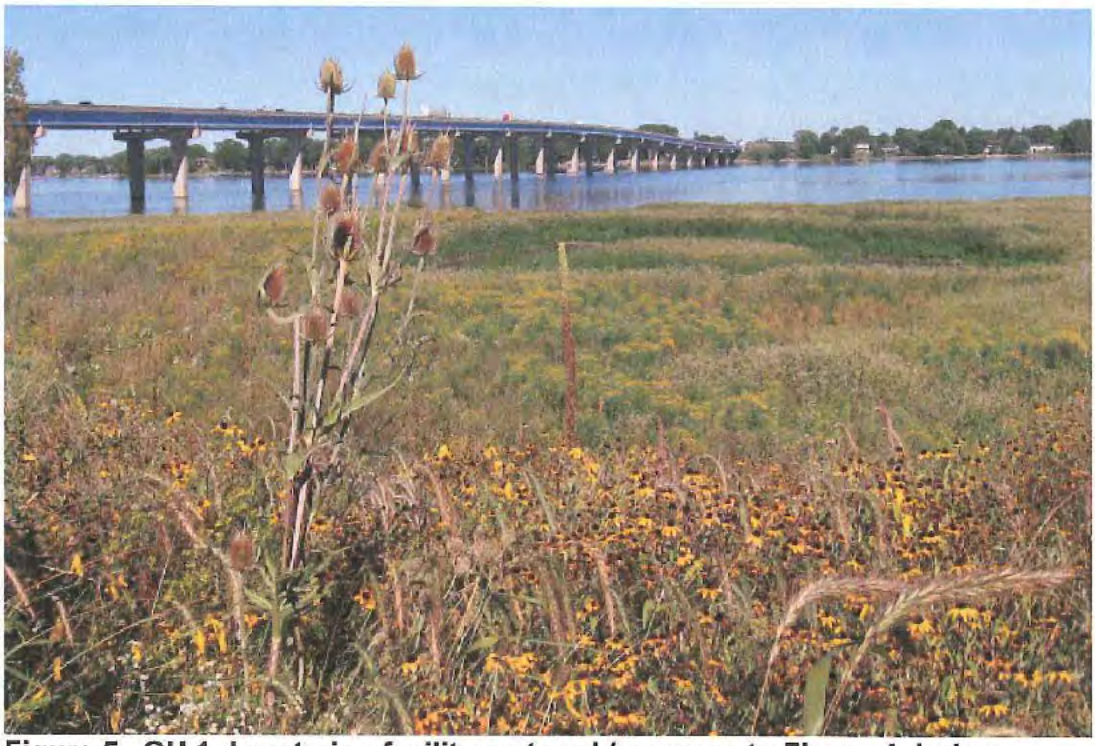

Figure 5. OU 1 dewatering facility restored (compare to Figure 4 during remediation).

Figure 6. Disposal of dredged sediments at landfill.

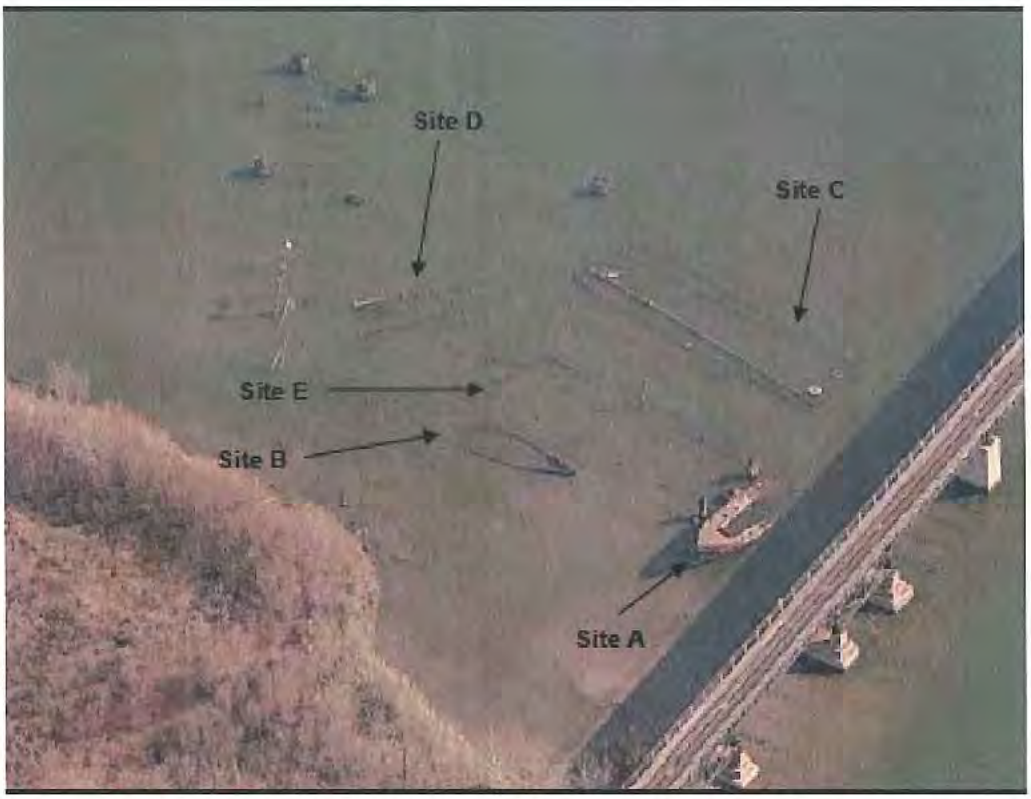

Figure 7. Shipwrecks in OU4 prior to dredging of contaminated sediments. Site A is the Bob Teed and Site B is the Satisfaction, both meriting placement of the shipwreck disposal site on the Historical Site listing.

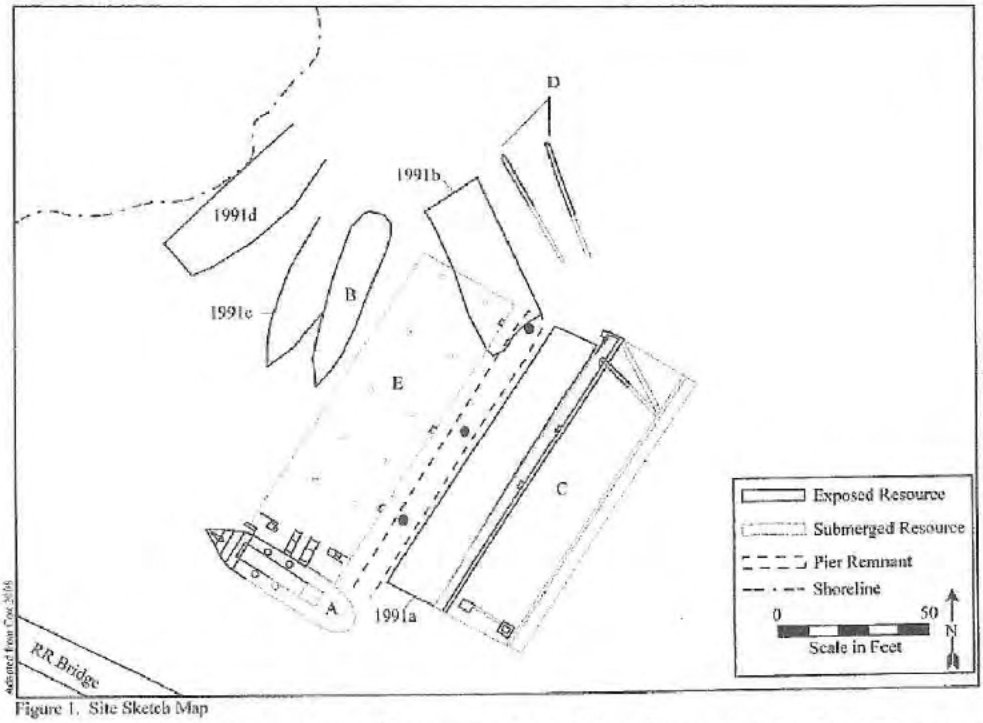

Figure 8. Line drawing of shipwrecks in OU 4. Site A is the Bob Teed, and Site B is the Satisfaction. Both of these ships were tugboats, operational from the late 1800s to the 1940s. Sites 1991a, 1991b, 1991c and 1991d were discovered during excavation activities in November 2013.

Figure 3 . View of Waterways Engineering Corporation Property. (undated)
(Courtesy: Wisconsin Maritime Museum Collection)

Note: Likely identities of vessels are annotated.

Figure 9. Ships found in the river in the ship disposal area off the site dewatering facility.

Figure 10. Shipwreck removal, November 2013.

APPENDIX C – SITE INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION 11/19/12	
Site name: Lower Fox River	**Date of inspection:**
Location and Region: Wisconsin, 5	**EPA ID:** WID 000195484 1
Agency, office, or company leading the five-year review: U.S. Environmental Protection	**Weather/temperature:**

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other Capping, covering & dredging contaminated sediments
- Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** N/A (Name) N/A (Title) N/A (Date)
   Interviewed at site at office by phone Phone no. _____
   Problems, suggestions; Report attached _____

2. **O&M staff** N/A (Name) N/A (Title) N/A (Date)
   Interviewed at site at office by phone Phone no. _____
   Problems, suggestions; Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency Wisconsin Department of Natural Resources
Contact Betty Olson
Name | Title | Date | Phone no.
Problems; suggestions; Report attached Continue coordination.

Agency U.S. Fish & Wildlife
Contact Betty Culbreath Trustee Council Coordinator 920-866-1753
Name | Title | Date | Phone no.
Problems; suggestions; Report attached Continue Trustee Coordination

Agency Oneida Tribe of Indians of Wisconsin
Contact Dave Dewey Environmental Health & Safety Division Director 920-869-1810
Name | Title | Date | Phone no.
Problems; suggestions; Report attached

Agency Menominee Indian Tribe of Wisconsin
Contact
Name | Title | Date | Phone no.
Problems; suggestions; Report attached

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits	Readily available	Up to date	N/A
	Remarks			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — Contractor for Federal Facility
Other N/A

2. **O&M Cost Records**

Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate N/A — Breakdown attached

Total annual cost by year for review period if available

From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS

Applicable (N/A)

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — (N/A)

Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — (N/A)

Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks _____

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident
Remarks _____

2. **Land use changes on site** N/A
Remarks _____

3. **Land use changes off site** N/A
Remarks _____

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A
Remarks _____

B. Other Site Conditions

Remarks N/A

VII. LANDFILL COVERS Applicable (N/A)

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** Location shown on site map Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks_____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8.	**Wet Areas/Water Damage**	Wet areas/water damage not evident	
	Wet areas	Location shown on site map	Areal extent_____
	Ponding	Location shown on site map	Areal extent_____
	Seeps	Location shown on site map	Areal extent_____
	Soft subgrade	Location shown on site map	Areal extent_____
	Remarks_____		
9.	**Slope Instability** Slides	Location shown on site map	No evidence of slope instability
	Areal extent_____		
	Remarks_____		
B. Benches	Applicable N/A		
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks_____		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks_____		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks_____		
C. Letdown Channels	Applicable (N/A)		
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent_____	Depth_____	
	Remarks_____		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type_____	Areal extent_____	
	Remarks_____		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent_____	Depth_____	
	Remarks_____		

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ No obstructions
Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations Applicable (N/A)

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks_____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks_____

E. Gas Collection and Treatment Applicable (N/A)

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks_____

F. Cover Drainage Layer Applicable (N/A)

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks_____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks_____

G. Detention/Sedimentation Ponds Applicable (N/A)

1. **Siltation** Areal extent_____ Depth_____ N/A
   Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   Erosion not evident
   Remarks_____

3. **Outlet Works** Functioning N/A
   Remarks_____

4. **Dam** Functioning N/A
   Remarks_____

H. Retaining Walls Applicable (N/A)

1. **Deformations** Location shown on site map Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** Location shown on site map Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge Applicable (N/A)

1. **Siltation** Location shown on site map Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** Location shown on site map N/A
   Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** Functioning N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS Applicable (N/A)

1. **Settlement** Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   Performance not monitored
   Frequency_____ Evidence of breaching
   Head_____

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines	Applicable	N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines	Applicable	N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks_____

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters_____
   Additive (*e.g.*, chelation agent, flocculent)_____
   Others_____
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually_____
   Quantity of surface water treated annually_____
   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Remedy is to make fish consumable and edible by humans and wildlife, and reduce PCB contamination in surface water.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Long-term monitoring has had initial sampling for OU1, OU2, and OU3. OU4 and OU5 will have initial long-term monitoring once that area has had remedy completed there estimated by 2018.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. None

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Frey, Rebecca

From: Eleder, Bonnie
Sent: Wednesday, July 16, 2014 2:25 PM
To: Frey, Rebecca
Cc: Hahnenberg, James; Eleder, Bonnie; Short, Thomas; Adler, Kevn
Subject: FYR Coordinator sign off on: Fox River NRDA/PCB Releases Site
Attachments: revised Fox River - Indicators Consistency Checklist - July 2014.pdf

Hi Becky,

Thank you for sending me the sign-off package for the Fox River NRDA/PCB Releases Site 5-Year Review (FYR) via email dated 7/15/2014, which included the FYR Report, Superfund Indicators Consistency Checklist (attached), and both environmental indicators worksheets (EIs).

With the recommended changes I provided earlier today and as you have addressed below being incorporated into the FYR report, via this email I am signing off as the FYR Coordinator on the FYR sign-off package. The EIs were signed off via a separate email dated 7/16/2014.

Please include a copy of this email as my formal FYR Coordinator "sign-off" in the FYR sign-off package.

Thank you,
Bonnie
****
Bonnie L. Eleder
FYR/EI/SWRAU Coordinator

From: Frey, Rebecca
Sent: Wednesday, July 16, 2014 2:09 PM
To: Eleder, Bonnie
Cc: Hahnenberg, James
Subject: RE: Fox River FYR comments - resolution of comments

Bonnie,

To confirm our telephone conversation, all of your changes to the Fox River FYR and Appendix A are being incorporated with the following exceptions:

- Not defining the acronym "CD" in the executive summary (b/c it's never used again)
- Changing the last paragraph in the IC section to read, *"Various Memoranda of Agreement are envisioned in the ICIAP and would have three key objectives:..."* [with rest of that paragraph left unchanged]
- Changing the next-to-last paragraph in the O&M section to read, *"These same monitoring activities will also be done at OU1 and OU2, with post-construction monitoring having begun in 2010 (OU1) and 2012 (OU2) and other monitoring activities to follow."*

I sent you the revised HE EI worksheet and revised Indicators Consistency Checklist in a separate email earlier this afternoon.

Thanks,
-Becky