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June 9, 2021

Mr. Bill Fitzpatrick, P.E., P.G.
HARP Project Manager
Wisconsin Department of Natural Resources
101 S. Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Subject: WDNR Comments dated March 15, 2021 on the Site Investigation Work Plan (SIWP)
Additional Investigation Sampling Plan, January 2021, Rev 1 and the
Quality Assurance Project Plan, January 2021, Rev 0
Downstream Hayton Millpond Dam, Chilton, Wisconsin
BRRTS 02-08-587108

Dear Mr. Fitzpatrick:

Thank you for the Department's comments on the above as contained in its letter dated March 15, 2021. On behalf of Tecumseh, below are our responses as well as the Site Investigation Work Plan (SIWP) Additional Investigation Sampling Plan, January 2021, Rev 1 and the Quality Assurance Project Plan, January 2021, Rev 0. We have also enclosed the appropriate form and technical assistance review fee.

WDNR Comments on the Site Investigation Work Plan (SIWP), January 2021, Rev 1

1. ***Note: a new BRRTS # for OU5 has been assigned per the Negotiated Agreement: 02-08-587108 HARP Downstream of Hayton Millpond Dam***

   Response: The new BRRTS# has been incorporated into the SIWP.

2. ***General Comment: Be aware that the site investigation process can be iterative, may change in scope for the media or geographical area requiring investigation, and additional sampling and an associated site investigation work plan (SIWP) may be required to complete the site investigation for OU5.***

   Response: Agreed.

3. ***Thank you for including DNR form 4400-316 SIWP Checklist in the report appendix. The checklist and the annotated comments with section references was helpful in the review of the SIWP.***

   Response: Noted and included in the SIWP.

4. ***Section 3.13 Emerging Contaminants – The department has reviewed the scoping statements for emerging contaminants PFAS and 1,4 Dioxane included in this SIWP. The department concurs with your determination that sampling for these compounds is not required at this time. This concurrence may change if additional information is received.***

   Response: Noted.

5. Degree and Extent – the SIWP has not defined the extent of the contamination below the Hayton Dam. The WP Scoping is to be used to present evidence as to the extent of contamination, based on existing data, or evidence of unimpacted media below the Dam. If the degree of contamination is unknown the WP must provide the steps that will be taken during the investigation to determine the extent. For example, PCBs were measured above background in sediment and fish at Clarks Mill, 26 miles below the dam.

Response: The SIWP is intended to provide data necessary to evaluate the degree and extent of PCB impacts downstream from the Hayton Dam whose source was the Tecumseh facility in New Holstein. The source of PCBs and contaminant flow and transport is further discussed in Section 3.2. Given General Comment #2, above, the scope of the investigation contained in the SIWP is appropriate under the circumstances.

a. The SIWP has proposed a study area extending 2 miles below the Dam. Please provide a rational for why this is the appropriate study area.

Response: The previous sediment studies in an area approximately 1.5 miles downstream of the dam showed low level PCB concentrations. Only 5 of 20 samples had total PCB concentrations above 1 mg/kg, and only 2 samples had PCB concentrations above 2 mg/kg. A surface-area weighted average concentration (SWAC) of 0.53 mg/kg was calculated for the Study Area. Furthermore, as discussed in Section 3.2 of the SIWP, potential PCBs in fine particles flowing over the dam is expected to represent a comparatively minor source concentration as compared to the source to Jordan Creek, approximately 8.5 miles upstream from the dam. Based on the results from past sediment sampling and this conceptual model of PCB fate and transport in the watershed, the 2-mile downstream Study Area represents a reasonable reach of river for sediment and overbank soil investigation. If the data from this site investigation warrants, additional sampling would be proposed further downstream for subsequent investigation (See General Comment #2, above).

b. If the proposed study area is something less than the area impacted by contamination provide a rational as to why it is appropriate to focus an investigation in this area.

Response: The proposed study area is approximately ½ mile further downstream than the area of known PCB-impacts. See the response to 5(a) and General Comment #2, above.

6. NR 716.07(2) requires that the SIWP include information on the knowledge of the type of contamination and the amount of the contamination. The Form 4400-316 Checklist identified the SIWP Section 3.2 as containing the information required for NR 716.07(2). Add the following information to Section 3.2:

Response: This information is provided in the revised SIWP.

a. Summary of past data on PCBs in water, fish and sediment.

Response: Historical PCB data for sediment downstream of the Millpond Dam, surface water, fish tissue, and Millpond sediment are included in Tables 1, 2, 3 and 4, respectively.

b. Include a summary of PCB data from the Hayton Millpond.

Response: The sediment data from the Millpond are now summarized in Table 4 and shown on Figure 4.

c. The sediment data collected in OU5 by the WDNR and TRC. Provide a map of these results.

Response: The sediment data collected downstream of the Millpond dam by TRC and WDNR are now summarized in Table 1 and on Figure 2.

d. Past water data on PCBs, e.g., USGS.

Response: The available discrete sampling results for surface water are summarized in Table 2. Appendix B contains a USGS report summarizing sediment data for the Hayton Millpond through 1995.

e. The information in this section should be sufficient to explain the current knowledge of contaminant concentration in the environmental media.

Response: See responses to Comments 6 (a) through (d), above.

7. Section 3.4 Environmental Media Potentially Affected (NR 716.07(4)) – Examples of water and fish data are presented. One PCB water sample from 2003 is presented. There are other water data such as samples from the millpond from 2001 and 2003 with concentrations up to 334 ng/l that may also be relevant in assessing potential effects. Nineteen fish samples were collected below the dam from 2015. This information may be combined with the information in Section 3.2.

Response: These data are now referenced in Sections 3.1, 3.2, and 3.4. See responses to Comment #6, above.

a. Compile relevant water data for the site in the Scoping Section and compared the data to numeric environmental standards such as water quality criteria for the protection of aquatic life and humans. Water quality criteria must include numeric and narrative criteria, designated use, and anti-degradation.

Response: The relevant surface water data are summarized in Table 2 (referenced in Sections 3.2 and 3.4). The NR 105 reference limits for wildlife (0.12 ng/L) and human cancer criteria (HCC) (0.003 ng/L) are included on the table notes.

b. Fish tissue data should be compiled in the Scoping Section and compared to numeric criteria for human health and wildlife.

Response: Table 3 contains a summary of the existing fish tissue data compared to current human health criteria.

c. Sediment data for this study area must be compiled in the Scoping Section and compared to environmental standards.

Response: Sediment data from downstream of the Hayton Dam and the Millpond are summarized in Table 1 and Table 4, respectively. The data are compared to the Site Remedial Action Goal of 1 mg/kg total PCBs in sediment.

d. Sample results shall be compared to environmental standards as discrete results, not averaged, composited, or normalized to other parameters.

Response: Tables 1 through 4 summarize the sediment, surface water, and fish tissue data, and include comparison of discrete results to the relevant environmental standards.

8. Section 3.7 Potential or Known Impacts to Receptors –this section does not call out all potential receptors as required by NR 716.07 (7). Receptor is defined in NR 700.03 (47) as "… environmental resources, including but not limited to, plant and animal species and humans, sensitive environments and habitats, water supply wells, and buildings or locations that have the potential to be, or have actually been, exposed to contamination."

Response: Section 3.7 has been updated.

a. Please consider plant and animal species and humans as potential receptors. The species listed in Section 3.8 would appear to be a starting point for this evaluation.

Response: The purpose of this SIWP does not include assessing potential risks to plant and animal species, please refer to the purpose of this SIWP discussed in Section 3.14. The data/results from the work performed as part of this SIWP will be used to further evaluate the plant and animal species and humans as potential receptors and the need for additional site investigation work. *See,* General Comment #2, above.

Regarding humans as potential receptors, please see response 8.b., below.

b. Add an evaluation of human health risk from PCBs in sediment and upland soil including direct contact.

Response: Potential risks to humans from direct contact with sediment, surface water, and fish tissue are evaluated in Tables 1 through 4 via the comparisons to the project RAGs and regulatory criteria/advisory levels. Potential risks to humans from direct contact will be discussed in the Site Investigation Report that will be prepared to summarize the results of this SIWP.

9. Section 3.8 Potential Impacts to Resources – This section is to address the requirements of NR 716.07 (8).

Response: The purpose of the SIWP is to further define the degree and extent of potential PCB impacts to in-channel soft sediment located approximately two miles downstream of the Hayton Millpond Dam, to begin defining the degree and extent of potential PCB impacts to overbank soil in this same area, and to use these results to assess if the overbank soil is a potential source of the PCB impacts observed in sediment. The potential impact to resources will be addressed after the degree and extent of PCB impacts are better defined in surface water, sediment, and soil. *See,* General Comment #2, above.

a. Impacts to downstream areas due to off-site transport of PCBs by fish, aquatic life and streamflow should be evaluated.

Response: See the general response to comment #9, above.

b. The presence of PCBs in water, sediment, and fish should be evaluated on the potential impacts to species, habitat or ecosystems sensitive to the contamination.

Response: See the general response to comment #9, above.

c. The report evaluated threatened and endangered species and concluded no impact to these species. The report didn't consider bioaccumulation and trophic transfer in the food chain that could affect the evaluated species.

Response: See the general response to comment #9, above.

d. Other species that are known for sensitivity to PCBs such as mink should also be evaluated.

Response: See the general response to comment #9, above.

e. Wetlands – the report mentions the functions of wetland including habitat however the potential effects of PCBs on wetland organisms is not mentioned.

Response: Potential effects of PCBs on wetland organisms was added to Section 3.8. See the general response to comment #9, above.

f. Outstanding Resources/Exceptional Resource Waters- The text states these resources are not present in the study area. However, impacts to downstream ORW/ERW due to off-site transport of PCBs by fish, aquatic life and streamflow should be evaluated. If there are ORW/ERW downstream of the OU5 field investigation area, these resources should be listed and evaluated for potential impacts.

Response: See the general response to comment #9, above.

10. Section 4 Site Description – This section is intended to provide a general overview of the geological and physiographical setting of the SIWP. The report does not provide site specific information regarding topography, surface water drainage patterns, hydrogeologic features, texture and classification of surface soils and sediment, geology, hydrogeology, and potential pathways. Basic site-specific information regarding each of these topics should be provided, it is not sufficient to state "(they) will not affect the choice of sampling methods, and sample locations have been accounted for based on these factors."

Response: Basic site-specific information regarding the site description and the geological and physiological setting has been provided in Section 4.

11. Section 5.1 Scope of Work – To define the degree and extent of site contamination the environmental media at the site must be sampled and analyzed.

a. The WP has identified the 4000 foot reach below the dam for SI data collection.

Response: The SIWP is proposing to investigate an area approximately 2 miles downstream from the Hayton Millpond Dam. The investigation process is iterative and will be expanded based on the results of the proposed SIWP. *See,* General Comment #2, above.

i. The distance may or may not be adequate for the purpose of a SI.

Response: Additional data may be collected as part of future investigation, based on the data from this SIWP.

ii. The study reach may be expanded if needed in the future.

Response: Agreed, the study area may be expanded in future investigations, as data warrant. *See,* General Comment #2, above.

b. Water column samples should be obtained for PCB analysis. Samples should be obtained in a variety of flow regimes and conditions to represent the expected variance of PCBs over time. Detection levels should be appropriate for the anticipated range of PCB concentrations.

Response: Surface water samples will be collected and analyzed for PCBs. The samples proposed in the SIWP are proposed to be collected during typical flow conditions, i.e. neither flood nor drought conditions. Additional samples may be collected based on the results of this site investigation.

c. Biological media must be evaluated to assess bioaccumulation and trophic transfer of PCBs. Insects, birds, and fish are resources that may be helpful in defining effects on biota. The Department is recommending an evaluation of fish and insects in this SI to assess these routes of bioaccumulation at this point in

the investigation. Fish tissue have been collected in the study area in 2015. These data should be adequate for an evaluation of fish PCBs.

Response: Based on the purpose of this SIWP, sampling of fish and biological media is not included in this SIWP, please refer to the purpose of this SIWP discussed in Section 3.14. The data/results from the work performed as part of this SIWP will be used to further evaluate biological receptors and the need for additional site investigation. In addition, fish tissue will be sampled under the monitored natural recovery plan (separate work plan and approval).

i. Aquatic macroinvertebrates should be sampled to assess this key foundation of the food chain and to evaluate the uptake of sediment and water column PCBs to the invertebrates and to the consumers of invertebrates. Invertebrates should be collected from soft organic sediment and sand/gravel areas using appropriate manual sampling protocols for wadable streams such as bulk grab sediment collection and nets.

Response: Based on the purpose of this SIWP, sampling of macroinvertebrates is not included in this SIWP, please refer to the purpose of this SIWP discussed in Section 3.14. The data/results from the work performed as part of this SIWP will be used to further evaluate macroinvertebrates and the need for additional site investigation. *See,* General Comment #2, above.

ii. Invertebrate samples from mud and sand/gravel areas must be processed and analyzed separately.

Response: See response above for item 11.c.i.

iii. The organic sediment sampled for invertebrates should also be collected for PCB analyses.

Response: See response above for item 11.c.i.

iv. Taxonomy analyses should be performed on invertebrates.

Response: See response above for item 11.c.i.

d. Sediment PCBs in the bed of the river are primarily associated with soft organic sediment as opposed to gravels, sands, or hardpan clays. The occurrence and distribution of soft anthropogenic sediment in the study area should be mapped (location, boundaries, thickness) ahead of sediment sampling to inform the study as to the appropriate sampling location to find sediment PCBs.

Response: Agreed. The sampling locations presented represent the general areas where sediment likely deposited based on the river morphology. At the time of sampling

a determination will be made regarding the location of the thickest deposit of soft, fine-grained, organic-rich sediment based on observation and poling of the sediment.

i. ***Section 5.2 setting up transect locations based on a 500-foot interval with a core collected 10-feet from each bank and the center of the channel, may make sense if the sediment is assumed to be universally impacted. However, it is more appropriate to locate the sampling both transects and core locations based on geomorphology evaluated in the field. DNR recommends a geomorphic evaluation of the distribution of soft anthropogenic sediment be completed prior to determining transects and core locations.***

   Response: Sampling locations have been adjusted to target areas of potential deposition based on river morphology. As stated in the general response to #11. (d), the sampling locations presented represent the areas where sediment is likely deposited (based on TRC's geomorphic evaluation) and will be adjusted in the field based on field observations and sediment poling.

ii. ***Section 5.3.2 while past sampling has been completed with a 2-inch core tube it may not be appropriate for all areas based on sediment grain size and sorting. Alternative methods of sampling that will have improved recovery of the fine- grained fraction such as a grab sampler (e.g., ponar) should be used.***

   Response: Section 5.3.3 (formerly Section 5.3.2) has been modified to allow the use of an alternate sampling method (e.g., dredge) in the event that a coring tool will not work.

iii. ***Where a core sampler is specified, quality control criteria for acceptable core recovery must be established.***

   Response: Section 5.3.3 (formerly 5.3.2) has been modified to specify core recovery criteria. Section 5.3.3 has also been modified to include additional sampling options regarding core tube size and other alternatives based on core recovery criteria and field conditions.

e. ***Bank face PCB deposits have been noted in prior sampling in the HARP project. Sediment sampling by the Department in 2014 found higher PCBs in sloughed bank material from the first cutbank meander below the dam and in the point bar deposit opposite the cutbank. These sediment PCB results were many times higher than millpond sediment indicating a localized PCB input to the study area. The river's eroding streambanks are the most likely source of the higher concentrations.***

   Response: Bank scrape sampling has been included in the revised SIWP, Sections 5.1 and 5.6. The bank scrape locations are paired with point bar sediment sampling locations on the opposite riverbank.

i. ***The SIWP must include bank scrape sampling to assess this source. Bank face sampling should be focused primarily on outside river bends and include grab samples of bank slump features at the base of cutbanks. The scrape samples should be performed in 1 foot intervals above the low water level of the stream with intervals collected up the bank face. Below low water elevation sampling of the banks should also be performed in one foot intervals.***

Response: Bank scrape sampling has been included in the revised SIWP.

ii. ***Add bank scraping sampling collection to 12 locations in the study area. Present the location of the scrape sampling in the SIWP and the procedures that will be used in the field to determine sample locations.***

Response: Eight areas of bank scrape sampling will be performed, at locations noted on Figure 2. The 8 scrape sampling locations are at each of the 8 major bends in the river between the dam and 2 miles downstream. If this sampling indicates that bank erosion is potentially a source of PCB impacts to the river, scrape sampling will be performed at additional locations as part of an iterative investigation process. *See,* General Comment #2, above.

f. ***Point bar deposits are comprised in large measure from secondary circulation transport from bed and bank erosion at meander bends. These deposits should be mapped and targeted for sampling for PCBs.***

Response: Point bars have been targeted for sampling. The sample locations on Figure 2 are approximate. The sediment samples will be collected from an area of soft sediment deposit within 15 feet of the approximate location.

g. ***Section 5.2 Over bank sampling- the SIWP proposed to sample overbank soils based on a 500-foot interval. The sampling would be more productive in assessing this environmental compartment if the sampling was focused on bank areas that are likely to have experiences inundation by the river.***

Response: Eight overbank soil samples will be collected targeting locations of low overbank areas and areas of apparent ponding or recent deposition. Overbank soil sampling is discussion Section 5.

i. ***DNR recommends a geomorphic evaluation be completed prior to determining sampling locations. Overbank sampling should be performed in areas where soft sediment would tend to drop out of suspension during a flood event. The rational for the proposed locations must be presented.***

Response: Low overbank areas and areas of apparent ponding or recent deposition will be targeted when selecting overbank sampling locations. Overbank sampling has been targeted in the low, swampy portion of the study area, where flooding and deposition would most likely occur. Overbank soil sample locations will be adjusted in the field based on field observations and soil sampling.

ii. Grab sampling or soil cores are more appropriate for overbank sampling versus sampling soil with a sediment corer.

Response: Overbank samples will be collected with hand tools such as a spade, a hand auger, a push tube sampler, or equivalent method as described in the revised workplan.

h. Sediment analyses – Sediment particle size and total organic carbon are important parameters to assess the behavior of sediment and trophic transfer of contaminants. These parameters should be added to the sediment analyses for a sufficient number of samples to characterize for a SI.

Response: Six samples will be analyzed for grain size and total organic carbon from representative fine-grained sediment.

i. The QAPP must include appropriate SOPs for all data collection including references to established protocols.

Response: The QAPP includes the appropriate SOPs for all data collection of surface water, sediment and overbank soil.

12. Section 5.2 Sample Location Rationale - See comments 11 d & g. Sampling locations must be selected to identify the degree and extent of contaminates and should be based on a conceptual site model of locations where PCBs are likely to accumulate. Setting up transect locations based on a 500-foot interval with a core collected 10-feet from each bank and the center of the channel, may make sense if the sediment is assumed to be universally impacted. However, it is more appropriate to locate the sampling transects and core locations based on geomorphology evaluated in the field. DNR recommends a geomorphic evaluation be completed prior to determining transects and core locations.

Response: Sampling locations have been moved to target point bars and other areas of potential deposition. Furthermore, the actual sampling location will be moved in the field to target fine-grained sediment, as described in response to comment #11.d.

13. Section 5.3 Sediment Sample Collection – The WP proposes to homogenize the upper 12 inches of a sediment core sample for laboratory analyses.

Response: Noted.

a. Sediment collected by core sample must be subsampled for lab analyses by the 0-6 inch interval and the 6-18 inch interval when available. If the full 6-18 inch interval is not available, the portion that is available must be analyzed.

Response: Sediment collection has been revised in Section 5.3.3 to sample the 0-6 inch interval and the 6-18 inch interval when available.

b. ***The SAP must specify recovery criteria for core sampling. Commonly a minimum recovery ratio of 75% is specified in sediment core sampling plans.***

Response: The criterion of 75% core recovery ratio has been incorporated in the revised SIWP.

c. ***Sediment core recovery ratios must be recorded and reported in the SI report.***

Response: Sediment core recovery ratios will be recorded in the field notes and reported in the SI report.

14. ***Section 5.3.3 Sediment Sample Processing – the WP proposes to use a pump to remove standing water in the core tube. A drilled hole or saw cut of the tube above the sediment water interface may be used to remove overlying water if appropriate measures are taken to preserve the fine material at the top of the sediment column. The core tubes may be drained if visual indications are that the water column sediment have settled, and fines will not be discharged by the draining of water.***

Response: Agreed. These sediment sampling processing measures are incorporated into the revised SIWP.

15. ***Section 5.6 – This section should be inclusive for soil and sediment samples.***

Response: Agreed

16. ***Section 5.7 QA/QC – Neither the SIWP nor the FSP associated with it included any field quality measures. This includes locational controls, recovery criteria (as mentioned in 13b) and procedures to prevent cross-contamination between sample locations.***

Response: Field quality measures are incorporated into the revised SIWP.

a. ***Collocated or split cores (i.e. field duplicates) that are processed independently at a frequency of 5% are recommended to assess field variance.***

Response: Field duplicates will be collected at a frequency of 1 for every 20 (or fewer) primary samples. Section 5.8 has been revised to include field duplicates.

b. ***Note that processing sample replicates (two aliquots from the same sample) at 10% as specified in the QAPP is an appropriate frequency.***

Response: Field duplicates, prepared as two aliquots from the same sample, will be collected at a rate of 1 for every 20 (or fewer) primary samples. Section 5.8 has been revised to include field duplicates.

c. Photo documentation is strongly encouraged.

Response: Sediment cores will be photographed at the time of sample processing. Additional photographs documenting field conditions and sample locations will also be collected.

d. As other environmental media are incorporated into the SIWP, appropriate field quality measures (e.g. blanks) should also be included.

Response: Agreed.

e. Include specific information on how field duplicate and replicate are processed in the field or the processing facility to create samples.

Response: Specific information on how field duplicates are processed in the field or the processing facility is included in Section 5.8 of the revised SIWP.

f. See comments on the QAPP, modify this section as appropriate.

Response: Section 5.8 of the revised SIWP has been modified to incorporate the comments on the QAPP.

17. Section 6.0 Schedule/Reporting

a. SI Report - This section describes the reporting of the field data collection. The SI report must contain the information described in NR 716.15 including data collected in the field investigation and the information and analyses performed in the SI scoping stage of the investigation. Please clarify the text in Section 6.0 as to the proposed content of the SI Report.

Response: Section 6.0 has been revised to clarify the SI Report.

b. Quality Assurance Information - The SI Report must include an evaluation of quality control data including the results of field duplicates, lab duplicates, and lab results for precision, accuracy and completeness.

Response: This evaluation of quality control data will be included in the SI Report and has been added to Section 6.0.

c. SWAC - The text describes using a SWAC to assess the results of sediment sampling. The Department has used SWAC to assess the results after a remedial action not to assess the risk of contamination prior to a remedial action. If a SWAC is proposed to assess the risk in the study area it would constitute a risk assessment which is limited by NR 722.11. Risk assessment may be allowed for the purpose of developing environmental standards only if "Compliance with the applicable environmental standards listed in s. NR 722.09 (2) will not be protective of public health, safety and welfare and the environment; or attaining compliance

with the applicable residual contaminant levels in ch. NR 720 is not practicable." A SWAC may be presented in the SI Report but it will not be used by the Department to assess site risks.

Response: The SI Report will include and present a SWAC. Tecumseh understands that the Department will not use the SWAC to assess site risks as this time.

18. Figure 2 - Add stream distance on the map @ 100 ft intervals, show all sediment data.

Response: Figure 2 has been modified to include stream distance markers and all existing sediment data from 2014 and 2015.

WDNR Comments on the Quality Assurance Project Plan, January 2021, Rev 0

19. Note: a new BRRTS # for OU5 has been assigned per the Negotiated Agreement: 02-08-587108 HARP Downstream of Hayton Millpond Dam.

Response: The new BRRTS# for Downstream of the Millpond Dam has been incorporated into the QAPP and SIWP.

20. There are several comments and changes required for the SIWP that will affect the QAPP; ensure that the QAPP is updated to reflect the changes to the SIWP.

Response: The QAPP has been updated to reflect the changes to the SIWP.

21. The QAPP must include appropriate SOPs for all data collection including references to established protocols.

Response: Appendix A contains SOPs for the laboratory and has been modified to include total organic carbon (TOC) by the Lloyd Kahn method. Appendix B has been inserted to include TRC's field sampling SOPs.

22. Section 1.2, 3rd sentence – "Dam" is incorrectly spelled "Dan"

Response: The text has been revised.

23. Section 1.2.1 WDNR PM, Bill Fitzpatrick is in the Environmental Management Division, Bureau of Remediation and Redevelopment.

Response: The text has been updated.

24. Section 1.4 Project Background and Description – The QAPP has defined the project boundary as 2 mile below the Hayton Dam: "Pursuant to the Negotiated Agreement, WDNR required further characterization of the sediment and overbank soil downstream of the Dam, extending from the Dam to approximately 2 miles downstream of the Dam in the South Branch Manitowoc River." The quoted text must be changed. The Negotiated Agreement has no such statement on the boundaries of the site. TRC must provide

justification as to why the 2 mile area is an appropriate investigation area for the purpose of this QAPP and SIWP.

Response: The QAPP has been revised appropriately. The revised SIWP provides a rational as to why a two-mile area is an appropriate study area. *See,* General Comment #2, above.

25. Section 1.5.2, Step 2 Identify the Goals – The goals of the investigation are to fulfill the obligations of NR 716: "…. to ensure that site investigations provide the information necessary to define the nature, degree and extent of contamination, define the source or sources of contamination, determine whether any interim actions, remedial actions, or both are necessary at the site or facility, and allow an interim or remedial action option to be selected that complies with applicable environmental laws."

Response: The QAPP text has been revised to reflect the overall goals of Chapter NR 716, the Negotiated Agreement (WDNR, Tecumseh Products, and TRC, 2018) and the SIWP.

a. In the first sentence change "investigation" to "field data collection"

Response: The text has been revised as requested.

b. Add bullets to call out other data collection such as sampling for water and biological media and sediment mapping.

Response: The specific field data collection objectives have been revised to meet the goals of the revised SIWP.

26. Section 1.5.7 – sediment subsample intervals. Soft sediment from a core sampler should be separated into a 0-6 inch interval for homogenization and analyses. If present the 6-18 inch interval or portion of the interval retrieved should be separated for homogenization and analyses

Response: The text has been revised to include sediment sample intervals as requested.

27. Section 1.7.1 and 1.7.2 Records Retention – The duration of records retention should be until five years after the receipt of a NR 726 case closure.

Response: The text has been revised.

28. Section 2.2.2 paragraph 1 provide additional detail as to when an alternate size core tube may be used e.g. what types of sediment might necessitate a wider diameter etc.

Response: The text has been revised as requested.

29. Section 2.2.2 - Core recovery criteria is not stated or assessed although the raw data would enable this to be done. See comment 13.

Response: The text has been revised to include core recovery criteria.

30. Table 2 - Holding times are incorrect for soil PCBs and do not match the laboratory SOP.

Response: The table has been revised to include the correct holding times from the laboratory SOP.

Sincerely,

TRC

Chris Harvey, P.E.
Principal

Attachments: Site Investigation Work Plan – Revision 2
Quality Assurance Project Plan – Revision 1

cc: William Nelson/WDNR – Madison, WI
S. Jason Smith/Tecumseh Products Co. LLC – Paris, TN
Curtis Toll/Greenberg Traurig LLP – Philadelphia, PA
Marc Faecher/TRC – New Providence, NJ
Ronald Bock/TRC – Irvine, CA
Bruce Iverson/TRC – Madison, WI
David Crass/Michael Best & Friedrich LLP – Madison, WI

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Technical Assistance, Environmental Liability Clarification or Post-Closure Modification Request

Form 4400-237 (R 12/18)

Notice: Use this form to request **a written response (on agency letterhead)** from the Department of Natural Resources (DNR) regarding technical assistance, a post-closure change to a site, a specialized agreement or liability clarification for Property with known or suspected environmental contamination. A fee will be required as is authorized by s. 292.55, Wis. Stats., and NR 749, Wis. Adm. Code., unless noted in the instructions below. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Open Records law [ss. 19.31 - 19.39, Wis. Stats.].

Definitions

"Property" refers to the subject Property that is perceived to have been or has been impacted by the discharge of hazardous substances.

"Liability Clarification" refers to a written determination by the Department provided in response to a request made on this form. The response clarifies whether a person is or may become liable for the environmental contamination of a Property, as provided in s. 292.55, Wis. Stats.

"Technical Assistance" refers to the Department's assistance or comments on the planning and implementation of an environmental investigation or environmental cleanup on a Property in response to a request made on this form as provided in s. 292.55, Wis. Stats.

"Post-closure modification" refers to changes to Property boundaries and/or continuing obligations for Properties or sites that received closure letters for which continuing obligations have been applied or where contamination remains. Many, but not all, of these sites are included on the GIS Registry layer of RR Sites Map to provide public notice of residual contamination and continuing obligations.

Select the Correct Form

This from should be used to request the following from the DNR:

- Technical Assistance
- Liability Clarification
- Post-Closure Modifications
- Specialized Agreements (tax cancellation, negotiated agreements, etc.)

Do not use this form if one of the following applies:

- Request for an **off-site liability exemption or clarification** for Property that has been or is perceived to be contaminated by one or more hazardous substances that originated on another Property containing the source of the contamination. Use DNR's Off-Site Liability Exemption and Liability Clarification Application Form 4400-201.
- Submittal of an Environmental Assessment for the **Lender Liability Exemption**, s 292.21, Wis. Stats., **if no response or review by DNR is requested**. Use the Lender Liability Exemption Environmental Assessment Tracking Form 4400-196.
- Request for an **exemption to develop on a historic fill site** or licensed landfill. Use DNR's Form 4400-226 or 4400-226A.
- **Request for closure** for Property where the investigation and cleanup actions are completed. Use DNR's Case Closure - GIS Registry Form 4400-202.

All forms, publications and additional information are available on the internet at: dnr.wi.gov/topic/Brownfields/Pubs.html.

Instructions

1. Complete sections 1, 2, 6 and 7 for all requests. Be sure to provide adequate and complete information.
2. Select the type of assistance requested: Section 3 for technical assistance or post-closure modifications, Section 4 for a written determination or clarification of environmental liabilities; or Section 5 for a specialized agreement.
3. Include the fee payment that is listed in Section 3, 4, or 5, unless you are a "Voluntary Party" enrolled in the Voluntary Party Liability Exemption Program **and** the questions in Section 2 direct otherwise. Information on to whom and where to send the fee is found in Section 8 of this form.
4. Send the completed request, supporting materials and the fee to the appropriate DNR regional office where the Property is located. See the map on the last page of this form. A paper copy of the signed form and all reports and supporting materials shall be sent with an electronic copy of the form and supporting materials on a compact disk. For electronic document submittal requirements see: http://dnr.wi.gov/files/PDF/pubs/rr/RR690.pdf"

The time required for DNR's determination varies depending on the complexity of the site, and the clarity and completeness of the request and supporting documentation.

Section 1. Contact and Recipient Information

Requester Information

This is the person requesting technical assistance or a post-closure modification review, that his or her liability be clarified or a specialized agreement and is identified as the requester in Section 7. DNR will address its response letter to this person.

Last Name	First	MI	Organization/ Business Name		
Smith	Jason		Tecumseh Products Company LLC		
Mailing Address			City	State	ZIP Code
5683 Hines Drive			Ann Arbor	MI	48108
Phone # (include area code)	Fax # (include area code)		Email		
(731) 707-2889	(734) 352-3745		jason.smith@tecumseh.com		

The requester listed above: (select all that apply)

- ☐ Is currently the owner
- ☐ Is considering selling the Property
- ☐ Is renting or leasing the Property
- ☐ Is considering acquiring the Property
- ☐ Is a lender with a mortgagee interest in the Property
- ☒ Other. Explain the status of the Property with respect to the applicant:

Responsible Party

Contact Information (to be contacted with questions about this request) ☒ Select if same as requester

Contact Last Name	First	MI	Organization/ Business Name		
Smith	Jason		Tecumseh Products Company LLC		
Mailing Address			City	State	ZIP Code
5683 Hines Drive			Ann Arbor	MI	48108
Phone # (include area code)	Fax # (include area code)		Email		
(731) 707-2889	(734) 352-3745		jason.smith@tecumseh.com		

Environmental Consultant (if applicable)

Contact Last Name	First	MI	Organization/ Business Name		
Harvey	Chris		TRC Environmental Corporation		
Mailing Address			City	State	ZIP Code
230 West Monroe St., Suite 630			Chicago	IL	60606
Phone # (include area code)	Fax # (include area code)		Email		
(312) 800-5910	(312) 578-0877		charvey@trccompanies.com		

Property Owner (if different from requester)

Contact Last Name	First	MI	Organization/ Business Name		
NA					
Mailing Address			City	State	ZIP Code
Phone # (include area code)	Fax # (include area code)		Email		

Section 2. Property Information

Property Name			FID No. (if known)	
Downstream of Hayton Mill Pond Dam			WID006116529	
BRRTS No. (if known)	Parcel Identification Number			
02-08-587108	see attached list			
Street Address	City		State	ZIP Code
3755 Weeks Road	Chilton		WI	53014
County	Municipality where the Property is located	Property is composed of:		Property Size Acres
Calumet	○ City ◉ Town ○ Village of Charlestown	○ Single tax parcel ◉ Multiple tax parcels		266

1. Is a response needed by a specific date? (e.g., Property closing date) Note: Most requests are completed within 60 days. Please plan accordingly.

◉ No ○ Yes

Date requested by: _____

Reason:

2. Is the "Requester" enrolled as a Voluntary Party in the Voluntary Party Liability Exemption (VPLE) program?

◉ No. **Include the fee that is required for your request in Section 3, 4 or 5.**

○ Yes. **Do not include a separate fee.** This request will be billed separately through the VPLE Program.

Fill out the information in Section 3, 4 or 5 which corresponds with the type of request:
Section 3. Technical Assistance or Post-Closure Modifications;
Section 4. Liability Clarification; or Section 5. Specialized Agreement.

Section 3. Request for Technical Assistance or Post-Closure Modification

Select the type of technical assistance requested: **[Numbers in brackets are for WI DNR Use]**

☐ No Further Action Letter (NFA) (Immediate Actions) - NR 708.09, [183] - **Include a fee of $350.** Use for a written response to an immediate action after a discharge of a hazardous substance occurs. Generally, these are for a one-time spill event.

☒ Review of Site Investigation Work Plan - NR 716.09, [135] - **Include a fee of $700.**

☐ Review of Site Investigation Report - NR 716.15, [137] - **Include a fee of $1050.**

☐ Approval of a Site-Specific Soil Cleanup Standard - NR 720.10 or 12, [67] - **Include a fee of $1050.**

☐ Review of a Remedial Action Options Report - NR 722.13, [143] - **Include a fee of $1050.**

☐ Review of a Remedial Action Design Report - NR 724.09, [148] - **Include a fee of $1050.**

☐ Review of a Remedial Action Documentation Report - NR 724.15, [152] - **Include a fee of $350**

☐ Review of a Long-term Monitoring Plan - NR 724.17, [25] - **Include a fee of $425.**

☐ Review of an Operation and Maintenance Plan - NR 724.13, [192] - **Include a fee of $425.**

Other Technical Assistance - s. 292.55, Wis. Stats. [97] (For request to build on an abandoned landfill use Form 4400-226)

☐ Schedule a Technical Assistance Meeting - **Include a fee of $700.**

☐ Hazardous Waste Determination - **Include a fee of $700.**

☐ Other Technical Assistance - **Include a fee of $700.** Explain your request in an attachment.

Post-Closure Modifications - NR 727, [181]

☐ Post-Closure Modifications: Modification to Property boundaries and/or continuing obligations of a closed site or Property; sites may be on the GIS Registry. This also includes removal of a site or Property from the GIS Registry. **Include a fee of $1050, and:**

☐ Include a fee of $300 for sites with residual soil contamination; and

☐ Include a fee of $350 for sites with residual groundwater contamination, monitoring wells or for vapor intrusion continuing obligations.

Attach a description of the changes you are proposing, and documentation as to why the changes are needed (if the change to a Property, site or continuing obligation will result in revised maps, maintenance plans or photographs, those documents may be submitted later in the approval process, on a case-by-case basis).

Skip Sections 4 and 5 if the technical assistance you are requesting is listed above and complete Sections 6 and 7 of this form.

Section 5. Request for a Specialized Agreement

Select the type of agreement needed. Include the appropriate draft agreements and supporting materials. Complete Sections 6 and 7 of this form. More information and model draft agreements are available at: dnr.wi.gov/topic/Brownfields/lgu.html#tabx4.

☐ Tax cancellation agreement - s. 75.105(2)(d), Wis. Stats. [654]

- ❖ **Include a fee of $700, and the information listed below:**

(1) Phase I and II Environmental Site Assessment Reports,
(2) a copy of the Property deed with the correct legal description.

☐ Agreement for assignment of tax foreclosure judgement - s.75.106, Wis. Stats. [666]

- ❖ **Include a fee of $700, and the information listed below:**

(1) Phase I and II Environmental Site Assessment Reports,
(2) a copy of the Property deed with the correct legal description.

☐ Negotiated agreement - Enforceable contract for non-emergency remediation - s. 292.11(7)(d) and (e), Wis. Stats. [630]

- ❖ **Include a fee of $1400, and the information listed below:**

(1) a draft schedule for remediation; and,
(2) the name, mailing address, phone and email for each party to the agreement.

Section 6. Other Information Submitted

Identify all materials that are included with this request.

Send both a paper copy of the signed form and all reports and supporting materials, and an electronic copy of the form and all reports, including Environmental Site Assessment Reports, and supporting materials on a compact disk.

Include one copy of any document from any state agency files that you want the Department to review as part of this request. The person submitting this request is responsible for contacting other state agencies to obtain appropriate reports or information.

☐ Phase I Environmental Site Assessment Report - Date: _____

☐ Phase II Environmental Site Assessment Report - Date: _____

☐ Legal Description of Property (required for all liability requests and specialized agreements)

☐ Map of the Property (required for all liability requests and specialized agreements)

Analytical results of the following sampled media: Select all that apply and include date of collection.

☐ Groundwater ☐ Soil ☐ Sediment ☐ Other medium - Describe: _____

Date of Collection: _____

☐ A copy of the closure letter and submittal materials

☐ Draft tax cancellation agreement

☐ Draft agreement for assignment of tax foreclosure judgment

☒ Other report(s) or information - Describe: Site Investigation Work Plan

For Property with newly identified discharges of hazardous substances only: Has a notification of a discharge of a hazardous substance been sent to the DNR as required by s. NR 706.05(1)(b), Wis. Adm. Code?

◯ Yes - Date (if known): _____

◯ No

Note: The Notification for Hazardous Substance Discharge (non-emergency) form is available at: dnr.wi.gov/files/PDF/forms/4400/4400-225.pdf.

Section 7. Certification by the Person who completed this form

☐ I am the person submitting this request (requester)

☒ I prepared this request for: Tecumseh Products Company LLC
Requester Name

I certify that I am familiar with the information submitted on this request, and that the information on and included with this request is true, accurate and complete to the best of my knowledge. I also certify I have the legal authority and the applicant's permission to make this request.

CD/A

Signature

6/9/2021

Date Signed

Principal

Title

(312) 800-5910

Telephone Number (include area code)

Section 8. DNR Contacts and Addresses for Request Submittals

Send or deliver one paper copy and one electronic copy on a compact disk of the completed request, supporting materials, and fee to the region where the property is located to the address below. Contact a DNR regional brownfields specialist with any questions about this form or a specific situation involving a contaminated property. For electronic document submittal requirements see: http://dnr.wi.gov/files/PDF/pubs/rr/RR690.pdf.

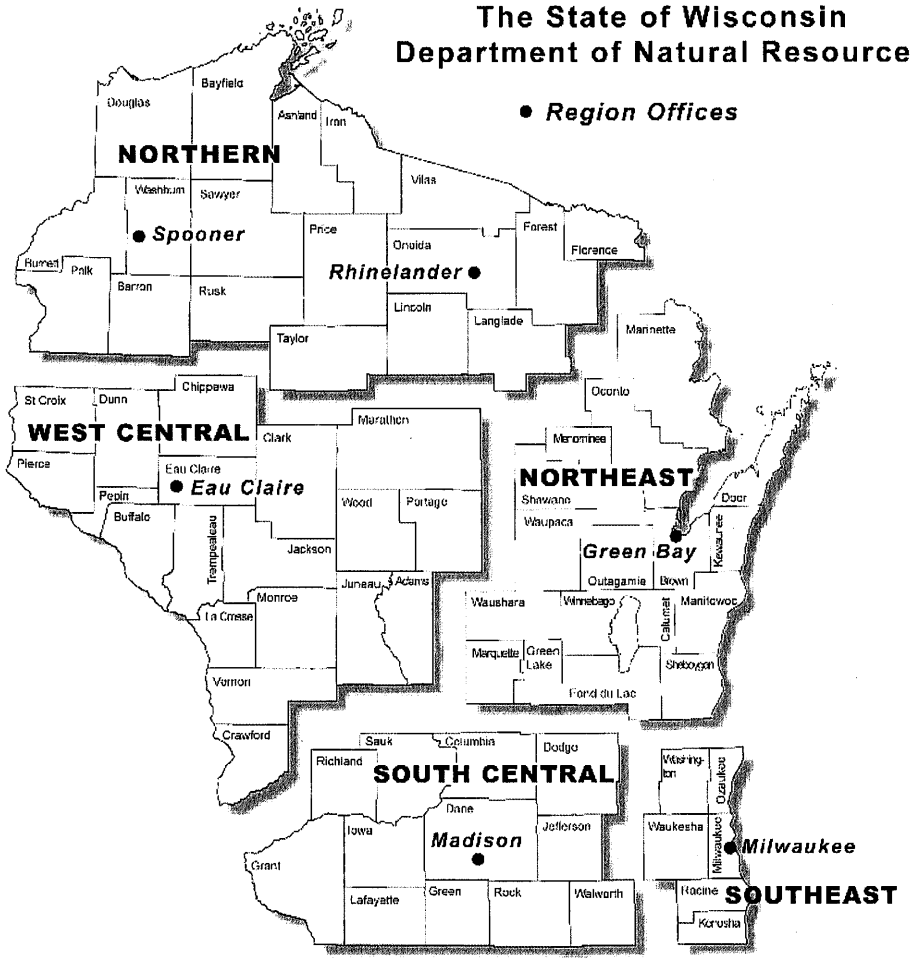
DNR NORTHERN REGION
Attn: RR Program Assistant
Department of Natural Resources
223 E Steinfest Rd Antigo, WI 54409

DNR NORTHEAST REGION
Attn: RR Program Assistant
Department of Natural Resources
2984 Shawano Avenue
Green Bay WI 54313

DNR SOUTH CENTRAL REGION
Attn: RR Program Assistant
Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg WI 53711

DNR SOUTHEAST REGION
Attn: RR Program Assistant
Department of Natural Resources
2300 North Martin Luther King Drive
Milwaukee WI 53212

DNR WEST CENTRAL REGION
Attn: RR Program Assistant
Department of Natural Resources
1300 Clairemont Ave.
Eau Claire WI 54702



Note: These are the Remediation and Redevelopment Program's designated regions. Other DNR program regional boundaries may be different.

DNR Use Only			
Date Received	Date Assigned	BRRTS Activity Code	BRRTS No. (if used)
DNR Reviewer	Comments		
Fee Enclosed? ◯ Yes ◯ No	Fee Amount $	Date Additional Information Requested	Date Requested for DNR Response Letter
Date Approved	Final Determination		

Owner	Parcel ID	Alternate Tax ID	Address	Acreage
Hayton Property Company LLC	006-0000-0000000-000-0-182016-00-330C	3826	5683 Hines Drive, Ann Arbor, MI 48108	4.32
Candy M Brassfield	006-0117-040020A-000-0-182016-00-3400	4383	N3770 Weeks Road, Charlestown, WI 53014	4.37
Roman P Gozdziewski	006-0117-030030A-000-0-182016-00-3400	4387	W1598 Center Road, Charlestown, WI 53014	0.85
Evergreen Valley Acres LLC	006-0117-030010A-000-0-182016-00-3400	4386	N3774 Weeks Road, Charlestown, WI 53014	0.7
Rex L Shipley	006-0117-020040A-000-0-182016-00-3400	4385	W1570 Center Street, Charlestown, WI 53014	0.75
RC Koehler Rentals LLC	006-0117-040010B-000-0-182016-00-3400	4384	W1603 Highway 151, Charlestown, WI 53014	9
Evergreen Valley Acres LLC	006-0117-040010A-000-0-182016-00-3400	4382	N3774 Weeks Road, Charlestown, WI 53014	3.37
Evergreen Valley Acres LLC	006-0000-0000000-000-0-182016-00-430B	3840	N3774 Weeks Road, Charlestown, WI 53014	3
Donald E Bonlander	006-0000-0000000-000-0-182016-00-430A	3839	N3742 North Mill Road, Charlestown, WI 53014	35.4699999
Johanna K Bonlander	006-0000-0000000-000-0-182016-00-440A	3843	N3742 North Mill Road, Charlestown, WI 53014	40
State of Wisconsin	006-0000-0000000-000-0-182016-00-410A	3837	101 South Webster Street, Madison, WI 53707	40
Therese Geiser	006-0000-0000000-000-0-182016-00-140A	3812	901 First Street, Kiel, WI 53042	15
State of Wisconsin	006-0000-0000000-000-0-182016-00-140B	3813	101 South Webster Street, Madison, WI 53707	5
State of Wisconsin DNR	006-0000-0000000-000-0-182015-00-230A	3790	101 South Webster Street, Madison, WI 53707	18
State of Wisconsin	006-0000-0000000-000-0-182015-00-230B	3791	101 South Webster Street, Madison, WI 53707	22
State of Wisconsin DNR	006-0000-0000000-000-0-182015-00-240B	3793	101 South Webster Street, Madison, WI 53707	19.68
Charles J Zarnoth Etux	006-0000-0000000-000-0-182015-00-240C	3794	N3166 South Mill Road, New Holstein, WI 53061	5.35
Charles J Zarnoth Etux	006-0000-0000000-000-0-182015-00-310B	3796	N3166 South Mill Road, New Holstein, WI 53061	9.15
State of Wisconsin	006-0000-0000000-000-0-182015-00-310A	3795	101 South Webster Street, Madison, WI 53707	30.4499999
				266.4599998

Site Investigation Work Plan Additional Investigation Sampling Plan

Downstream Hayton Millpond Dam
Chilton, Wisconsin

June 2021
Revision 2

BRRTS No. 02-08-587108

Prepared For:

Tecumseh Products Company LLC

Prepared By:

TRC Environmental Corporation
230 W. Monroe Street, Suite 630
Chicago, IL 60606

TABLE OF CONTENTS

TABLES

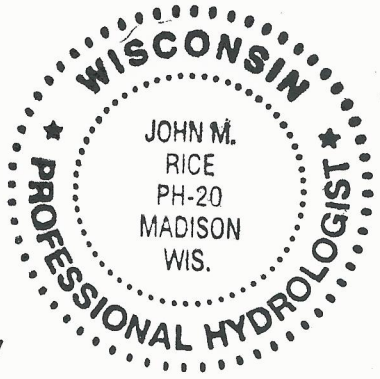
FIGURES

APPENDICES

1.0 Professional Certification

Consistent with NR 712.09(1) Wis. Adm. Code that submittals prepared by, or under the supervision of, a professional engineer, a hydrogeologist or a scientist shall be dated and certified by the professional engineer, hydrogeologist or scientist using the appropriate certification:

"I, John Rice, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."



6-9-2021

John M. Rice, PH-20 (SEAL)

2.0 Project Management Plan

Consistent with NR 716.09(2)(a) to (c) Wis. Adm. Code, the following information is provided:

1. **Site Address and Location:**
   - Street Address: 3755 Weeks Road, Chilton, Wisconsin 53014
   - Quarter-Quarter Section, Township, Range, and County: SE ¼ of SW ¼ of Section 16, SW ¼ and SE ¼ and NE ¼ of SE ¼ of Section 16, SE ¼ of NE ¼ of Section 16, SW ¼ and SE ¼ of NW ¼ of Section 15 of Township 18 North, Range 20 East, Calumet County
   - NR 716.15 (5) (d) Location Information: Refer to **Figure 1**
   - Latitude and Longitude: 88°07'06.40"W 44°01'29.00"N
   - Wisconsin Transverse Mercator (WTM) Coordinates: 1,300,324.49342 U.S. ft. N, 2,200,751.36494 U.S. ft. E
2. **Responsible Party:**
   - Tecumseh Products Company LLC
     5683 Hines Drive
     Ann Arbor, MI 48108

     Ms. Carrie Williamson, General Counsel
     (734) 585-9616 direct
     carrie.williamson@tecumseh.com
3. **Name of the Consultant Involved with the Project:**
   - TRC Environmental Corporation
     230 West Monroe Street, Suite 630
     Chicago, IL 60606

     Mr. Chris Harvey, P.E.
     charvey@trccompanies.com
     (312) 909-0043 cell

While not a requirement of the Wisconsin Department of Natural Resources (WDNR), included in Appendix A is a completed Site Investigation Work Plan Preparation Checklist, Form 4400-316 (R 07/19) to reference how this Site Investigation Work Plan (SIWP) addresses the requirements of NR 716.07 Wis. Adm. Code.

3.0 Introduction

Consistent with NR 716.09(2)(d) Wis. Adm. Code, the following applicable information per NR 716.07 (Site Investigation Scoping) is provided.

3.1 Site History and Background

This SIWP presents the proposed sampling approach to continue the required site characterization downstream of the Hayton Millpond Dam. This SIWP outlines TRC Environmental Corporation's (TRC's) site investigation scoping and proposed sampling to conduct additional investigation downstream of the dam. This additional investigation will expand on the reconnaissance study that was completed in August 2015.

In November 2018, WDNR, Tecumseh Products Company LLC (Tecumseh), and TRC executed a Negotiated Agreement (BRRTS #02-08-281506) (Negotiated Agreement), in which Tecumseh agreed to certain response actions and obligations (WDNR, 2018). In accordance with Section III.K. of the Negotiated Agreement, within 60 days of the Agreement, Tecumseh shall submit to the Department a Wis. Admin. Code ch. NR 716 a sampling plan to characterize the nature and extent of polychlorinated biphenyl (PCB) contamination below the Hayton Millpond Dam. The Downstream of the Hayton Millpond Dam area has been assigned a new BRRTS tracking number: BRRTS 02-08-587108.

Tecumseh submitted a Sampling and Analysis Plan (SAP) to the WDNR on January 8, 2019. On November 18, 2020, WDNR rejected the SAP and requested the submittal of a SIWP and a revised Quality Assurance Project Plan (QAPP). Tecumseh submitted the SIWP and revised QAPP to the WDNR on January 14, 2021. On March 15, 2021, WDNR provided comments concerning both submittals. This revised SIWP, Rev. 2, and QAPP, Rev. 1 responds to and addresses the WDNR's March 15, 2021, comments.

The Site includes the area downstream of the dam at the Hayton Millpond where hazardous substances attributable to the former Tecumseh manufacturing facility may have migrated (WDNR, 2018).

Significant PCB source removal (greater than 96% mass removal) and restoration efforts have been completed in Hayton Area Remediation Project (HARP) OU1 through OU4/Lower upgradient of the Site. No further action (NFA) letters have been received for each OU within HARP (OU1 through OU4/Lower).

This SIWP deals solely with the proposed investigation area downstream of the dam and does not address the upgradient HARP area. The area downstream of the dam is located over 8.5 miles downstream from the potential source, a former manufacturing facility in New Holstein, Wisconsin (see Section 3.2). Figure 1 shows the location of the proposed investigation area downstream of the Hayton Millpond Dam.

In August 2015, Tecumseh completed a reconnaissance study downstream of the dam at the request of the WDNR in its letter dated January 15, 2015 (WDNR, 2015). The methods and means used in this reconnaissance study were established in a WDNR-approved SAP (WDNR, 2013).

The reconnaissance study area extended from the Hayton Millpond Dam to approximately 1.5 miles downstream of the dam in the South Branch Manitowoc River. Seven transects, each with three sample locations (right, left, and center of the channel looking downstream) were selected for the reconnaissance investigation. As requested by WDNR, stream sections likely to have soft sediment deposits (i.e. slow-moving sections and inside stream bends) were targeted.

On August 18, 2015, TRC collected sediment samples at each of the seven transect locations with oversight from a WDNR representative. Once a sampling transect was located, TRC and WDNR probed sediment within the river to find adequate soft sediment for sampling. All sampling locations were approved by WDNR during the investigation. The sampling locations were biased toward areas with soft sediment accumulation and did not include fast flowing portions of the river or areas dominated by sand, gravel, or sand and soft sediments combined. The sample locations are shown on Figure 2.

Adequate soft sediment for sample collection was recovered at 20 of the 21 sampling locations. Only soft sediment (not gravel or clay till) was collected for sample analyses. In cores where discernable layers were identified within soft sediment, care was taken to collect discrete samples representing each zone. In cores without discernable soft sediment layers, all soft sediment was collected and homogenized for analysis. Soft sediment sampling zones ranged in thickness from the top 1.8 inches to 12.0 inches of sediment within the core tubes.

The reconnaissance sediment sampling results are summarized in Table 1. The total PCB concentrations from the August 18, 2015 sampling event ranged from non-detect with a 0.0286 mg/kg reporting limit (MR1-IC-901C) to 3.67 mg/kg (MR3-IC-003L). Only 5 of 20 samples had total PCB concentrations above 1 mg/kg, and only 2 samples had PCB concentrations above 2 mg/kg. A surface-area weighted average concentration (SWAC) of 0.53 mg/kg was calculated for the study area. This SWAC is biased high and is conservative, as sampling areas were focused on portions of the river having the greatest soft sediment accumulation and the sample cores did not include any native underlying material (e.g., hardpan clay) (TRC, 2015b).

The distribution and range of results indicated low levels of PCBs below the Hayton Millpond Dam. The sampling methodology did not “dilute” any sample results or otherwise bias the results. The SWAC confirmed that there is no on-going source of contamination, and that there is little PCB-associated risk downstream of the dam (TRC, 2015b).

3.2 Type and Amount of Contamination

3.2.1 Industrial History

From 1956 to 2006, Tecumseh previously owned and operated a small engine manufacturing facility located at 1604 Michigan Avenue, New Holstein, Wisconsin (TRC, 2019). This is a description of the historical source associated with HARP (BRRTS #02-08-281506). The property consists of approximately 39 acres (8 total parcels) that includes a developed section and an undeveloped lot. The former manufacturing building occupies approximately 404,700 square feet, and there are several outbuildings along the western portion of the property (TRC, 2019). Immediately north of the property is the storm water drainage ditch/outfall and agricultural fields. The storm sewer discharges to drainage ditches adjacent to the facility, which flow into Jordan Creek, Pine Creek, the Hayton Millpond, and the South Branch Manitowoc River (downstream of the dam).

The facility is currently unoccupied and zoned as heavy industrial. Adjacent zoning includes heavy industrial to the north; heavy industrial, light industrial, and multi-family residential to the east; heavy industrial and commercial to the south; and heavy industrial and light industrial to the west. During Tecumseh's ownership, the facility housed offices, production, testing, and storage areas. Procedures/structures previously identified as environmental concerns included the chromium plating, painting, engine testing, foundry work, a wastewater treatment plant sludge pit, a coolant pit, fuel oil tanks, and hazardous waste storage (TRC, 2019). The environmental impacts in these areas were addressed under previous and on-going site investigations and remediation (see Section 3.3).

It has been stated in previous reports that the source of PCBs at HARP is a result of an accidental discharge into the storm sewer from a dielectric fluid/transformer. Aroclor 1254 is predominantly detected in the site sediments and only transformers were listed by Monsanto as a principal end use for Aroclor 1254 (Foth, 1996). The facility discharged PCBs and other hazardous substances to a storm sewer that drained to storm water ditches adjacent to the facility.

3.2.2 PCB Fate and Transport

The release of PCB transformer oil (Aroclor 1254), would have been as a dense non-aqueous phase liquid (DNAPL), with a specific gravity of approximately 1.5. The oil would have relatively quickly partitioned to solids in the organic-rich sediment because PCBs have a low solubility in water and a high affinity for organic solids.

From their initial release, the PCBs would have been carried downstream on soil particles and deposited in the creek channel sediment and overbank soil. As is typical of impacts to flowing stream sediment, the concentrations in sediment and overbank soil are generally higher near the source and tend to be lower further downstream. This pattern is caused by dispersion and mixing of the source material with clean, unimpacted sediment and soil. Concentrations of PCBs in the creek channel sediment exceeded 2000 mg/kg in some sediment locations near the source, while concentrations of sediment in the Millpond (approximately 8.5 miles downstream) are generally less than 2 mg/kg.

PCBs were observed in overbank soil, as well as sediment downstream from the New Holstein facility. The data suggest that the overbank transport of PCBs occurred during high flow, since elevated concentrations of PCBs (over 50 mg/kg) were identified in the creek floodplain up to 100 feet from the creek channel. Once the PCBs were deposited in the upland floodplain, there would be little opportunity for them to be remobilized and transported back to the channel because flow velocities in the overbank areas are limited by vegetation and shallow depths even during flood events.

Soil/sediment deposited in the stream channel and bank is much more vulnerable to erosion and transport, as compared to PCBs deposited in the floodplain. While PCBs that initially settled with solids in depositional areas (e.g. point bars) may not have moved since they were initially deposited, solids that settled in less stable parts of the channel may have continued to have been transported downstream, primarily during high flow events.

Downstream transport from the dam is affected by the Hayton Millpond and the confluence with the Manitowoc River. The Millpond represents a significant sediment depositional feature that would have captured much of the PCB-containing particulate that was transported downstream. In addition, the PCB-containing particles from Pine Creek would also have been mixed with clean

sediment particles from elsewhere in the Pine/Jordan Creek watershed, including flow from the main branch of the Manitowoc River that joins Pine Creek at the Millpond. Therefore, the source of PCBs to the Manitowoc River is fundamentally different than the original release of transformer oil to Jordan Creek.

Downstream from the dam, the fine PCB-containing solids would tend to settle out in low-energy, low velocity features of the river, such as point bars, pools, eddies, and overbank. Little deposition of fine-grained material is expected where the river is straight, shallow, and fast-flowing. The sampling plan has been modified to explicitly target those areas of fine-grained sediment depositional areas in the channel and overbank.

PCB concentrations in surface water, fish tissue, and sediment have been monitored in the Pine Creek, Jordan Creek, and South Branch of the Manitowoc River periodically over more than 30 years. The available surface water and fish tissue data for HARP, areas upstream of HARP, and downstream of the dam are summarized in Table 2 and Table 3, respectively. The fish tissue sampling locations within and adjacent to HARP are shown in Figure 3. Sediment sampling data from the Hayton Millpond collected since 2005 are summarized in Table 4 and shown on Figure 4. As noted previously, the existing sediment data collected from downstream of the Hayton Millpond dam are summarized in Table 1 and on Figure 2. Appendix B contains the USGS report summarizing PCB data from the Hayton Millpond and its tributaries from 1993 through 1995.

Based on historic sampling, low levels of PCBs in sediment are present below the dam. The PCB concentrations in the South Branch of the Manitowoc River range from <0.0286 mg/kg (non-detection) to 15 mg/kg but have been shown to be decreasing over time. Sample results from 2014 and 2015 can be seen in Table 1. PCB concentrations in the surface water from 1993 through 2006 have exceeded the Wisconsin Administrative Code NR 105 Surface Water Quality Criteria for wildlife (0.12 ng/L) and human cancer (0.003 ng/L), as shown in Table 3. Sediment concentrations observed in the Hayton Millpond, upstream of the Site, have been shown to be decreasing with most samples collected in 2016 yielding a PCB concentration below the project remedial action limit (RAL) of 1 mg/kg as seen in Table 4.

3.3 History of Previous Hazardous Substance Discharges

The former Tecumseh facility in New Holstein has been the subject of environmental investigations and response since the early 1990s. Several environmental case numbers (i.e., BRRTS) have been opened with the WDNR, and most of these cases have been fully addressed and closed out, including several cases related to underground storage tanks (USTs). The bulk of the environmental work performed at the site has been done pursuant to BRRTS cases related to volatile organic compounds (VOCs) (BRRTS #02-08-100332 and #03-08-001070), and chromium (BRRTS #02-08-363333). The BRRTS cases related to VOCs have all been closed (TRC, 2019).

Tecumseh's operations included two chromium plating lines on the south end of the facility. The former chromium plating line has chromium impacts to soil and groundwater that are being addressed. Per- and polyfluoroalkyl substances (PFAS) were known to be used in some chromium plating processes to suppress the formation of chromium vapors. PFAS are an emerging class of contaminants and clean-up of PFAS impacts to the environment is subject to regulation under Wis. Stat. s. 292 and Wis. Adm. Code NR 700. Based on a site investigation in February 2020, PFAS was detected in groundwater and BRRTS #02-08-585623 was assigned (TRC, 2020). These contaminants and cases are being addressed separately.

3.4 Environmental Media Potentially Affected

Potential or known environmental media affected includes soil, sediment, surface water, fish and other biological organisms. This SIWP focuses on soil, sediment, and surface water to further characterize and assess PCBs and to evaluate the potential impact to receptors, including potential biological uptake.

Based on previous studies, low level PCBs have been detected in sediment, which can be seen in Tables 1 and 4. The remedial action limit (RAL) in sediments for this project is 1 mg/kg (ppm) and most sediment samples collected in 2015 and 2016 were below this standard. The sample locations were selected to be representative of the river such that data can be extrapolated to adjacent geomorphic settings. Channel gradient, meander bends, and depositional settings are parameters that have been considered in the sample location selection process.

Previous studies by WDNR showed low level PCB concentrations in surface water downstream of the dam. The most recent samples, dated May 2003, showed low level PCB concentrations (0.018 nanograms per liter [ng/L]), immediately downstream of the dam. These samples were collected long before the HARP remediation activities were successfully implemented and completed. A summary of surface water sample results can be found in Table 2 and shown in Figure 3. The Wisconsin Administrative Code NR 105 Surface Water Quality Criteria for wildlife is 0.12 ng/L and for human cancer is 0.003 ng/L.

Previous studies by WDNR showed low level PCB impacts to fish tissue downstream of the dam. The most recent results, dated July 2014, showed low level of PCB concentrations (0.15 ppm to 0.56 ppm) in rock bass. Higher PCB concentrations were detected in carp (up to 3.9 ppm) and greater redhorse (up to 2.2 ppm). Fish tissue concentrations upstream of the dam had higher concentrations of PCBs prior to completion of the HARP remediation. A full summary of fish tissue results can be found in Table 3 and shown in Figure 3. The Wisconsin Department of Health Services Fish Consumption Advisory Levels have a “do not eat” criterion of 2.0 ppm.

As part of the Negotiated Agreement, Tecumseh will complete Natural Recovery Monitoring of surface water (Section III.M.) and fish tissue (Section III.L. and Exhibit G), including the area downstream of the dam.

3.5 Location of Site and Proximity to Other Sources of Contamination

As mentioned above, the Hayton Mill Pond Dam is more than 8.5 miles from the potential source, the former manufacturing facility in New Holstein, Wisconsin. Other sources of contamination have been addressed or are being addressed under separate environmental cases. In addition, HARP (located upstream of the dam) has been successfully remediated and is undergoing natural recovery and wetland mitigation monitoring.

Based on a review of WDNR’s BRRTS website, a closed LUST site (BRRTS #03-08-000285) is located approximately 0.2 miles south of the river within ½ mile downstream of the dam. In addition, there are several open (shown below in Table A) and closed environmental cases in close proximity to the South Branch Manitowoc River upstream of the dam in Chilton, Wisconsin.

Table A

BRRTS No	Activity Name	Address	Municipality	Zip	FID	Activity Type	Comments
02-08-520157	Mirro Plt #20 (Former)	44 Walnut St	Chilton Cty	53014	408021130	ERP	
06-08-426946	Mirro Co Plt #20 (Former) (VPLE)	44 Walnut St	Chilton Cty	53014	408021130	VPLE	Previous Applicant-Newell Rubbermaid Inc 29 E Stephensen Freeport Il 61032
02-08-000040	Chilton Plating Co Inc	420 E Main St	Chilton	53014	408026300	ERP	
04-08-049117	Chilton Plating	420 E Main St	Chilton	53014	408026300	Spill	Old Spill ID: 931116-04
02-08-000632	Schneider Property	476 E Main St	Chilton		None	ERP	
02-08-561133	Chilton Metal Products (Former) - CVOC	300 E Breed St Site A	Chilton	53014	408013760	ERP	
03-08-000802	Chilton Metal Products	300 E Breed St Site A	Chilton	53014	408013760	LUST	
02-08-562919	Chilton E Main St (State Lead)	E Main St	Chilton		None	ERP	

3.6 Need for Permission from Property Owners to Allow Access

The sampling described in this SIWP will be performed on private and municipal property, so permission from these property owners will be required prior to work taking place. The property owners, parcel IDs, and their current mailing addresses along the South Branch of the Manitowoc River are listed in Table B below:

Table B

Owner Name	Parcel ID	Alternate Tax ID	Mailing Address
Hayton Property Company LLC	006-0000-0000000-000-0-182016-00-330C	3826	5683 Hines Drive Ann Arbor, MI 48108
Candy M Brassfield	006-0117-040020A-000-0-182016-00-3400	4383	N3770 Weeks Road Charlestown, WI 53014
Roman P Gozdziewski	006-0117-030030A-000-0-182016-00-3400	4387	W1598 Center Road Charlestown, WI 53014
Evergreen Valley Acres LLC	006-0117-030010A-000-0-182016-00-3400	4386	N3774 Weeks Road Charlestown, WI 53014
Rex L Shipley	006-0117-020040A-000-0-182016-00-3400	4385	W1570 Center Street Charlestown, WI 53014
RC Koehler Rentals LLC	006-0117-040010B-000-0-182016-00-3400	4384	W1603 Highway 151 Charlestown, WI 53014
Evergreen Valley Acres LLC	006-0117-040010A-000-0-182016-00-3400	4382	N3774 Weeks Road Charlestown, WI 53014

Table B

Owner Name	Parcel ID	Alternate Tax ID	Mailing Address
Evergreen Valley Acres LLC	006-0000-0000000-000-0-182016-00-430B	3840	N3774 Weeks Road Charlestown, WI 53014
Donald E Bonlander	006-0000-0000000-000-0-182016-00-430A	3839	N3742 North Mill Road Charlestown, WI 53014
Johanna K Bonlander	006-0000-0000000-000-0-182016-00-440A	3843	N3742 North Mill Road Charlestown, WI 53014
State of Wisconsin	006-0000-0000000-000-0-182016-00-410A	3837	101 South Webster Street Madison, WI 53707
Therese Geiser	006-0000-0000000-000-0-182016-00-140A	3812	901 First Street Kiel, WI 53042
State of Wisconsin	006-0000-0000000-000-0-182016-00-140B	3813	101 South Webster Street Madison, WI 53707
State of Wisconsin DNR	006-0000-0000000-000-0-182015-00-230A	3790	101 South Webster Street Madison, WI 53707
State of Wisconsin	006-0000-0000000-000-0-182015-00-230B	3791	101 South Webster Street Madison, WI 53707
State of Wisconsin DNR	006-0000-0000000-000-0-182015-00-240B	3793	101 South Webster Street Madison, WI 53707
Charles J Zarnoth Etux	006-0000-0000000-000-0-182015-00-240C	3794	N3166 South Mill Road New Holstein, WI 53061
Charles J Zarnoth Etux	006-0000-0000000-000-0-182015-00-310B	3796	N3166 South Mill Road New Holstein, WI 53061
State of Wisconsin	006-0000-0000000-000-0-182015-00-310A	3795	101 South Webster Street Madison, WI 53707

3.7 Potential or Known Impacts to Receptors

There are no potential or known impacts to receptors, including buildings, utilities or other subsurface improvements, and water supply wells within 1,200 feet of the outermost edge of contamination. There are no buildings within the floodplain of the South Branch Manitowoc River downstream of the dam. Based on a search of the WDNR Well Driller Viewer database, there are 10 water supply wells within 1,200 feet of the South Branch Manitowoc River study area downstream of the dam. Information about these wells is listed below in Table C. Groundwater is not known to be or potentially affected by PCBs, and there is no suspected interaction between the study area and the wells based on their screened intervals.

Table C

Well ID	Owner Name	Well Location	Approximate Distance from Study Area	Screened Interval
8DT969	N/A	SW 1/4 of Section 16 of T18N R20E	375 ft	41 to 73 ft bgs
AY011	Lydia Urban	N3770 Weeks Road, Chilton, WI 53014	180 ft	61 to 138 ft bgs
LV892	William Mueller	W1570 Center Street, Chilton, WI 53014	195 ft	52 to 160 ft bgs
VD212	Vince Bradley	W1580 Highway 151, Chilton, WI 53014	730 ft	72 to 180 ft bgs
8DT976	Lloyd Tiffany	SE 1/4 of SW 1/4 of Section 16 of T18N 20E	295 ft	42 to 141 ft bgs

Table C

Well ID	Owner Name	Well Location	Approximate Distance from Study Area	Screened Interval
8DT975	Leroy P. Coudex	SE 1/4 of SW 1/4 of Section 16 of T18N 20E	295 ft	58 to 154 ft bgs
8DT977	John Rahmer	SE 1/4 of SW 1/4 of Section 16 of T18N 20E	295 ft	63 to 117 ft bgs
JC805	Leroy Dudek	Route 4, Chilton, WI 53014	295 ft	42 to 130 ft bgs
HB013	Lucille Cullen	W1490 Highway 151, Chilton, WI 53014	570 ft	63 to 160 ft bgs
LV857	Lynette Wingers	W1421 Highway 151, Chilton, WI 53014	445 ft	105 to 200 ft bgs

3.8 Potential Impacts to Resources

Potential for impacts to the following resources were evaluated:

- **Sensitive species, habitats or ecosystems** - The study area downstream of the dam was reviewed for state and federally threatened and endangered species in June 2018 and again in December 2020 through the WDNR and U.S. Fish and Wildlife Service Information for Planning and Consultation (IPaC) online tool. This information was reviewed to determine the potential presence of sensitive species in the vicinity of the Study Area. The state review from 2018 and 2020 indicated no records of pertinent endangered resources being present within a 1-mile buffer (for terrestrial and wetland species) and a 2-mile buffer (for aquatic species) of the Study Area. The IPaC review indicated two federally-listed species may occur in the vicinity: the northern long-eared bat (*Myotis septentrionalis*) and whooping crane (*Grus americana*). It is unlikely potential PCB contamination directly impacted the northern long-eared bat or whooping crane. The northern long-eared bat roosts in trees and would therefore have avoided being impacted. The whooping crane uses western Wisconsin as a stopover during migration and would not likely have been at the Study Area. (The eastern migratory flock of whooping cranes is designated as a non-essential experimental population and does not fall under the Endangered Species Act.)

- **Wetlands** - Mapped wetlands are present within the Study Area. 71.43 acres of Wisconsin Wetland Inventory (WWI) mapped wetlands are present within the area downstream of the dam ("Study Area") as well as three wetlands mapped as being too small to delineate. The classification and amount of mapped wetlands within the Study Area are provided in Table D below.

Table D

ID	Wetland Classification	Acres
E2K	Emergent/wet meadow; Narrow-leaved persistent; Wet soil, Palustrine	42.29
T3/S3K	Forested, Scrub/shrub	5.52
T3/E2K	Forested; Emergent/wet meadow; Narrow-leaved persistent; Wet soil, Palustrine	0.37
E1Hf	Emergent/wet meadow; Standing water, Palustrine; Farmed	1.80
T3K	Forested; Broadleaved deciduous' Wet soil, Palustrine	21.45
Point	Wetland too small to delineate	NA

Potential impacts to functional values or uses of wetlands include the following Water Quality Standards, as listed in chapter NR 103.03:

- Storm and flood water storage and retention and the moderation of water level fluctuation extremes;
- Hydrologic functions including the maintenance of dry season streamflow, the discharge of groundwater to a wetland, the recharge of groundwater from a wetland to another area and the flow of groundwater through a wetland;
- Filtration or storage of sediments, nutrients or toxic substances that would otherwise adversely impact the quality of other waters of the state;
- Shoreline protection against erosion through the dissipation of wave energy and water velocity and anchoring of sediments;
- Habitat for aquatic organisms in the food web including, but not limited to fish, crustaceans, mollusks, insects, annelids, planktonic organisms and the plants and animals upon which these aquatic organisms feed and depend upon for their needs in all life stages;
- Habitat for resident and transient wildlife species, including mammals, birds, reptiles and amphibians for breeding, resting, nesting, escape cover, travel corridors and food; and
- Recreational, cultural, educational, scientific, and natural scenic beauty values and uses.

It is not anticipated that PCBs would directly or indirectly impact the first, second, or fourth Water Quality Standards. PCBs have the potential to impact the toxic substances that would otherwise adversely impact the quality of other waters of the state; habitat for aquatic organisms in the food web; habitat for resident and transient wildlife species; and recreational, cultural, educational, and scientific values and uses. PCBs are not anticipated to directly impact the natural scenic beauty of wetlands.

- **Outstanding resource waters (ORWs), and exceptional resource waters (ERWs)** - ORWs and ERWs as listed in chapters NR 102.10 NR 102.11 are not present within the Study Area. Therefore, potential impacts to these resources are not likely.
- **Sites or facilities of historical or archaeological significance** - Sources reviewed for sites or facilities of historical or archaeological significance included the Wisconsin Historic Preservation Database (WHPD), the Archaeological Report Inventory (ARI), the Archaeological Site Inventory (ASI), the Architecture History Inventory (AHI), the C.E. Brown Atlas and C.E. Brown Manuscripts, Wisconsin Land Economic Inventory plat maps (WLEI), General Land Office (GLO) survey plat maps, and the National Register of Historic Places (NRHP), Wisconsin Historical Aerial Image Finder (WHAIF).

  The literature and archives review determined that two historic structures are recorded within the Study Area. The first is the West Street Bridge (AHI #2696). The bridge was replaced in 2019. The bridge was built in 1901 and carries Weeks Road over Pine Creek. The bridge was a rubble limestone bridge with six segmentally arched spans. The West Street Bridge was determined eligible for listing on the National Register of Historic Places

(NRHP) and was added on October 14, 2016. The bridge was demolished and replaced in 2019 and is no longer eligible for listing on the NRHP.

The second historic structure is the Old Mill Supper Club (AHI #2703). The building was built in 1908 and consists of a two-story vernacular mill building. The Old Mill Supper Club has not been reviewed for listing on the NRHP. No known archaeological sites, cemeteries, or previous archaeological surveys overlap the Study Area as it is currently outlined.

As a standard part of a desktop review, cultural resources within one mile of the Study Area noted 11 archaeological sites, 2 cemeteries, and 15 historic buildings or structures. These cultural resources will not be affected.

- **Plants and Animals** - The purpose of this SIWP does not warrant or include assessing potential risks to plant and animal species. Please refer to the purpose of this SIWP discussed in Section 3.14. The data/results from the work performed as part of this SIWP will be used to further evaluate the need for this additional work.
- **Human Health Direct Contact Risks** - Potential risks to humans from direct contact with sediment, surface water, and fish tissue are evaluated in Tables 1 through 4 via the comparisons to the project remedial action level of 1 mg/kg, Wisconsin Administrative Code NR 105 Surface Water Quality Criteria, and Wisconsin Department of Health Services Fish Consumption Advisory Levels. Potential risks to humans from direct contact will be discussed in the Site Investigation Report that will be prepared to summarize the results of this SIWP.

3.9 Potential Interim and Remedial Actions Applicable to Release

There are no potential interim and remediation actions currently applicable to downstream of the Hayton Mill Pond Dam. The proposed investigation will help determine the need for an interim and/or remedial action for PCB contamination downstream of the dam.

3.10 Immediate or Interim Actions Taken or in Progress

As mentioned above, significant risk reduction has been achieved by the remedial activities completed in HARP. The remediation activities resulted in substantial PCB source removal (greater than 96% mass removal) and restoration efforts have been completed in HARP OU1 through OU4/Lower between 2001 and 2020. The WDNR-approved remediation actions were completed by removing in-channel sediment and overbank soil in the dry. The excavated material was stabilized and disposed at a nearby landfill. More than 140,000 tons of sediment and soil was removed and disposed. All operable units have received NFA letters. The remediation areas were successfully restored to approximately pre-existing conditions. The Site will progress to monitored natural recovery in accordance with the Negotiated Agreement.

3.11 Other Items

A comprehensive scoping and evaluation (as discussed in the subsections of Section 3.0) has been conducted for this SIWP and no other items, including climatological conditions and background water or soil quality information would affect the scope of the investigation.

3.12 Need to Gather Data to Determine Hydraulic Conductivity

Groundwater is not a known or potentially affected media for PCBs downstream of the dam. There is no need to gather data to determine hydraulic conductivity.

3.13 Emerging Contaminants

An evaluation of emerging contaminants, PFAS and 1,4-dioxane is provided below.

3.13.1 PFAS

The PCB impacts associated with the Site downstream of the Hayton Dam are likely the result of a release of dielectric oil containing the PCB mixture Aroclor 1254 to the City of New Holstein stormwater system. The release likely occurred before 1970, between 1952 to 1969. It is believed to be the result of a single, relatively short duration release of less than 1,000-gallons of liquid material to the City of New Holsten stormwater system. PCBs were transported downstream in the HARP watershed by alternate scour and redeposition of PCB-laden fine-grained soils during storm events (ATS, 2001).

PFAS has not been identified as an additive to PCB-containing dielectric oil in scientific literature (Glüge, et. al., 2020), by Interstate Technology & Regulatory Council's PFAS Team (ITRC, 2020), or in WDNR's guidance document on Site Investigation Scoping, DNR-RR-101E (WDNR, 2019). As such, PCB-containing dielectric fluid is not a known source of PFAS.

As discussed in Section 3.3, a PFAS investigation is currently underway at the facility (BRRTS #02-08-585623) associated with the chrome plating operations. This environmental case is being investigated and addressed separately.

Based on the above information, further investigation into PFAS downstream of the dam is not warranted.

3.13.2 1,4-Dioxane

1,4-dioxane is a common contaminant at sites contaminated with certain chlorinated solvents (particularly 1,1,1-trichloroethane) because of its widespread use as a stabilizer for chlorinated solvents (USEPA, 2017). The environmental cases involving chlorinated solvents and VOCs (BRRTS #02-08-100332 and #03-08-001070) associated with the former facility are closed (see Section 3.3). In addition, due to the contaminants of concern are PCBs from dielectic fluid, investigation into 1,4-dioxane downstream of the dam is not warranted.

3.14 Purpose

This SIWP focuses on further characterization of PCBs in sediment, overbank soil and surface water downstream of the Hayton Millpond Dam. As discussed in the Negotiated Agreement (WDNR, Tecumseh Products, and TRC, 2018), the overall objective is to submit to the Department a Wis. Adm. Code ch. NR 716 a "…sampling plan to characterize the nature and extent of the PCB contamination below Hayton Mill Pond dam."

As described in NR 716.01 Wis. Adm. Code *"…. site investigations provide the information necessary to define the nature, degree and extent of contamination, define the source or sources*

of contamination, determine whether any interim actions, remedial actions, or both are necessary at the site or facility, and allow an interim or remedial action option to be selected that complies with applicable environmental laws." Furthermore, as noted in WDNR's letter dated March 15, 2021, "a site investigation may be an iterative process where information collected in one step may inform the process of the need for further evaluation, analysis or data collection in order to meet the overall objective of the site investigation."

In consideration of the above information and with acknowledgement that site investigation is an iterative process, the purposes of this SIWP are:

- To further define the degree and extent of potential PCB impacts to in-channel sediment.
- To assess the potential PCB impacts to overbank soil.
- To assess the potential PCB impacts in surface water.

Also as described in NR 716.01 Wis. Adm. Code *"Nothing in this chapter shall be construed to require plans or reports that are more detailed or complex than is justified by the known scope of contamination or the complexity of the site or facility."* Based on the upstream PCB source removal activities and associated NFA determinations, the current knowledge of contaminant concentrations downstream of Hayton Dam, and the scoping as described throughout Section 3, the complexity of the site investigation as commented on by the WDNR in their letter dated March 15, 2021 is not justified at this time.

The sampling and analysis discussed in Section 5 are to address the SIWP purpose as outlined above and justified by the current knowledge and complexity of the area downstream of Hayton Dam. Based on the results of this data collection, an evaluation will be performed to assess the need for further evaluation, analysis, or data collection.

4.0 Site Description

Consistent with NR 716.09(2)(e) Wis. Adm. Code, this section provides basic information on the physiographical and geological setting to choose sampling methods and locations.

4.1 Existing Topography

The land surrounding the South Branch of the Manitowoc River in the Study Area is primarily agricultural with more woodlands present as Station 55+00 is approached from upstream.

The section of the South Branch of the Manitowoc River being investigated in this work plan has an average approximate elevation of 809 feet above mean sea level (amsl), with a gradual downward slope (814 ft amsl to 804 ft amsl) from the Hayton Dam to the eastern end of the study area. Beginning at the Hayton Dam and traveling east, the surrounding riverbanks have an elevation of up to 830 ft amsl and are sharply incised on the north side initially and then mainly on the south side for the first 3,000 feet of the river. These first 3,000 feet of the river are also relatively straight with one turn to the southeast. This section has an approximate sinuosity of 1.09. After this section, the river begins to meander to the northeast, and the riverbanks are poorly incised and range from 806 ft amsl to 808 ft amsl. This eastern meandering section of the river through wooded lowland has an approximate sinuosity of 2.01. Overall, the portion of the South Branch of the Manitowoc River in the study area has an approximate sinuosity of 1.75.

4.2 Surface Water Drainage Patterns and Significant Hydrogeologic Features

All surface water in the Study Area ultimately flows into the South Branch of the Manitowoc River, which meanders from the southwest corner to the northeast corner of this area. No other significant hydrogeologic features are found in the study area besides the South Branch of the Manitowoc River.

The ordinary high water mark (OHWM) is defined as the point on the bank or shore up to which the water, by its presence, wave action or flow, leaves a distinct mark on the shore or bank. This demarcation helps in determining where bank erosion might be expected. The OHWM has been determined in the study area, as described in the Ordinary High Water Mark Determination letter, dated February 19, 2021, and agreed upon by WDNR. The OHWM is shown on Figure 2.

4.3 Texture and Classification of Surface Soils

According to the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey, the study area consists mainly of Kewaunee loam, Manawa silt loam, Wauseon sandy loam, Mosel loam, fluvaquents, and Poygan silty clay loam.

4.4 Nature and Distribution of Geologic Materials

Historic well construction reports in the area generally show shallow topsoil above a clay layer ranging from 6 to 30 feet thick on top of sand and gravel with bedrock below. From previous work performed in the study area, the South Branch of the Manitowoc Riverbed typically contains a layer of soft sediment (mainly organics and silt) on top of native hardpan, clay, and/or glacial till.

4.5 General Hydrogeologic Information

From well construction logs in the study area, it appears that bedrock is typically encountered at approximately 31 to 72 feet bgs. Bedrock below the study area is mapped as dolomite and is part of the Silurian system. Also, a majority of the study area is classified as FEMA floodway Zone AE which presents a 1% chance of flooding annually, according to WDNR's Surface Water Data Viewer online application.

4.6 Potential Hazardous Substance Migration Pathways

Migration of potential hazardous substances in the study area would be due to erosion of sediment from cutbanks and other areas of fast-flowing current during high flow/flooding events and deposition in point bars and lower velocity sections of the river. Areas with the highest potential for sediment settling will be targeted during sampling.

5.0 Sampling and Analysis Plan

Consistent with NR 716.09(2)(f) and (g) Wis. Adm. Code, this section provides information on the proposed sampling and analysis strategy. Samples will be collected and analyzed in accordance with the Quality Assurance Project Plan (QAPP) developed for the South Branch Manitowoc River investigation area (TRC, 2021).

5.1 Scope of Work

Based on the scoping evaluation in Sections 3.1 – 3.13 and the purpose discussed in Section 3.14, the SIWP includes the following tasks:

- **Surface Water Sampling**
  - One surface water sample will be collected at each of the 16 in-channel transect locations shown on Figure 2.
  - At each transect location, the surface water sample will be collected from the approximate midpoint of the water column in the thalweg of the river.
- **In-Channel Sediment Sampling**
  - Sediment probing with a rod or a core tube will be performed at each of 16 in-channel transect locations (Figure 2) to determine the location of the thickest soft sediment deposits along the transect. The sediment sampling transects will be coincident with the surface water sampling locations.
  - Up to three sediment cores will be collected at each of 16 sampling transect locations shown on Figure 2 (up to 48 cores).
  - At each transect, one core will be collected within approximately 10 feet of the left bank, one core will be collected within approximately 10 feet of the right bank, and one core will be collected at the approximate center of the channel where sediment is present. Each recovered sediment core will be physically logged and up to two sediment samples from the core with the greatest thickness of soft sediment will be processed for laboratory analysis.
  - A total of up to 32 sediment samples will be processed for laboratory analysis, up to two from each of the sampling transects shown on Figure 2.
- **Overbank Soil Sampling**
  - A total of 8 overbank soil samples will be collected at the eight overbank sample locations shown on Figure 2.
  - These results will be used to evaluate the overbank soil conditions and potential source areas.
- **Scrape Sample Collection**
  - Scrape samples will be collected from the riverbank at 8 locations shown on Figure 2.

All sampling will be performed during a period of normal flow conditions (i.e., neither flood stage nor drought). The rationale for sample locations is described in the following Section 5.2.

5.2 Sample Location Rationale

TRC will collect 16 total surface water samples, 32 sediment samples (up to two from each of the 16 sampling transects), 8 overbank soil samples, and 8 scrape samples (Figure 2) for laboratory analysis. The sample locations were selected to evaluate the sediment, overbank soil, and potential source areas. Figure 2 shows the sampling locations and transects. The locations of the proposed samples were determined using the following guidelines:

- To characterize the nature and extent of potential low-level PCB impacts, transect samples are based on a spacing of approximately 500 feet between transect intervals.
- Each transect location was evaluated and modified to account for geomorphological characteristics of the river and the results of previous investigations. A transect location was moved to a river bend or wider section of the river that may have higher rates of sediment accumulation. Channel gradient, proximity to the river channel and meander bends, surface elevation, and depositional setting were considered in the sample and transect location selection process.
- A transect location was slightly modified if it was near a previous sediment sample location with slightly higher PCB concentrations to confirm those previous sample results.
- Based on WDNR's concerns that there is a potential source area in the floodplain downstream of the Hayton Mill Pond Dam, overbank soil samples will be collected from locations within two miles of the dam. This distance correlates to the higher PCB concentrations detected in previous sediment sample events.
- Surface water samples will be collected in correlation to the sediment sampling locations.
- The overbank soil samples will be collected from within 10 feet of the top of the riverbank, and target locations of low overbank areas and areas of apparent ponding or recent deposition.
- Scrape samples will be collected on the outside of significant bends in the river (i.e., cut banks) to evaluate the potential for eroding material from the river's streambanks as potential source material.

The following Sections describe the surface water, sediment, and soil sampling plans in more detail.

5.3 In-Channel Sediment Sample Collection

This section describes the sampling equipment and methodology for the collection of sediment samples in the Manitowoc River from the locations described above.

5.3.1 Sediment Sampling Locations

Prior to mobilizing to the field, the site will be cleared through Digger's Hotline and the site will be marked to indicate identified underground utilities that cross the river. Riparian landowners whose

land will be accessed along the investigation area will be contacted prior to the initiation of field activities (see Section 3.6).

The locations of the proposed surface water and sediment transects will be pre-loaded into a global positioning system (GPS) receiver capable of sub-meter accuracy (Trimble Geoexplorer handheld GPS unit, Juniper Geode Bluetooth GPS, or equivalent). The GPS unit will be used to navigate as close as practicable to each target transect location. The field technician will access the sampling locations by wading. Surface water sampling will be performed prior to collecting sediment samples in order to minimize the mobilization of particulate material in the water column.

5.3.2 Sediment Sample Collection

At each transect, up to three sediment cores will be collected and physically logged. Three general locations along each transect will be targeted, one within approximately 10 feet of the left (looking downstream) bank of the river, one within approximately 10 feet of the right bank of the river, and one from the approximate center of the channel. The locations of the cores will be modified in the field as necessary to target depositional features and locations containing the thickest deposits of soft sediment as determined by probing with a rod or coring device. The final locations of each sediment core will be recorded with the GPS unit.

Consistent with the sample methodology implemented throughout this project, sediment core samples will be collected using a manually driven coring device such as a piston core sampler or a push tube. Cores will be collected in clear plastic (PVC, lexan, polycarbonate, or equivalent) core tubes approximately 2-inches in diameter. The actual diameter of the core may vary between 1.5 inches and 2.75 inches, depending on the device employed. At each location, the core tube will be lowered through the water column until in contact with the sediment surface, and the water depth, estimated to the nearest 0.1 foot, will be recorded. The core tube will then be pushed by hand through the entire thickness of soft sediment and into the underlying soil until refusal is encountered, or to a maximum of 3 feet below the sediment/surface water interface. The penetration depth will be recorded. The sample core will be extracted from the sediment, capped, labeled, maintained in a vertical orientation, and transported to shore for processing. If soft sediment is not present; or the core recovery at the time of retrieval is less than 18 inches **and** does not appear representative of sediment conditions, up to three attempts may be made to collect a representative core sample at the sample location. A sediment core will be considered representative if the core recovery ratio at the time of sampling is at least 75%.

Physical data collected at each location will include the following:

- The water depth;
- The distance that the core is pushed into the sediment;
- The thickness of soft sediment;
- The conditions of refusal (physical impediment or resistance);
- The visual description of the deposit; and
- The recovery length.

In the event that field conditions prohibit the collection of sediment with a coring device, alternative sampling methods such as dredges (e.g., Ponar or Ekman), augers, or shovels/scoops may be used to collect grab samples from the sediment.

5.3.3 Sediment Sample Processing

Sediment cores will be processed at a designated location on shore or at the TRC office in Madison, Wisconsin. Standing water in the core tubes will be carefully removed once visual observation indicates that particulates in the water column have settled and fines will not be discharged by draining the water. Standing water will be removed using a suction pump equipped with low-density polyethylene (LDPE) tubing. New, clean tubing will be used for each core, and care will be taken to preserve any fine material at the top of the sediment surface. Alternatively, a drilled hole or saw cut in the tube above the sediment water interface may be used to remove overlying water, taking care to preserve the fine material at the top of the sediment column. After removing the standing water, each core tube will be cut lengthwise and the core will be split to allow for visual logging and sample preparation. The cores will be described in accordance with the Unified Soil Classification System (USCS) and core logs will be prepared.

After the cores from a given transect have been logged, one core from the transect will be selected for the collection of analytical samples. The analytical samples will be collected from the core within the transect with the greatest thickness of soft sediment. Up to two samples will be processed, one from the 0- to 6-inch interval, and a second from the 6- to 18-inch interval, if adequate sample material is recovered. Sediment from the targeted intervals will be segregated and placed in separate homogenization vessels (e.g. steel bowl, foil pan, or equivalent). At a minimum, one sample from the upper 6 inches will be collected. If less than 6 inches of soft sediment are recovered at a sample location, the full thickness of the soft sediment will be placed in a homogenization vessel for processing. A sample from the 6- to 18-inch interval will be processed if at least three inches of sediment are recovered in that interval (i.e., a minimum soft sediment recovery of 9 inches in the full core). Once the sample material has been selected and segregated, each sample will be thoroughly homogenized and placed into the laboratory sample containers. The sample containers will be placed on ice and shipped to Pace Analytical Laboratories in Green Bay, Wisconsin for PCB analysis (USEPA Method 8082-WIS). Up to six samples of soft sediment will also be submitted for Total Organic Carbon (TOC) analysis (USEPA Method 5310C) and grain size distribution. Samples will be selected to represent a range of materials encountered. Samples for grain size distribution may be composited from locations with similar sediment material in order to meet sample volume requirements.

Excess sediment material, if any, will be placed in 5-gallon buckets, sealed, and managed as investigation-derived waste (IDW) in accordance with Section 5.11. Sample processing equipment may be new, single-use, and disposable; or may be re-used at the discretion of the field crew, if these materials can be adequately decontaminated following use. All non-dedicated, non-disposable sampling equipment will be decontaminated in accordance with Section 5.10 prior to collecting or processing the next sample.

5.4 Surface Water Sample Collection

This section describes the sampling equipment and methodology for the collection of surface water samples.

5.4.1 Surface Water Sampling Locations

The locations of the proposed surface water and sediment transects will be pre-loaded into a global positioning system (GPS) receiver capable of sub-meter accuracy (Trimble Geoexplorer handheld GPS unit, Juniper Geode Bluetooth GPS, or equivalent). The GPS unit will be used to navigate as close as practicable to each target transect location. The field technician will access the sampling locations by wading. Surface water sampling will be performed prior to collecting sediment samples in order to minimize the mobilization of particulate material in the water column.

5.4.2 Surface Water Sample Collection

Surface water sampling will be performed during a period representing typical flow on the river (e.g., not during periods of drought or flood). Surface water samples will be collected from the approximate midpoint of the water column in the thalweg of the river channel at each transect location. Water samples will be collected either by direct filling of the sample container, direct filling of a transfer container to use to fill laboratory sample containers, or by peristaltic pump, depending on the field conditions at the sampling location. To collect the sample by direct filling of the sample container (or transfer container), the field technician will invert the sample container, lower it to the sampling depth, right the container, and seal the container with the lid prior to removing the bottle from the water column.

If the water sample is to be collected with a peristaltic pump, as may be necessary in either very shallow or deep water, a piece of low density polyethylene (LDPE) tubing (or equivalent), weighted as needed, will be lowered to the approximate midpoint of the water column. The sample will then be pumped directly into the laboratory sample containers. The sample containers will be placed on ice and shipped to Pace Analytical Laboratories in Green Bay, Wisconsin for PCB analysis (USEPA Method 8082-WIS).

5.5 Overbank Soil Sample Collection

This section describes the sampling equipment and methodology for the collection of overbank sediment samples.

5.5.1 Overbank Soil Sampling Locations

TRC will collect 8 overbank soil samples (Figure 2). The sampling locations have been selected to target areas of potential overbank flow and potential deposition. Therefore, the low, wooded wetland area has been targeted for most of the sampling due to its low topography and tendency to flood. These samples will be collected to evaluate the overbank soil conditions and potential source areas. The overbank samples will be collected from approximately within 10 feet from the edge of the riverbank. The final locations of each sample will be recorded with the GPS unit. Subsequent samples may be collected and analyzed laterally or at additional depth intervals based on the results from the initial samples.

5.5.2 Overbank Soil Sample Collection and Processing

Overbank soil samples will be collected using either a spade, a hand auger, a push tube sampler, or equivalent. Each soil sample will be collected from the ground surface to a depth of 6 inches below ground surface (bgs) to evaluate the soil conditions. The soil will be either placed directly into a homogenization vessel (e.g. steel bowl, foil pan, or equivalent) and processed at the sample

location, or transferred to a suitable container for transport to a designated location on-site or to the TRC office in Madison, Wisconsin for processing.

Sample descriptions will be completed for each sampling location. The USCS soil texture, color, moisture, root content, mottling, and other features (such as odor, presence of shell fragments, or sand or gravel lenses) will be recorded. Descriptions will be completed of the material recovered at each of the sampling locations on WDNR boring log forms.

Soil samples for analysis will be thoroughly homogenized and placed into the laboratory sample containers. Sample containers will be placed on ice and shipped to Pace Analytical Laboratories in Green Bay, Wisconsin for PCB analysis (USEPA Method 8082-WIS).

Excess soil sample material, if any, will be placed in 5-gallon buckets, sealed, and managed as IDW in accordance with Section 5.11. Sample processing equipment may be new, single-use, and disposable; or may be re-used at the discretion of the field crew, if these materials can be adequately decontaminated following use. All non-dedicated, non-disposable sampling equipment will be decontaminated in accordance with Section 5.10 prior to collecting or processing the next sample.

5.6 Scrape Sample Collection

This section describes the sampling equipment and methodology for the collection of scrape overbank and sediment samples.

5.6.1 Scrape Sampling Locations

TRC will collect scrape samples at 8 locations as shown in Figure 2. The exact locations will be determined in the field to capture the location where slumping or erosion of the bank material is occurring. These samples will be collected on the outside of 8 significant bends in the river (i.e. cut banks) to evaluate the potential for eroding material from the river's streambanks as potential source areas. [Note: These 8 scrape sampling locations are paired with point bar sediment sampling locations.] The scrape samples will be collected at approximate one-foot vertical intervals along the riverbank. Samples will be collected from the sediment at the toe of slope (not more than 5 feet from the edge of water) to the top of the riverbank at one-foot vertical intervals.

5.6.2 Scrape Sample Collection and Processing

Scrape soil samples will be collected using either a spade, a hand auger, a push tube sampler, or equivalent. Each soil sample will be collected from the ground surface to a depth of 6 inches bgs to evaluate the soil conditions. The soil will be either placed directly into a homogenization vessel (e.g. steel bowl, foil pan, or equivalent) and processed at the sample location, or transferred to a suitable container for transport to a designated location on-site or to the TRC office in Madison, Wisconsin for processing.

Sample descriptions will be completed for each sampling location. The USCS soil texture, color, moisture, root content, mottling, and other features (such as odor, presence of shell fragments, or sand or gravel lenses) will be recorded. Descriptions will be completed of the material recovered at each of the sampling locations on WDNR boring log forms.

Soil samples for analysis will be thoroughly homogenized and placed into the laboratory sample containers. Sample containers will be placed on ice and shipped to Pace Analytical Laboratories in Green Bay, Wisconsin for PCB analysis (USEPA Method 8082-WIS).

Excess soil sample material, if any, will be placed in 5-gallon buckets, sealed, and managed as IDW in accordance with Section 5.11. Sample processing equipment may be new, single-use, and disposable; or may be re-used at the discretion of the field crew, if these materials can be adequately decontaminated following use. All non-dedicated, non-disposable sampling equipment will be decontaminated in accordance with Section 5.10 prior to collecting or processing the next sample.

5.7 Surface Water, Sediment, and Soil Sample Identification

All samples collected for this investigation will be designated with a "MR-" location identifier (ID) representing the South Branch Manitowoc River. The sample locations in this investigation will use the following naming system:

- **Surface Water Samples**

  Surface water samples will have the additional prefix "SW" following the location ID.

  - For surface water samples on the left side of the river:
    - MR SW [#010-499]L
      Example: MR SW 012L
  - For surface water samples on the right side of the river:
    - MR SW [#510-899]R
      Example: MR SW 512R
  - For surface water samples (center of the river):
    - MR SW [#910-999]C
      Example: MR SW 912C

- **In-Channel Sediment Samples**

  In-channel samples will have the additional prefix "IC" following the location ID.

  - For in-channel samples on the left side of the river:
    - MR IC [#010-499]L
      Example: MR IC 012L
  - For in-channel samples on the right side of the river:
    - MR IC [#510-899]R
      Example: MR IC 512R
  - For in-channel samples (center of the river):
    - MR IC [#910-999]C
      Example: MR IC 912C

- **Overbank Soil Samples**

  Overbank soil samples will have the additional prefix “OB” following the location ID.

  - Overbank characterization samples on the left side of the river will be named as follows:
    - MR OB [#010-499]L [interval]
      Example: MR 012L 0-6”
  - And on the right side of the river:
    - MR OB [#510-899]R [interval]
      Example: MR 512R 0-6”

- **Scrape Samples**

  Scrape samples will have the additional prefix “SCR” following the location ID.

  - Scrape samples will include a letter interval from lowest to highest (i.e. A, B, C…)
  - Scrape samples will include a designation above water “AW” or under water “UW”
  - Scrape samples on the left side of the river will be named as follows:
    - MR [#010-499]L [interval] [water level]
      Example: MR SCR 012L B / UW (second vertical interval / under water)
  - And on the right side of the river:
    - MR [#510-899]R [interval]
      Example: MR SCR 512R D / AW (third vertical interval / above water)

The 3-digit sample number for all in-channel, overbank, and scrape sample locations will be unique for a given sample type (e.g., overbank soil on the left side of the river) and will be labeled in sequence from upstream to downstream (e.g., beginning with “010” for soil on the left bank). The ground surface will be used as the 0” reference for the sample interval. In addition, where sample interval potentially become deeper than 6”, additional samples will be collected in 12” intervals.

5.8 Sample Shipment and Laboratory Analysis

Samples for chemical analysis will be placed on ice immediately after collection for transport to Pace Analytical Laboratories in Green Bay, Wisconsin. The analytical lists and methods are included in Table 5. Representative laboratory detection limits are included in the QAPP (TRC, 2021) and are summarized in Table 6.

5.9 Quality Assurance/Quality Control (QA/QC) Samples

This section summarizes the QA/QC samples for this SIWP. More detail of the QA/QC samples and process is provided in QAPP, Rev. 1, June 2021.

5.9.1 Field Duplicates

Blind field duplicate samples, prepared by splitting a single sample into two separate containers, will be used to evaluate sampling precision. Field duplicates of sediment or soil cores will be prepared by splitting the core lengthwise into two separate containers for sample processing. Duplicates of surface water or other solid matrix materials (those not collected with a coring device) will be direct filled into separate sample containers (or homogenization vessels) at the sampling location. Points where duplicate samples are to be collected will be selected by the field technician and the samples will be submitted as single-blind duplicates to the laboratory. Field duplicates will be collected at a rate of one for every 10 (or fewer) primary samples for the surface water matrix. Duplicate samples will be collected at a frequency of one for every 20 or fewer for solid matrix samples (e.g., sediment, soil, and scrape samples).

5.9.2 Replicate Samples

Replicate samples, prepared by splitting the same sample material into two sample containers after processing, will be collected for solid matrix samples (sediment, soil, and scrape samples). Replicate samples will be collected at a rate of one for every 10 (or fewer) primary samples.

5.9.3 Equipment Blanks

Equipment (rinsate) blanks are analyzed to check for contamination related to equipment decontamination procedures. Equipment blanks are collected by rinsing a piece of field-cleaned equipment with deionized water and collecting the rinsate in the sample container. Equipment blanks will only be collected if non-disposable, non-dedicated sampling equipment is used. If applicable, equipment blanks will be collected at a frequency of one for every 20 (or fewer) primary samples that are collected with the non-dedicated, non-disposable equipment.

5.9.4 Temperature Blanks

In accordance with NR 716.13 (6), the condition of each cooler will be evaluated upon receipt at the laboratory. Samples received on ice are considered preserved at the correct temperature (4°C, ± 2°). Temperature blanks may also be analyzed to assess whether the sample temperature was maintained during sample transport, especially in the case that the ice has all melted. Temperature blanks consist of a sample container, generally polyethylene, filled with tap water. One temperature blank will be transported with each cooler containing sample containers. No other QA/QC samples will be collected as a part of this investigation.

5.10 Equipment Decontamination

Equipment decontamination will be performed in accordance with the QAPP (TRC, 2021).

5.10.1 Single-Use Sampling Equipment

To the extent practicable, single-use sampling equipment and materials will be used for the collection of samples. The materials used will be new and clean, and will be placed in plastic for transport to the site. Once used, single-use equipment will be placed in plastic bags and managed as IDW material. Single-use equipment may include, but is not limited to, the following:

- Disposable foil pans

- PVC, polycarbonate, acrylic (or similar material) core barrel liners
- Polyethylene (or similar) core tube caps
- Disposable nitrile or latex gloves

5.10.2 Non-dedicated Sampling Equipment

Non-dedicated equipment used for sample collection or sample processing will be new or cleaned before its initial use in the field, and cleaned again before use at each subsequent sampling site (and between sample intervals). Equipment subject to this decontamination procedure includes, but is not limited to, the following:

- Coring tools (e.g., pistons or core barrels)
- Scoops, spatulas, and mixing bowls (if re-used)

The general procedure for decontaminating field equipment is as follows:

- Scrape off as much loose material as possible.
- Disassemble the equipment, as appropriate.
- Wash with detergent/potable water solution.
- Rinse thoroughly with distilled or deionized (DI) water.
- Allow equipment to air dry prior to next use.
- Wrap equipment for transport with inert material (aluminum foil or plastic wrap) to prevent direct contact with potentially contaminated material.

Field decontamination of sampling equipment will take place at a designated location on-site. Decontamination will be performed in 5-gallon buckets and managed as IDW (Section 5.11). Decontamination water will be changed out for new, clean solutions at a minimum of once per sampling day.

5.11 Sediment and Soil Sampling Investigation Derived Waste (IDW)

IDW streams generated during this investigation are expected to include excess sediment sample material, excess soil sample material, decontamination fluids, and general refuse (e.g., used personal protective equipment, single-use sampling equipment, and trash). If sediment and soil sample processing occurs at the site, excess sample material and decontamination water will be sealed in 5-gallon buckets, labeled with the date and contents, and left on site for disposal pending characterization.

If processing is performed at the TRC office, excess sample material will be sealed in 5-gallon buckets, labeled, and held in a secure location at the TRC office until they are transported back to the site for storage and future disposal. Decontamination fluid generated at the Madison office will be discharged to the sanitary sewer. General refuse will be collected in sealed trash bags and placed in a waste dumpster at the TRC office.

5.12 Sample Results, Data Management, and Validation

Laboratory data generated under the sampling described in this SIWP will be subject to Level II data reporting, which includes the following:

- Cover letter
- Analytical results
- Analytical batch QA/QC results (e.g., surrogate recoveries, method blanks, laboratory control samples, MS/MSDs, as appropriate)
- Summary of nonconformances
- Laboratory copies of the Chain-of-Custody forms

TRC will maintain the analytical data in a project database. Prior to importing the laboratory data into the database, TRC will review the analytical data reports for usability. If data completeness or usability is uncertain, TRC will attempt to resolve conflicts with the laboratory and obtain a revised analytical report.

5.13 Other Procedures for Site Management - HASP

The sampling activities will adhere to the Health and Safety Plan (HASP) that was developed by TRC for the reconnaissance study activities described in Section 3.1 (TRC, 2015a). The HASP includes safety precaution information and emergency procedures. The HASP is updated as needed based on the work to be performed. The HASP is incorporated into this SIWP by reference.

6.0 Schedule/Reporting

Consistent with NR 716.09(2)(h) Wis. Adm. Code, this section provides information on the proposed schedule and reporting, is as follows:

- Pending WDNR approval of this SIWP, as well as landowner access agreements, the investigation activities are scheduled to start in late summer/early fall 2021.
- Sample results will be reported to the WDNR and property owners/occupants within 10 business days of receiving the sample results.
- The results will be submitted to WDNR in the Site Investigation Report (SIR) within 60 days after completion of field investigations and receipt of all laboratory data.

Consistent with NR 716.15 Wis. Adm. Code, following the field investigation and receipt of laboratory analytical results, the data will be compiled, analyzed, and incorporated into the SIR. The SIR will summarize the background information and document the investigative activities conducted and will describe the methods employed during the investigation. The SIR will include an evaluation of quality control data including results of field duplicates, laboratory duplicates and analytical results for precision, accuracy, and completeness. The SIR will include a detailed narrative of the results of the investigation, referencing and including the appropriate summary data tables and maps, figures, and photographs. The SIR will include a base map that shows the sampling locations. The analytical and physical results will be presented on figures and tables attached to the SIR. The logs for sediment sampling locations, as well as laboratory analytical reports, will be appended to the SIR. In addition, other appropriate data collected during the field investigation will be appended to document the quality of work performed.

The SIR will include a summary of the results and recommendations for further investigation activities as necessary based on the results.

The SIR will also include a computed SWAC for the investigation area using the in-channel sediment samples from this sampling effort and the 2015 reconnaissance sampling event. The SWAC approach has been used at numerous sediment remediation sites in the U.S. and specifically in Wisconsin to evaluate risk reduction (e.g., Reible, et al., 2003) after a remedial action. The SWAC represents the area of exposure across a river or creek system and is the widely accepted methodology used to evaluate potential risk. The SWAC approach has also been used to confirm closure for upstream OUs of HARP.

As requested by the WDNR in previous Reaches of HARP, the SWAC will be calculated using the actual width of the stream at the sampling locations. The SWAC analysis zones will be set to start and end at the mid-points between adjacent sample/transect locations.

7.0 Technical Review Request

Pursuant to NR 749.02, Wis. Adm. Code, TRC requests a technical review response from WDNR of this SIWP. TRC will provide a $700 review fee.

8.0 References

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Table 1: Summary of Sediment Sampling Results - Downstream of Hayton Dam
2014 to 2015

July 2014 Sampling Event			August 2015 Sampling Event		
Sample ID	**Sample Interval**	**PCBs (mg/kg)**	**Sample ID**	**Sample Interval**	**PCBs (mg/kg)**
			MR1-IC-001L	0-3.6"	0.074
			MR1-IC-501R	0-3.6"	**1.32**
			MR1-IC-901C	3.6-6.0"	< 0.0286
S1	NR	0.28	MR2-IC-002L	0-3.6"	0.183
S2	NR	**11**	MR2-IC-502R	3.6-4.2"	0.0374 J
S2A	NR	**15**	MR3-IC-003L	0-8.4"	**3.67**
			MR3-IC-503R	0-12"	0.0511 J
			MR3-IC-903C	0-6"	0.229
S3	NR	**6.2**	MR4-IC-004L	0-3"	**1.95**
S4	NR	0.31	MR4-IC-004L	3-6.6"	0.214
S5	NR	**1.8**	MR4-IC-504R	0-5.4"	0.0507 J
			MR4-IC-904C	0-1.8"	0.0332 J
			MR5-IC-005L	0-7.8"	**2.05**
			MR5-IC-505R	0-7.2"	0.25
			MR5-IC-905C	0-10.8"	0.382
			MR6-IC-006L	0-10.2"	0.178
			MR6-IC-506R	0-9.6"	0.337
			MR6-IC-906C	0-7.2"	0.582
			MR7-IC-007L	0-9.6"	< 0.0455
			MR7-IC-507R	0-9.6"	**1.08**
			MR7-IC-907C	0-8.4"	0.489

Notes:

1. 2015 sampling event conducted by TRC Environmental Corporation on August 18, 2015
2. July 2014 sampling was performed by the WDNR. WDNR samples 1, 2, and 2A are located between transects MR2 and MR3; WDNR sample 3 is located near transect MR4; and WDNR samples S4 and S5 are located north (downstream) of transect MR4. See Figure 2 for sample locations.

Bold text indicates an exceedance of the Remedial Action Goal of 1 ppm

NR = not reported

Table 2: Summary of Historical Water Column Sampling Results
Pine Creek, Jordan Creek, and Manitowoc River Near Hayton

Date	Total PCBs (dissolved + particulate) (ng/L)											
	Jordan Creek Downstream of WWTP	S. Tributary to Jordan Creek at Outfall	S. Tributary to Jordan Creek at HH Road	N. Tributary to Jordan Creek at HH Road	N. Tributary to Jordan Creek at Confluence	Jordan Creek Downstream of N. Tributary	Jordan Creek at Confluence with Pine Creek	Pine Creek 600 ft Upstream of Charlesburg Road	Pine Creek at Charlesburg Road	Danes Road	Quarry Road Bridge	Manitowoc River at Hayton
06/30/1993												110
07/06/1993												44
08/24/1993												227
09/16/1993												116
11/16/1993												38
02/16/1994												106
02/16/1994												109
02/21/1994												126
04/26/1994												83
05/18/1994												173
07/13/1994												114
08/30/1994												258
09/22/1994												302
10/25/1994												106
01/25/1995												90
01/25/1995												89
03/16/1995												85
03/22/1995												34
04/20/1995												200
04/20/1995												330
04/20/1995												80
05/10/1995												205
05/11/1995												1
05/18/1995								123			289	263
06/15/1995								406			563	159
08/13/1995												143
08/15/2001									136			335
09/05/2001											730	
09/27/2001												0
01/17/2002									181		134	42
03/12/2002									137		83	25
04/09/2002									364		370	32
05/02/2002									115		183	103

Table 2: Summary of Historical Water Column Sampling Results
Pine Creek, Jordan Creek, and Manitowoc River Near Hayton

Date	Total PCBs (dissolved + particulate) (ng/L)											
	Jordan Creek Downstream of WWTP	S. Tributary to Jordan Creek at Outfall	S. Tributary to Jordan Creek at HH Road	N. Tributary to Jordan Creek at HH Road	N. Tributary to Jordan Creek at Confluence	Jordan Creek Downstream of N. Tributary	Jordan Creek at Confluence with Pine Creek	Pine Creek 600 ft Upstream of Charlesburg Road	Pine Creek at Charlesburg Road	Danes Road	Quarry Road Bridge	Manitowoc River at Hayton
05/28/2003												0
06/23/2003	3	18	53									
06/24/2003				983	364	94						
06/25/2003								471				
08/21/2006	2	9	211									
08/22/2006				687	587	63				186		
08/23/2006							212		99	186		

WAC Chapter NR 105 Surface Water Quality Criteria and Secondary Values for Toxic Substances:
Wildlife Criteria (Table 7) 0.12 ng/L PCBs
Human Cancer Criteria (Table 9) 0.003 ng/L PCBs
Due to the limitations of the laboratory methods, all reported detections exceed both the Wildlife Criteria and the Human Cancer Criteria

Notes:
The Human Cancer Criteria for PCBs that applies is for Cold Water Communities/Public Water Supply due to PCBs classification as a bioaccumulative chemical of concern (BCC) [NR 105.09 Table 9]

Table 3: Summary of Fish Tissue Sampling Results
Pine Creek, Jordan Creek, Hayton Millpond, and the Manitowoc River

WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Upstream Locations								
085017	JORDAN CREEK WISCONSIN AVENUE CTH X (upstream of Tecumseh and downstream of Wisconsin Ave.)	7/30/2014	CREEK CHUB	WHOLE FISH	1	6.1	0.042	**2.7**
			CREEK CHUB	WHOLE FISH	1	6.5	0.046	**14**
			CREEK CHUB	WHOLE FISH	1	6.6	0.05	**4.6**
			CREEK CHUB	WHOLE FISH	1	6.7	0.062	**3.4**
			CREEK CHUB	WHOLE FISH	1	6.9	0.062	**3.8**
085009	PINE CREEK UPSTREAM OF CTH T	9/4/1991	COMMON CARP	SKIN ON FILLET	2	22.1	2.41	**77**
			COMMON CARP	SKIN ON FILLET	1	17.6	1.18	**17**
			COMMON CARP	WHOLE FISH	3	20.6	1.85	**73**
			NORTHERN PIKE	SKIN ON FILLET	1	19.9	0.72	**19**
			NORTHERN PIKE	SKIN ON FILLET	1	18.3	0.58	**22**
			NORTHERN PIKE	SKIN ON FILLET	1	17.5	0.47	**12**
085016	PINE CREEK DOWNSTREAM OF CTH T (upstream of confluence with Jordan Creek)	7/21/2014	CREEK CHUB	WHOLE FISH	1	2.7	0.002	**3.1**
			CREEK CHUB	WHOLE FISH	1	3.3	0.006	**2**
			CREEK CHUB	WHOLE FISH	1	4.1	0.014	0.64
			CREEK CHUB	WHOLE FISH	1	6.6	0.046	1.6
			CREEK CHUB	WHOLE FISH	1	7.8	0.084	**5.2**
			WHITE SUCKER	WHOLE FISH	1	5.7	0.032	**9.3**
			WHITE SUCKER	WHOLE FISH	1	6.2	0.042	**22**
			WHITE SUCKER	WHOLE FISH	1	6.5	0.042	0.9
			WHITE SUCKER	WHOLE FISH	1	7.8	0.09	**3.9**
085003	MANITOWOC RIVER - SOUTH BRANCH BELOW CHILTON STP	9/4/1991	ROCK BASS	SKIN ON FILLET	3	8.2	0.16	0.95
			WHITE SUCKER	SKIN ON FILLET	3	11.6	0.17	1.2
			WHITE SUCKER	WHOLE FISH	3	9.6	0.15	**26**
085005	MANITOWOC RIVER - SOUTH BRANCH BETWEEN HIGHWAY 57 & HIGHWAY Y	9/4/1991	NORTHERN PIKE	SKIN ON FILLET	1	16.8	0.39	1.7
			NORTHERN PIKE	SKIN ON FILLET	1	13.6	0.22	0.46
			ROCK BASS	SKIN ON FILLET	2	8.1	0.18	0.6
			WHITE SUCKER	SKIN ON FILLET	1	14.8	0.52	0.87
		8/19/1997	GREEN SUNFISH	SKIN ON FILLET	1	5.5	0.06	0
			GREEN SUNFISH	SKIN ON FILLET	1	5.4	0.05	0.24
			NORTHERN PIKE	SKIN ON FILLET	1	21.75	0.93	**2.1**
			NORTHERN PIKE	SKIN ON FILLET	1	21	0.91	0.16
			NORTHERN PIKE	SKIN ON FILLET	1	14.5	0.29	0
			PUMPKINSEED	SKIN ON FILLET	1	4.9	0.06	0
			ROCK BASS	SKIN ON FILLET	1	8.6	0.19	0.23
			WHITE SUCKER	SKIN ON FILLET	1	14.4	0.5	1.2
			WHITE SUCKER	SKIN ON FILLET	1	13.75	0.4	0.31
			WHITE SUCKER	SKIN ON FILLET	1	11.9	0.3	0
			YELLOW PERCH	SKIN ON FILLET	1	5.75	0.04	0
		9/2/1997	COMMON CARP	SKIN ON FILLET	1	22.1	1.87	0
			COMMON CARP	SKIN ON FILLET	1	18.5	1.35	0
			COMMON CARP	SKIN ON FILLET	1	18.25	1.34	0
			COMMON CARP	WHOLE FISH	3	19.5	1.52	0

Table 3: Summary of Fish Tissue Sampling Results
Pine Creek, Jordan Creek, Hayton Millpond, and the Manitowoc River

WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Upstream Locations (continued)								
085011	MANITOWOC RIVER - SOUTH BRANCH DOWNSTREAM OF CHILTON UPSTREAM OF IRISH RD	8/8/2006	CREEK CHUB	WHOLE FISH	1	8.25	0.1	0.94
			CREEK CHUB	WHOLE FISH	1	8.25	0.098	1.2
			CREEK CHUB	WHOLE FISH	1	8	0.08	0.82
			CREEK CHUB	WHOLE FISH	1	7.75	0.078	0.91
			CREEK CHUB	WHOLE FISH	1	6.75	0.054	0.88
			ROCK BASS	SKIN ON FILLET	1	7.67	0.154	0.091
			ROCK BASS	SKIN ON FILLET	1	7.5	0.148	0.32
			ROCK BASS	SKIN ON FILLET	1	7.5	0.144	0.06
			ROCK BASS	SKIN ON FILLET	1	7.5	0.15	0.25
			ROCK BASS	SKIN ON FILLET	1	7.4	0.124	0.14
			WHITE SUCKER	SKIN ON FILLET	1	8.5	0.088	0.34
			WHITE SUCKER	SKIN ON FILLET	1	8	0.076	0.42
			WHITE SUCKER	SKIN ON FILLET	1	5	0.02	0.72
			WHITE SUCKER	SKIN ON FILLET	1	4.75	0.018	0.3
085019	MANITOWOC RIVER - SOUTH BRANCH UPSTREAM OF HAYTON MILLPOND	8/25/2015	NORTHERN PIKE	SKIN ON FILLET	1	19	0.656	0.72
			WHITE SUCKER	SKIN ON FILLET	1	16.6	0.826	**3.8**
			WHITE SUCKER	SKIN ON FILLET	1	18.1	1.062	**7.1**
Hayton Area Remediation Project								
085007	JORDAN CREEK AT HONEYMOON HILL ROAD (OU 1)	6/11/1992	CYPRINIDAE MINNOW	WHOLE FISH	10	3.5	0.01	**45**
085008	JORDAN CREEK ABOVE CONFLUENCE WITH PINE CREEK (OU 1)	6/11/1992	CYPRINIDAE MINNOW	WHOLE FISH	52	4.6	0.02	**56**
		8/19/1997	CYPRINIDAE MINNOW	WHOLE FISH	25	4.5	0.01	**57**
			CYPRINIDAE MINNOW	WHOLE FISH	25	2.8	0.01	**53**
085012	JORDAN CREEK UPSTREAM OF TECUMSEH RD (OU 1)	8/15/2006	CREEK CHUB	WHOLE FISH	1	6.75	0.056	**33**
			CREEK CHUB	WHOLE FISH	1	6.75	0.052	**17**
			CREEK CHUB	WHOLE FISH	1	6.5	0.048	**25**
			CREEK CHUB	WHOLE FISH	1	6.5	0.044	1.4
			CREEK CHUB	WHOLE FISH	1	6.25	0.044	**20**
		7/30/2014	CREEK CHUB	WHOLE FISH	1	4.6	0.018	**5.1**
			CREEK CHUB	WHOLE FISH	1	4.9	0.016	**12**
			CREEK CHUB	WHOLE FISH	1	5.2	0.022	**6**
			CREEK CHUB	WHOLE FISH	1	5.2	0.024	**6.6**
			CREEK CHUB	WHOLE FISH	1	6.7	0.054	**11**
			LONGNOSE DACE	WHOLE FISH	2	2.75	0.003	**9.2**
			LONGNOSE DACE	WHOLE FISH	3	3.07	0.005	**22**
			WHITE SUCKER	SKIN ON FILLET	1	8.3	0.112	**7.5**
			WHITE SUCKER	SKIN ON FILLET	1	8.9	0.128	**5.4**
			WHITE SUCKER	WHOLE FISH	1	6.4	0.036	**4.1**
			WHITE SUCKER	WHOLE FISH	1	6.6	0.046	**14**

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Pine Creek, Jordan Creek, Hayton Millpond, and the Manitowoc River

WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Hayton Area Remediation Project (continued)								
085014	PINE CREEK UPSTREAM OF DANES RD (OU 2/UPPER)	8/15/2006	CREEK CHUB	WHOLE FISH	1	9.75	0.158	**100**
			CREEK CHUB	WHOLE FISH	1	8.25	0.114	**60**
			CREEK CHUB	WHOLE FISH	1	8.25	0.12	**42**
			CREEK CHUB	WHOLE FISH	1	7.5	0.08	**62**
			CREEK CHUB	WHOLE FISH	1	7.25	0.066	**64**
			GREEN SUNFISH	SKIN ON FILLET	1	4	0.022	**5.8**
			GREEN SUNFISH	SKIN ON FILLET	4	3.44	0.012	**16**
			WHITE SUCKER	SKIN ON FILLET	1	9.25	0.13	**17**
			WHITE SUCKER	SKIN ON FILLET	1	8.5	0.102	**9.5**
			WHITE SUCKER	SKIN ON FILLET	1	8.5	0.106	**23**
			WHITE SUCKER	SKIN ON FILLET	1	10	0.182	**16**
			WHITE SUCKER	SKIN ON FILLET	1	9.5	0.164	**15**
085015	PINE CREEK UPSTREAM OF HAYTON RD (OU 3)	9/25/2014	CENTRAL MUDMINNOW	WHOLE FISH	2	2.65	0.003	**9.9**
			CENTRAL MUDMINNOW	WHOLE FISH	2	3.15	0.005	**9.9**
			CENTRAL MUDMINNOW	WHOLE FISH	1	4	0.012	**14**
			CENTRAL MUDMINNOW	WHOLE FISH	1	4.1	0.012	**11**
			CENTRAL MUDMINNOW	WHOLE FISH	1	5.6	0.026	**6.7**
			COMMON CARP	SKIN ON FILLET	1	28.5	4.732	**32**
			GREEN SUNFISH	SKIN ON FILLET	1	3.2	0.01	**6.7**
			GREEN SUNFISH	SKIN ON FILLET	1	3.3	0.01	**6.1**
			GREEN SUNFISH	SKIN ON FILLET	1	3.6	0.018	**4.9**
			GREEN SUNFISH	SKIN ON FILLET	1	4	0.02	**6.5**
			NORTHERN PIKE	SKIN ON FILLET	1	17	0.506	1.1
			NORTHERN PIKE	SKIN ON FILLET	1	6.1	0.018	**2.3**
			NORTHERN PIKE	SKIN ON FILLET	1	8	0.048	**2.2**
			NORTHERN PIKE	SKIN ON FILLET	1	13.8	0.236	1.2
			NORTHERN PIKE	SKIN ON FILLET	1	15.5	0.314	1
			NORTHERN PIKE	WHOLE FISH	1	6.9	0.034	**3.5**
			NORTHERN PIKE	WHOLE FISH	1	7.4	0.036	**3.1**
			PUMPKINSEED	SKIN ON FILLET	1	3.7	0.018	**6.1**
			PUMPKINSEED	SKIN ON FILLET	1	4.9	0.04	**2.1**
			ROCK BASS	SKIN ON FILLET	1	5.7	0.058	1.4
			ROCK BASS	SKIN ON FILLET	1	6.7	0.098	**2.4**
			WHITE SUCKER	SKIN ON FILLET	1	4.5	0.012	**15**
			WHITE SUCKER	SKIN ON FILLET	1	10.7	0.192	**2.5**
			WHITE SUCKER	SKIN ON FILLET	1	11.3	0.258	**7.8**
			WHITE SUCKER	SKIN ON FILLET	1	11.8	0.244	**12**
			WHITE SUCKER	SKIN ON FILLET	1	14.6	0.562	**10**

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Pine Creek, Jordan Creek, Hayton Millpond, and the Manitowoc River

WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Hayton Area Remediation Project (continued)								
085004	MANITOWOC RIVER - SOUTH BRANCH HAYTON MILLPOND (OU 4/LOWER)	7/7/1992	BLACK BULLHEAD	SKIN OFF FILLET	4	7.2	0.11	**5.1**
			BLACK BULLHEAD	SKIN OFF FILLET	3	8.1	0.11	**2.5**
			BLUEGILL	SKIN ON FILLET	4	4.9	0.1	**3**
			COMMON CARP	SKIN ON FILLET	1	16.3	0.97	**15**
			COMMON CARP	SKIN ON FILLET	1	21.7	2.61	**14**
			COMMON CARP	SKIN ON FILLET	1	17.3	1.16	**12**
			COMMON CARP	SKIN ON FILLET	1	16.2	0.94	**5**
			LARGEMOUTH BASS	SKIN ON FILLET	1	13.9	0.62	**4.4**
			REDHORSES	SKIN ON FILLET	1	18.3	1.28	**4.2**
			ROCK BASS	SKIN ON FILLET	1	7.7	0.17	1.5
			WHITE SUCKER	SKIN ON FILLET	2	13.8	0.45	**4.1**
			WHITE SUCKER	SKIN ON FILLET	2	13.4	0.45	**6.2**
		9/5/1997	BLACK CRAPPIE	SKIN ON FILLET	1	9	0.22	1.8
			COMMON CARP	SKIN ON FILLET	1	20.5	1.9	**11**
			COMMON CARP	SKIN ON FILLET	1	19.1	1.52	**5.4**
			COMMON CARP	SKIN ON FILLET	1	18.1	1.35	**8.6**
			COMMON CARP	WHOLE FISH	3	19.2	1.59	**15**
			NORTHERN PIKE	SKIN ON FILLET	1	23	1.17	**4.3**
			NORTHERN PIKE	SKIN ON FILLET	1	17.8	0.48	**4**
			NORTHERN PIKE	SKIN ON FILLET	1	16	0.32	**15**
			PUMPKINSEED	SKIN ON FILLET	1	5	0.05	**2.5**
			ROCK BASS	SKIN ON FILLET	1	9.75	0.33	**2.4**
			ROCK BASS	SKIN ON FILLET	1	6.63	0.1	0.86
			WHITE SUCKER	SKIN ON FILLET	1	16.5	0.72	**8.1**
			WHITE SUCKER	SKIN ON FILLET	1	15	0.54	**3.8**
			WHITE SUCKER	SKIN ON FILLET	1	13.6	0.42	**9.3**
			YELLOW PERCH	SKIN ON FILLET	1	8	0.11	0.62
		6/25/2001	BLACK BULLHEAD	SKIN OFF FILLET	1	8.5	0.11	**2.1**
			BLACK BULLHEAD	SKIN OFF FILLET	1	8.13	0.15	0.96
			BLACK BULLHEAD	SKIN OFF FILLET	1	8	0.11	0.098
			BLACK BULLHEAD	SKIN OFF FILLET	1	7.75	0.11	**2.7**
			BLACK CRAPPIE	SKIN ON FILLET	1	10.5	0.28	**2.9**
			COMMON CARP	SKIN ON FILLET	1	19.63	1.64	**20**
			COMMON CARP	SKIN ON FILLET	1	19.5	1.67	**9.5**
			COMMON CARP	SKIN ON FILLET	1	19.25	1.44	**2.8**
			COMMON CARP	WHOLE FISH	3	20.38	1.66	**18**
			LARGEMOUTH BASS	SKIN ON FILLET	1	15.88	1.04	1.7
			WHITE SUCKER	SKIN ON FILLET	1	14.88	0.57	**3.1**
			WHITE SUCKER	SKIN ON FILLET	1	14.06	0.52	**3.1**
			WHITE SUCKER	SKIN ON FILLET	1	13.5	0.41	**4**

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WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Hayton Area Remediation Project (continued)								
085004 (continued)	MANITOWOC RIVER - SOUTH BRANCH HAYTON MILLPOND (OU 4/LOWER) (continued)	8/25/2015	COMMON CARP	SKIN ON FILLET	1	22.7	3.266	**23**
			COMMON CARP	SKIN ON FILLET	1	23.7	3.53	**13**
			COMMON CARP	SKIN ON FILLET	1	23.9	3.6	**18**
			COMMON CARP	SKIN ON FILLET	1	24.5	3.512	**8**
			COMMON CARP	SKIN ON FILLET	1	24.9	3.472	**39**
			COMMON SHINER	WHOLE FISH	1	3.9	0.008	**4.9**
			COMMON SHINER	WHOLE FISH	1	4.5	0.014	**6.9**
			COMMON SHINER	WHOLE FISH	1	5.1	0.022	**7**
			GOLDEN SHINER	WHOLE FISH	1	4	0.01	**4.9**
			GOLDEN SHINER	WHOLE FISH	1	4.1	0.01	**6.3**
			PUMPKINSEED	WHOLE FISH	1	3.3	0.018	**4.9**
			PUMPKINSEED	WHOLE FISH	1	3.4	0.018	**6.8**
			PUMPKINSEED	WHOLE FISH	1	4.4	0.03	**2.6**
			PUMPKINSEED	WHOLE FISH	1	5.7	0.074	**2**
			ROCK BASS	SKIN ON FILLET	1	6.2	0.088	0.17
			ROCK BASS	SKIN ON FILLET	1	7.7	0.188	0.15
			WHITE SUCKER	SKIN ON FILLET	1	9.1	0.12	**7.6**
			WHITE SUCKER	SKIN ON FILLET	1	10.8	0.236	1.6
			WHITE SUCKER	SKIN ON FILLET	1	11.1	0.252	**2.6**
			WHITE SUCKER	SKIN ON FILLET	1	15.5	0.696	**13**
Downstream of Hayton Millpond Dam								
085018	MANITOWOC RIVER - SOUTH BRANCH BONLANDER FARM UPSTREAM OF KILLSNAKE WILDLIFE AREA- DOWNSTREAM OF WEEKS RD	7/29/2015	BLACK CRAPPIE	SKIN ON FILLET	1	8.4	0.15	0.31
			BLACK CRAPPIE	SKIN ON FILLET	1	8.5	0.15	0.16
			COMMON CARP	SKIN ON FILLET	1	18	1.164	**3.7**
			COMMON CARP	SKIN ON FILLET	1	19.1	1.728	**2.6**
			COMMON CARP	SKIN ON FILLET	1	19.4	1.282	1
			COMMON CARP	SKIN ON FILLET	1	21.3	1.844	**3.5**
			COMMON CARP	SKIN ON FILLET	1	22.9	2.49	**3.9**
			NORTHERN PIKE	SKIN ON FILLET	1	15.7	0.334	0.04
			NORTHERN PIKE	SKIN ON FILLET	1	16.4	0.352	0.1
			NORTHERN PIKE	SKIN ON FILLET	1	17.8	0.472	0.11
			REDHORSE, GREATER	SKIN ON FILLET	1	15.3	0.616	**2.2**
			REDHORSE, GREATER	SKIN ON FILLET	1	15.3	0.598	1.9
			REDHORSE, GREATER	SKIN ON FILLET	1	15.5	0.612	1.4
			REDHORSE, GREATER	SKIN ON FILLET	1	15.5	0.622	**2.1**
			REDHORSE, GREATER	SKIN ON FILLET	1	16.2	0.752	**2.2**
			ROCK BASS	SKIN ON FILLET	1	7.5	0.13	0.15
			ROCK BASS	SKIN ON FILLET	1	8.4	0.206	0.56
			ROCK BASS	SKIN ON FILLET	1	9.4	0.27	0.22
			YELLOW PERCH	SKIN ON FILLET	1	6.5	0.044	0.8

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WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Downstream of Hayton Millpond Dam (continued)								
085010	MANITOWOC RIVER - SOUTH BRANCH ABOVE LEMKE ROAD	8/25/1997	COMMON CARP	SKIN ON FILLET	1	21.9	1.92	**2.4**
			COMMON CARP	SKIN ON FILLET	1	20.6	1.62	**3**
			COMMON CARP	SKIN ON FILLET	1	19.1	1.55	**12**
			COMMON CARP	WHOLE FISH	3	20.53	1.7	**7.8**
			NORTHERN PIKE	SKIN ON FILLET	1	9	0.67	**6.7**
			ROCK BASS	SKIN ON FILLET	1	9	0.22	1.2
			ROCK BASS	SKIN ON FILLET	1	7.9	0.16	**2.1**
			ROCK BASS	SKIN ON FILLET	1	7.25	0.14	1.9
			ROCK BASS	SKIN ON FILLET	1	7	0.11	1.7
			ROCK BASS	SKIN ON FILLET	1	5.63	0.06	1.3
			WHITE SUCKER	SKIN ON FILLET	1	12.6	0.38	**2.3**
			WHITE SUCKER	SKIN ON FILLET	1	12.3	0.33	**3.9**
			WHITE SUCKER	SKIN ON FILLET	1	12.25	0.3	**2.2**
		6/16/2003	COMMON CARP	SKIN ON FILLET	1	21.3	1.91	**2.9**
			COMMON CARP	SKIN ON FILLET	1	20	1.62	**8.7**
			COMMON CARP	SKIN ON FILLET	1	19.5	1.51	**23**
			COMMON CARP	SKIN ON FILLET	1	19.4	1.49	**11**
			COMMON CARP	SKIN ON FILLET	1	19	1.2	**13**
			COMMON CARP	SKIN ON FILLET	1	18	1.13	**19**
			NORTHERN PIKE	SKIN ON FILLET	1	25.4	1.49	**3.1**
			NORTHERN PIKE	SKIN ON FILLET	1	20.1	0.66	**7.4**
			NORTHERN PIKE	SKIN ON FILLET	1	19	0.47	1.9
			NORTHERN PIKE	SKIN ON FILLET	1	18.7	0.66	**2.2**
			NORTHERN PIKE	SKIN ON FILLET	1	16.6	0.35	1.7
			ROCK BASS	SKIN ON FILLET	1	9	0.15	**3.5**
			ROCK BASS	SKIN ON FILLET	1	8.6	0.21	**5.2**
			ROCK BASS	SKIN ON FILLET	1	8.1	0.14	1.4
			ROCK BASS	SKIN ON FILLET	1	7.7	0.13	1.2
			ROCK BASS	SKIN ON FILLET	1	6.7	0.09	**2.1**
083001	MANITOWOC RIVER - SOUTH BRANCH AT LEMKE ROAD	10/9/1996	FATHEAD MINNOW	WHOLE FISH	30			**3.1**
			FATHEAD MINNOW	WHOLE FISH	30			**3**
365015	MANITOWOC RIVER COLLINS ROAD	6/22/1992	BLACK BULLHEAD	SKIN OFF FILLET	3	7	0.07	0.77
			BLACK BULLHEAD	SKIN OFF FILLET	4	6	0.05	0.74
			COMMON CARP	SKIN ON FILLET	1	19.3	1.45	1.1
			COMMON CARP	SKIN ON FILLET	1	18.5	1.27	0.93
			COMMON CARP	SKIN ON FILLET	1	18	1.27	1.3
			COMMON CARP	WHOLE FISH	2	16	1	**3.8**
365028	MANITOWOC RIVER HIGHWAY W	7/28/2015	COMMON CARP	SKIN ON FILLET	1	16.5	0.85	0.78
			COMMON CARP	SKIN ON FILLET	1	17.5	1.114	**2.4**
			COMMON CARP	SKIN ON FILLET	1	17.9	1.092	1.1
			COMMON CARP	SKIN ON FILLET	1	19	1.244	0.8
			COMMON CARP	SKIN ON FILLET	1	19.3	1.38	1.2
			COMMON CARP	SKIN ON FILLET	1	19.4		0.21

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WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Downstream of Hayton Millpond Dam (continued)								
365011	MANITOWOC RIVER ABOVE OSLO (CATO) DAM (DAM ABANDONED-REMOVED 1992)	8/30/1988	NORTHERN PIKE	SKIN ON FILLET	1	20.88	0.82	0.45
			SMALLMOUTH BASS	SKIN ON FILLET	1	10.25	0.19	1.2
			SMALLMOUTH BASS	SKIN ON FILLET	1	8.75	0.16	1.1
			SMALLMOUTH BASS	SKIN ON FILLET	1	8	0.1	0.7
365014	MANITOWOC RIVER ABOVE CLARKS MILLS DAM	6/19/1992	BLACK BULLHEAD	SKIN OFF FILLET	2	8.7	0.15	0.28
			COMMON CARP	SKIN ON FILLET	2	20	1.82	1.4
			COMMON CARP	SKIN ON FILLET	2	19.6	1.68	**2.2**
			COMMON CARP	SKIN ON FILLET	1	18.7	1.32	0.2
			COMMON CARP	WHOLE FISH	3	11.2	0.3	1.6
			NORTHERN PIKE	SKIN ON FILLET	1	19.6	0.73	0.21
			NORTHERN PIKE	SKIN ON FILLET	1	17	0.5	0.53
			NORTHERN PIKE	SKIN ON FILLET	1	16.5	0.5	0.23
			WHITE SUCKER	SKIN ON FILLET	3	17.1	0.91	1.1
			WHITE SUCKER	SKIN ON FILLET	3	12.8	0.45	1.3
		10/30/1996	COMMON CARP	SKIN ON FILLET	3	20.9	1.79	1
			COMMON CARP	SKIN ON FILLET	3	19.2	1.36	0.38
			COMMON CARP	WHOLE FISH	3	20.9	1.79	**2.7**
			COMMON CARP	WHOLE FISH	3	19.2	1.36	**2**
			NORTHERN PIKE	SKIN ON FILLET	1	24.2	1.28	0.3
			NORTHERN PIKE	SKIN ON FILLET	1	20.8	0.8	0.14
			NORTHERN PIKE	SKIN ON FILLET	1	20.2	0.69	0.18
			WHITE SUCKER	SKIN ON FILLET	1	14.6	0.56	0.45
			WHITE SUCKER	SKIN ON FILLET	1	14.4	0.5	0.25
			WHITE SUCKER	SKIN ON FILLET	1	14.4	0.49	0.48
		6/11/2001	BLACK BULLHEAD	SKIN OFF FILLET	1	8.25	0.11	0
			BLACK BULLHEAD	SKIN OFF FILLET	1	8	0.13	0
			BLACK BULLHEAD	SKIN OFF FILLET	1	7.94	0.11	0.14
			BLACK BULLHEAD	SKIN OFF FILLET	1	6.63	0.07	0.14
			COMMON CARP	SKIN ON FILLET	1	21.19	2.03	0.35
			COMMON CARP	SKIN ON FILLET	1	20.88	1.57	0.75
			COMMON CARP	SKIN ON FILLET	1	20	1.5	0.35
			WHITE SUCKER	SKIN ON FILLET	1	13.94	0.48	0.28
			WHITE SUCKER	SKIN ON FILLET	1	12.06	0.31	0.21
			WHITE SUCKER	SKIN ON FILLET	1	11.5	0.28	0.11
			YELLOW PERCH	SKIN ON FILLET	1	7	0.07	0.076

Table 3: Summary of Fish Tissue Sampling Results
Pine Creek, Jordan Creek, Hayton Millpond, and the Manitowoc River

WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Downstream of Hayton Millpond Dam (continued)								
365014 (continued)	MANITOWOC RIVER ABOVE CLARKS MILLS DAM (continued)	6/9/2015	BLACK BULLHEAD	SKIN OFF FILLET	1	7.5	0.096	0.05
			BLACK BULLHEAD	SKIN OFF FILLET	1	8	0.102	0.067
			BLACK BULLHEAD	SKIN OFF FILLET	1	8	0.12	0.1
			BLACK BULLHEAD	SKIN OFF FILLET	1	8.3	0.126	0.11
			BLACK BULLHEAD	SKIN OFF FILLET	1	9	0.168	0.066
			BLACK CRAPPIE	SKIN ON FILLET	1	6.5	0.054	0.094
			BLACK CRAPPIE	SKIN ON FILLET	1	7.1	0.1	0.082
			BLACK CRAPPIE	SKIN ON FILLET	1	7.5	0.096	0.055
			BLACK CRAPPIE	SKIN ON FILLET	1	7.5	0.123	0.057
			BLUEGILL	SKIN ON FILLET	1	5.6	0.066	0.18
			COMMON CARP	SKIN ON FILLET	1	15.5	0.682	0.46
			COMMON CARP	SKIN ON FILLET	1	16.6	0.996	1.7
			COMMON CARP	SKIN ON FILLET	1	19.5	1.482	1.2
			COMMON CARP	SKIN ON FILLET	1	19.9	1.55	1.1
			COMMON CARP	SKIN ON FILLET	1	21.5	1.924	**2**
			COMMON CARP	SKIN ON FILLET	1	22.5	2.268	**5.8**
			WHITE SUCKER	SKIN ON FILLET	1	10	0.186	0.2
			WHITE SUCKER	SKIN ON FILLET	1	10.3	0.19	0.22
			WHITE SUCKER	SKIN ON FILLET	1	11.4	0.262	0.47
			WHITE SUCKER	SKIN ON FILLET	1	11.5	0.276	0.11
			WHITE SUCKER	SKIN ON FILLET	1	15	0.478	0.061
365008	MANITOWOC RIVER MANITOU PARK	5/22/1986	COMMON CARP	WHOLE FISH	3	23.3	3.37	1.4
		5/6/1987	CHANNEL CATFISH	SKIN OFF FILLET	1	18.5	1.04	**2.1**
		5/13/1988	CHANNEL CATFISH	SKIN OFF FILLET	1	25.1	3.34	**4.6**
		9/1/1988	CHANNEL CATFISH	SKIN OFF FILLET	1	29	4.65	**3.6**
			CHANNEL CATFISH	SKIN OFF FILLET	1	20	1.35	1.4
			CHANNEL CATFISH	SKIN OFF FILLET	1	17	0.65	1.3
		4/6/1990	RAINBOW TROUT	SKIN ON FILLET	1	28.1	3.86	0.68
			RAINBOW TROUT	SKIN ON FILLET	1	27.4	3.3	0.79
			RAINBOW TROUT	SKIN ON FILLET	1	27	3.18	0.61
		5/2/1991	CHANNEL CATFISH	SKIN OFF FILLET	1	10.2	0.14	0.45
			COMMON CARP	WHOLE FISH	3	19.1	1.72	0.53
		5/23/1991	CHANNEL CATFISH	SKIN OFF FILLET	1	25.8	3.35	1.6
			SMALLMOUTH BASS	SKIN ON FILLET	1	10.5	0.28	0.29
			SMALLMOUTH BASS	SKIN ON FILLET	2	9.35	0.15	0.2
			SMALLMOUTH BASS	SKIN ON FILLET	2	8.8	0.14	0.2
		5/21/1996	CHANNEL CATFISH	SKIN OFF FILLET	1	22.4	1.85	**2.4**
			CHANNEL CATFISH	SKIN OFF FILLET	1	22.3	2.46	0.97
			CHANNEL CATFISH	SKIN OFF FILLET	1	21.4	1.72	1.4
			CHANNEL CATFISH	SKIN OFF FILLET	1	19.8	1.46	**2.2**
			COMMON CARP	SKIN ON FILLET	4	21.9	2.33	0.78
			COMMON CARP	WHOLE FISH	4	21.9	2.33	0.85
			SMALLMOUTH BASS	SKIN ON FILLET	1	12.9	0.52	0.1
			SMALLMOUTH BASS	SKIN ON FILLET	1	12.9	0.51	0.072
			SMALLMOUTH BASS	SKIN ON FILLET	1	12.3	0.4	0.17
			SMALLMOUTH BASS	SKIN ON FILLET	1	11.2	0.3	0.086

Table 3: Summary of Fish Tissue Sampling Results
Pine Creek, Jordan Creek, Hayton Millpond, and the Manitowoc River

WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Downstream of Hayton Millpond Dam (continued)								
365008 (continued)	MANITOWOC RIVER MANITOU PARK (continued)	5/24/1996	COMMON CARP	SKIN ON FILLET	3	21.3	2.14	0.41
			COMMON CARP	WHOLE FISH	3	21.3	2.14	0.77
			SMALLMOUTH BASS	SKIN ON FILLET	1	17.1	1.23	0.2
		6/7/1996	CHANNEL CATFISH	SKIN OFF FILLET	1	19.8	1.22	1.2
		7/2/2001	CHANNEL CATFISH	SKIN OFF FILLET	1	22.38	2.33	1.4
			CHANNEL CATFISH	SKIN OFF FILLET	1	21.38	2.05	0.46
			COMMON CARP	SKIN ON FILLET	1	21.5	2.22	1.3
			COMMON CARP	SKIN ON FILLET	1	21.25	2.43	1.1
			COMMON CARP	SKIN ON FILLET	1	18.5	1.43	0.99
			COMMON CARP	WHOLE FISH	3	22.38	2.46	1.6
			SMALLMOUTH BASS	SKIN ON FILLET	1	17.25	1.04	0.22
			SMALLMOUTH BASS	SKIN ON FILLET	1	17	1.04	0.37
			SMALLMOUTH BASS	SKIN ON FILLET	1	15.38	0.94	0.35
			SMALLMOUTH BASS	SKIN ON FILLET	1	14.63	0.78	0.44
			SMALLMOUTH BASS	SKIN ON FILLET	1	14.63	0.73	0.29
			SMALLMOUTH BASS	SKIN ON FILLET	1	13.25	0.52	0.27
365007	MANITOWOC RIVER MANITOWOC	6/21/1976	BROOK TROUT	SKIN ON FILLET	1	17.5		**4.4**
			BROWN TROUT	SKIN ON FILLET	1	19.2		1.8
			BROWN TROUT	SKIN ON FILLET	1	19.1		**6**
			BROWN TROUT	SKIN ON FILLET	1	18.2		**7.2**
			COHO SALMON	SKIN ON FILLET	1	19.5		**2.5**
			LAKE TROUT	SKIN ON FILLET	1	21.8		**3**
			LAKE WHITEFISH	SKIN ON FILLET	1	13.8		0.8
			LAKE WHITEFISH	SKIN ON FILLET	1	20.1		**5.3**
			RAINBOW TROUT	SKIN ON FILLET	1	19.2		**4.2**
		6/27/1978	COMMON CARP	WHOLE FISH	5	22		**5.3**
			COMMON CARP	WHOLE FISH	5	24.2		**10**
		5/9/1979	BROWN BULLHEAD	WHOLE FISH	5	8.4	0.12	0.2
			CHANNEL CATFISH	WHOLE FISH	5	17.5	0.81	**9.5**
			SMALLMOUTH BASS	WHOLE FISH	5	10.9	0.3	**2.1**
			WHITE SUCKER	WHOLE FISH	5	11.9	1.1	1.3
		5/10/1979	COMMON CARP	WHOLE FISH	5	17.7	1.4	**3.6**
		4/13/1983	COMMON CARP	SKIN ON FILLET	3	18	1.4	0.3
		4/14/1983	CHANNEL CATFISH	SKIN OFF FILLET	3	22.6	2.1	**6.8**
			COMMON CARP	SKIN ON FILLET	2	18.6	1.6	0.6
		4/10/1984	CHANNEL CATFISH	SKIN OFF FILLET	1	21.4	1.5	**5.8**
			CHANNEL CATFISH	SKIN OFF FILLET	1	23	2.15	**7.4**
			CHANNEL CATFISH	SKIN OFF FILLET	1	24	3	**5.8**
		10/7/1988	CHINOOK SALMON	SKIN ON FILLET	1	39.1	8.91	**2.2**
			CHINOOK SALMON	SKIN ON FILLET	1	38.1	10.5	1.4
			CHINOOK SALMON	SKIN ON FILLET	1	36.7	7.4	1.7
			CHINOOK SALMON	SKIN ON FILLET	1	36.1	7.52	**2.5**
			CHINOOK SALMON	SKIN ON FILLET	1	34.8	7.2	**2.5**
			COHO SALMON	SKIN ON FILLET	1	29.7	5.41	0.69
			COHO SALMON	SKIN ON FILLET	1	26	2.41	0.73
			COHO SALMON	SKIN ON FILLET	1	25	2.51	0.56

Table 3: Summary of Fish Tissue Sampling Results
Pine Creek, Jordan Creek, Hayton Millpond, and the Manitowoc River

WDNR Location Code	Location Description	Sample Dates	Sample Type	Sample Form	Number of Fish in Sample	Length[(1)]	Weight[(1)]	Total PCBs (ug/g)
Downstream of Hayton Millpond Dam (continued)								
365007 (continued)	MANITOWOC RIVER MANITOWOC (continued)	10/14/1988	BROWN TROUT	SKIN ON FILLET	1	26	4.21	1.9
			BROWN TROUT	SKIN ON FILLET	1	25.1	4.7	**2.3**
			BROWN TROUT	SKIN ON FILLET	1	25	4.01	1.9
			BROWN TROUT	SKIN ON FILLET	1	24.3	3.9	1.9
			CHINOOK SALMON	SKIN ON FILLET	1	33	6.4	1.9
			CHINOOK SALMON	SKIN ON FILLET	1	32.4	6.7	1.5
			COHO SALMON	SKIN ON FILLET	1	25	2.51	0.82
			COHO SALMON	SKIN ON FILLET	1	24	2.11	1.2
			COHO SALMON	SKIN ON FILLET	1	23.9	2.02	0.57
			COHO SALMON	SKIN ON FILLET	1	22.1	1.92	0.34
			RAINBOW TROUT	SKIN ON FILLET	1	28.3	3.4	1.3

Notes:

Data are from the WDNR Fish Contaminant Database

Bold text indicates an exceedance of the Wisconsin Department of Health Services (DHS) and United States Food and Drug Administration (FDA) "do not eat" criteion of 2 ppm.

Wisconsin DHS Fish Consumption Advisory Levels (DNR Administrative Report No.73):

≥ 2.0 ppm	Do Not Eat
≤ 0.05 to < 2.0 ppm	Restricted Consumption
< 0.5 ppm	Unlimited Consumption

Footnotes:

(1) Length and weight for samples comprised of more than one specimen are averages

Table 4: Summary of Sediment Sampling Results - Hayton Millpond
2005 to 2016

2005 Sampling Event			2016 Sampling Event		
Sample ID	Sample Interval	PCBs (mg/kg)	Sample ID	Sample Interval	PCBs (mg/kg)
RU-1B	0-12"	**4.9**	2016-RU-1B	0-11"	**1.73**
RU-1C	0-12"	**3.4**	2016-RU-1C	0-12"	0.77
RU-1C	12-18"	0.088	2016-RU-1C	12-14"	**1.88**
RU-1D	0-12"	**4**	2016-RU-1D	0-8"	**1.2**
RU-3A	0-12"	**1.4**	2016-RU-3A	0-12"	0.62
RU-3A	12-18"	0.23	2016-RU-3A	12-18"	0.679
RU-3C	0-12"	**5.8**	2016-RU-3C	0-11"	**1.15**
RU-3E	0-6"	**1.8**	2016-RU-3E	0-6"	0.436
RU-5C	0-12"	**1.5**	2016-RU-5C	0-10"	0.763
RU-5D	0-12"	**1.6**	2016-RU-5D	0-10"	0.534
RU-5E	0-12"	**1.6**	2016-RU-5E	0-12"	0.524
RU-5E	12-18"	0.047	2016-RU-5E	12-18"	0.156
RU-6C	0-12"	**3.1**	2016-RU-6C	0-10"	0.809
RU-6C	12-18"	0.051	2016-RU-6C	12-18"	0.558
RU-17B	0-12"	**5.7**	2016-RU-17B	0-6"	0.913
RU-17C	0-12"	**5.6**	2016-RU-17C	0-12"	0.949
RU-17C	12-18"	0.22	2016-RU-17C	12-18"	0.89
RU-17D	0-12"	**4.8**	2016-RU-17D	0-10"	0.471
RU-18D	0-12"	0.79	2016-RU-18D	0-11"	0.735
RU-18E	0-12"	**6.2**	2016-RU-18E	0-12"	0.764

Notes:

Data collected by TRC Environmental Corporation in 2005 and 2016.

Bold text indicates an exceedance of the Remedial Action Goal of 1 ppm

Table 5: Sample Container, Preservation and Holding Time Requirements
Site Investigation Work Plan

Analyte	CAS Number	Matrix	Analytical Method	Sample Container	Preservation	Maximum Holding Time
Total PCB	NA	Solid	USEPA SW-846 Method 8082	(1) 2 oz. or 4 oz. wide mouth glass jar	4° ± 2°C	365 days to extraction/ 365 days to analysis
PCB-1016 (Aroclor 1016)	12674-11-2					
PCB-1221 (Aroclor 1221)	11104-28-2					
PCB-1232 (Aroclor 1232)	11141-16-5					
PCB-1242 (Aroclor 1242)	53469-21-9					
PCB-1248 (Aroclor 1248)	12672-29-6	Water	USEPA SW-846 Method 8082	(2) 1 L amber glass bottles	4° ± 2°C	
PCB-1254 (Aroclor 1254)	11097-69-1					
PCB-1260 (Aroclor 1260)	11096-82-5					
Total Organic Carbon	N/A	Solid	Lloyd Kahn	(1) 4 oz. wide mouth glass jar	4° ± 2°C	14 days
Grain Size Analysis	N/A	Solid	ASTM D422/AASHTO T88	Resealable bag or bucket	None	N/A

Notes:

PCB = polychlorinated biphenyl

SW-846 = USEPA Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.

Table 6: Detection Limits and Reporting Limits - Soil Analysis by EPA Method 8082
Site Investigation Work Plan

Analyte	CAS Number	Matrix	Method	Units	True MDL	PQL
Total PCB	NA	Solid	USEPA SW-846 Method 8082	ug/kg	15.22	50.0
PCB-1016 (Aroclor 1016)	12674-11-2			ug/kg	15.22	50.0
PCB-1221 (Aroclor 1221)	11104-28-2			ug/kg	15.22	50.0
PCB-1232 (Aroclor 1232)	11141-16-5			ug/kg	15.22	50.0
PCB-1242 (Aroclor 1242)	53469-21-9			ug/kg	15.22	50.0
PCB-1248 (Aroclor 1248)	12672-29-6			ug/kg	15.22	50.0
PCB-1254 (Aroclor 1254)	11097-69-1			ug/kg	15.22	50.0
PCB-1260 (Aroclor 1260)	11096-82-5			ug/kg	15.22	50.0
Total PCB	NA	Aqueous	USEPA SW-846 Method 8082	ug/L	0.112	0.5
PCB-1016 (Aroclor 1016)	12674-11-2			ug/L	0.112	0.5
PCB-1221 (Aroclor 1221)	11104-28-2			ug/L	0.112	0.5
PCB-1232 (Aroclor 1232)	11141-16-5			ug/L	0.112	0.5
PCB-1242 (Aroclor 1242)	53469-21-9			ug/L	0.112	0.5
PCB-1248 (Aroclor 1248)	12672-29-6			ug/L	0.112	0.5
PCB-1254 (Aroclor 1254)	11097-69-1			ug/L	0.112	0.5
PCB-1260 (Aroclor 1260)	11096-82-5			ug/L	0.112	0.5
Total Organic Carbon	NA	Solid	Lloyd Kahn	mg/kg	50.55	100.0

Notes:

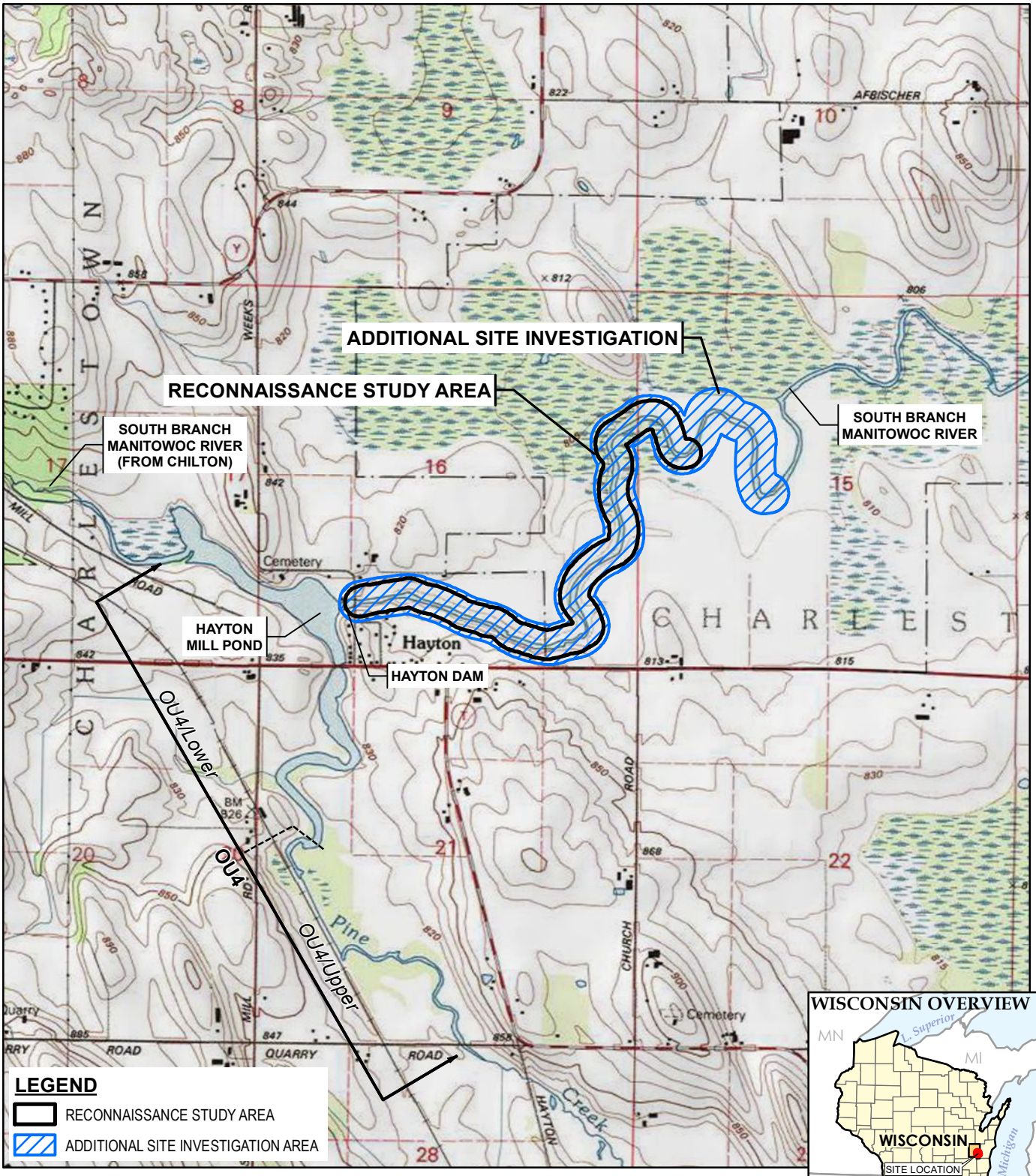
1. Actual solid reporting limits are on a dry weight basis and will be higher than the values listed due to moisture content and the volume of the solid sample.
2. Samples may be diluted due to the presence of high levels of target and non-target analytes, or other matrix interferences.
3. Laboratory MDLs, PQLs and Control Limits are subject to change.

PCB = polychlorinated biphenyl

MDL = Method Detection Limit

PQL = Practical Quantitation Limit

TRC - GIS



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 2,000 '
1:24,000

0 2,000 4,000
FEET

TRC
708 Heartland Trail
Suite 3000
Madison, WI 53717
Phone: 608.826.3600

DOWNSTREAM HAYTON MILLPOND DAM
ADDITIONAL SITE INVESTIGATION

SITE LOCATION MAP

DRAWN BY:	R. SUEMNICHT
APPROVED BY:	C. HARVEY
PROJECT NO:	320928
FILE NO.	320928-006.mxd
DATE:	JUNE 2021

FIGURE 1

TRC - GIS

Coordinate System: NAD 1983 HARN WISCRS Calumet County Feet (Foot US)
Map Rotation: 0

Plot Date: 6/9/2021, 11:07:24 AM by RSUEMNICHT -- LAYOUT: ANSI B (11"x17")
Path: E:\Tecumseh\HARP\2018_320928\320928-007.mxd

LEGEND

- TRC SEDIMENT SAMPLING/TRANSECT LOCATION (AUGUST 2015)
- WDNR SEDIMENT SAMPLING/TRANSECT LOCATION (JULY 2014)
- SEDIMENT SAMPLE LOCATION
- OVERBANK SOIL SAMPLE LOCATION
- SCRAPE SAMPLE LOCATION
- TRANSECT LOCATION
- PARCEL BOUNDARY
- ESTIMATED OHWM 2014 (TRC)

TRC SAMPLE: LABEL FORMAT

SAMPLE ID
***AUG. 2015 PCB RESULT* [mg/kg]**

WDNR SAMPLE: LABEL FORMAT

SAMPLE ID
***JULY 2014 PCB RESULT* [mg/kg]**

NOTES

1. BASE MAP IMAGERY FROM CALUMET COUNTY, 2018.
2. PARCEL BOUNDARIES FROM WISCONSIN STATE CARTOGRAPHER'S OFFICE.

0 600 1,200 Feet

1 " = 600 '
1:7,200

PROJECT:
SITE INVESTIGATION WORK PLAN
DOWNSTREAM OF HAYTON MILLPOND DAM

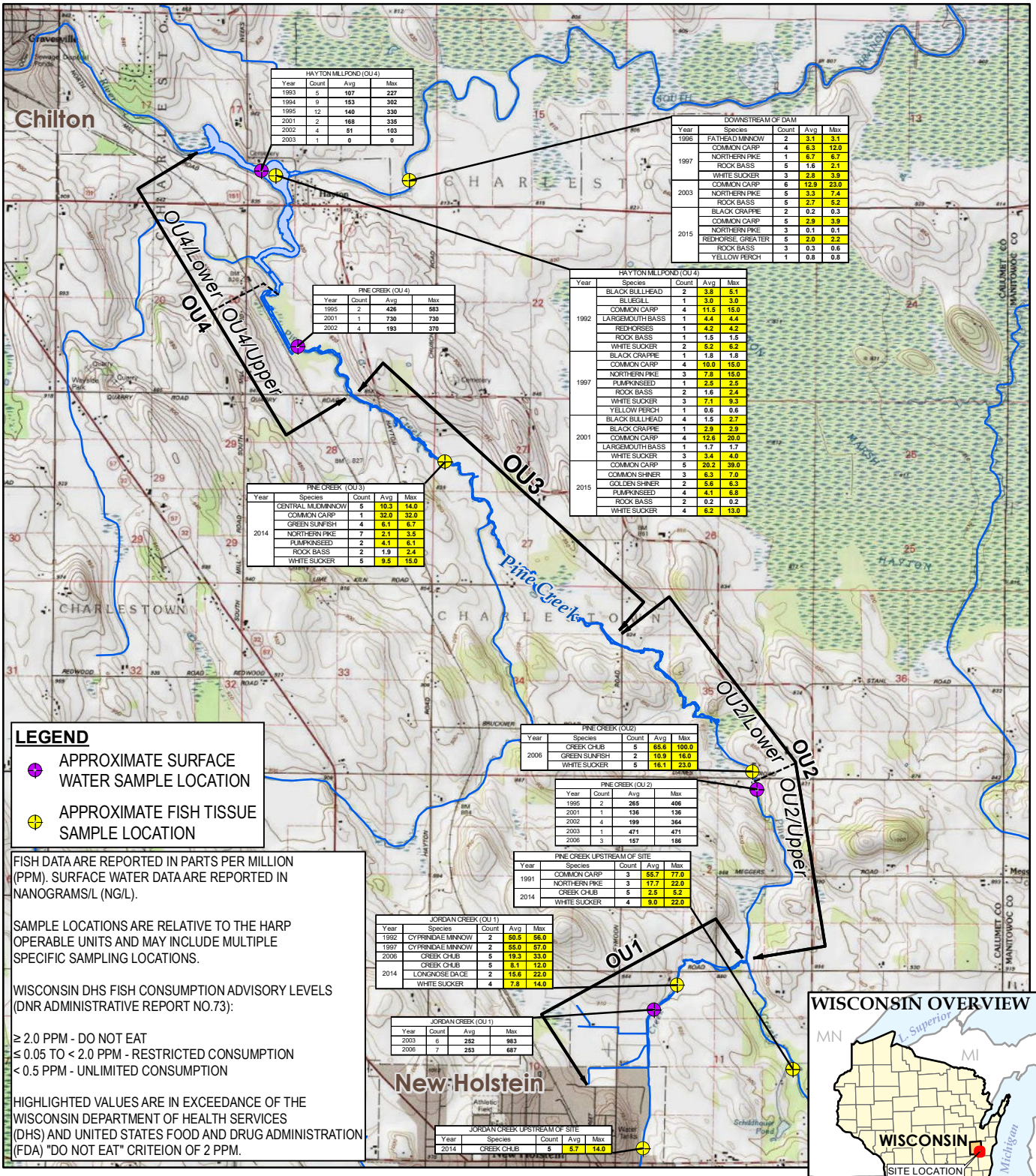
TITLE:
RECONNAISSANCE STUDY RESULTS AND PROPOSED DOWNSTREAM SAMPLING LOCATIONS

DRAWN BY:	R. SUEMNICHT	PROJ NO.:	320928
CHECKED BY:	J. RICE		
APPROVED BY:	C. HARVEY		
DATE:	JUNE 2021		

FIGURE 2

TRC
708 Heartland Trail, Suite 3000
Madison, WI 53717
Phone: 608.826.3600
www.trcsolutions.com

FILE NO.: 320928-007.mxd



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES (1992-1993).

N

1 " = 4,000 '
1:48,000

0 2,000 4,000
FEET

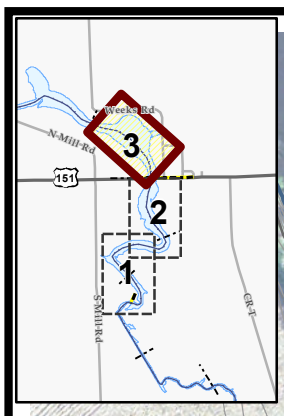
TRC
708 Heartland Trail
Suite 3000
Madison, WI 53717
Phone: 608.826.3600

SITE INVESTIGATION WORK PLAN
DOWNSTREAM OF HAYTON MILLPOND DAM

FISH TISSUE DATA (2014 - 2015)

DRAWN BY:	R. SUEMNICHT
APPROVED BY:	C. HARVEY
PROJECT NO:	320928
FILE NO.	320928-008.mxd
DATE:	JUNE 2021

FIGURE 3



RU-7A
0-11 | 0.530
11-16 | NA

RU-7B
0-12 | 0.320
12-24 | NA
24-27 | NA
VC | 0.094

RU-7C
0-12 | 0.440
12-18 | NA
18-22 | NA
VC | 0.360

RU-19A
0-14 | 0.720

RU-19B
0-12 | 2.100
12-18 | 0.120

RU-19C
0-12 | 1.300
12-16 | <0.064

RU-6C
0-12 | 3.100
12-18 | 0.051
18-26 | NA
VC | 0.780

RU-500R
0-6 | 0.45
6-12 | 0.58

2016-RU-6C
0-12" | 0.809
12-18" | 0.558

RU-18E
0-14 | 6.200
14-18 | 0.420

2016-RU-18E
0-12" | 0.764

RU-001L
0-6 | <0.0322
6-12 | <0.0316

RU-6B
0-12 | 2.300
12-18 | 0.300
18-23 | NA
VC | 0.560

RU-6A
0-6 | 0.044
6-13 | NA

RU-18D
0-12 | 0.790

2016-RU-18D
0-11" | 0.735

RU-18C
0-12 | 0.760

RU-18B
0-12 | 1.500
12-18 | 0.130

RU-5C
0-12 | 1.500
12-18 | 0.044
VC | 0.560

RU-5E
0-12 | 1.600
12-18 | 0.047
VC | 1.000

RU-5F
0-12 | 2.100
12-19 | 0.050
VC | 0.950

2016-RU-5C
0-10" | 0.763

2016-RU-5E
0-12" | 0.524
12-18" | 0.156

RU-5A
0-7 | 0.031

RU-5D
0-12 | 1.600
12-20 | 0.057
VC | 0.820

RU-18A
0-12 | 1.800
12-18 | 0.089

RU-5B
0-12 | 1.400
12-18 | 0.062
VC | 0.950

2016-RU-5D
0-10" | 0.534

RU-4E
0-3 | 0.044
3-6 | NA

RU-17D
0-12 | 4.800
12-18 | 0.170

RU-17C
0-12 | 5.600
12-18 | 0.220

2016-RU-17D
0-12" | 0.471

RU-3A
0-12 | 1.400
12-18 | 0.230

2016-RU-17C
0-12" | 0.949
12-18" | 0.89

RU-4D
0-12 | 3.000
12-20 | 0.048
VC | 2.600

2016-RU-3A
0-12" | 0.62
12-18" | 0.679

RU-3B
0-12 | 1.500
12-18 | 0.038

RU-4C
0-12 | 3.000
12-18 | 1.100
18-24 | 0.500
VC | 3.100

RU-16C
0-13 | 3.300

RU-3C
0-12 | 5.800
12-18 | 0.170

RU-17B
0-12 | 5.700
12-18 | 1.700
18-26 | <0.005

RU-16B
0-3 | 2.900
3-6 | 0.210

2016-RU-3C
0-11" | 1.15

2016-RU-17B
0-6" | 0.913

RU-3D
0-8 | 1.100
8-12 | 0.130

RU-16A
0-7 | 3.500
7-14 | 1.500

RU-3E
0-6 | 1.800
6-12 | 0.170

RU-2B
0-12 | 2.900
12-18 | 0.760
18-24 | NA
24-29 | NA
VC | 0.910

2016-RU-3E
0-6" | 0.436

RU-4B
0-12 | 1.900
12-18 | 1.200
VC | 2.200

RU-2A
0-12 | 0.420
12-16 | NA

RU-4A
0-12 | 0.031

RU-2D
0-12 | 3.600
12-18 | 0.490
18-26 | NA
VC | 0.470

RU-17A
0-8 | 0.800

RU-2C
0-12 | 4.500
12-18 | 0.052
18-24 | NA
24-28 | NA
VC | 0.820

RU-2E
0-12 | 0.480
12-13 | NA

RU-1A
0-9 | 2.200
9-14 | 0.022

RU-1C
0-12 | 3.800
12-20 | 0.088

RU-1B
0-12 | 4.900
12-20 | 0.590

2016-RU-1C
0-12" | 0.77
12-18" | 1.88

RU-20A
0-9 | 1.900
9-16 | 0.430

2016-RU-1B
0-11" | 1.73

RU-1D
0-12 | 4.000
12-18 | 0.100

RU-20B
0-12 | 6.600
12-20 | 0.720

2016-RU-1D
0-8" | 1.2

RU-20C
0-12 | 2.800
12-18 | <0.006

445+00
435+00

MILL POND
START REACH U (South)
END REACH T (Lower)
151

Weeks Rd
Center St

LEGEND:

SEDIMENT SAMPLE (2005)
SEDIMENT SAMPLE (2016)
1-FT WATER DEPTH CONTOUR
OVERBANK SAMPLE (2013)
0.5-FT WATER DEPTH CONTOUR

BASE MAP IMAGERY FROM CALUMET COUNTY, 2018. SAMPLES RESULTS FROM 2005 THAT WERE RESAMPLED IN 2016 HAVE LABEL BOX TEXT SHOWN IN GRAY.

TRC
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Madison, WI 53717
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DRAWN BY:	R. SUEMNICHT
CHECKED BY:	T. HESS
APPROVED BY:	C. HARVEY
DATE:	JUNE 2021

SCALE: 1: 1,200 (0 — 1 " = 100 ' — 100)
DATE PRINTED:

HARP OU4/LOWER **PHASE IV SAMPLING ARESULTS SUMMARY**

SAMPLING RESULTS/BATHYMETRY
MILLPOND

PROJ. NO. 320928 | FILE NAME 320928-005.mxd | **FIGURE 4**

Printed By: RSUEMNICHT on 2/2/2012, 04:08:58 PM
Path: E:\Tecumseh\HARP\2018_320928\320928-005.mxd
Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet (Foot US)
Map Rotation: 312

Appendix A: Site Investigation Work Plan Preparation Checklist

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Site Investigation Work Plan Preparation Checklist
Wis. Admin. Code § NR 716.07

Form 4400-316 (R 07/19)

Wisconsin DNR – NR 700 Process

Remediation and Redevelopment Program — **April 2019**

Purpose

This guidance is offered as an optional tool to help develop and review site investigation work plans for compliance with Wis. Admin. Code ch. NR 716 Site Investigation requirements. Consultants may choose to use this checklist as an outline for preparation of the site investigation work plan. Use of this checklist is not required. Rule citations are added for clarity. The checklist is meant for use with Wis. Admin. Code § NR 716.09 and other site investigation related guidance. For more comprehensive site investigation related information, visit our web page at dnr.wi.gov and search: "site investigation."

Receipt of Site Investigation Work Plan NR 716.09 (1)		**Comments**
☒ NR 716.09 (1)	Within 60 days of receipt of RP letter, or other notification that a site investigation is required	
☐ NR 716.09 (1), NR 700.11 (3g)	One paper copy	Not applicable; DNR has temporarily suspended the requirement for one paper copy.
☒ NR 716.09 (1), NR 700.11 (3g)	One electronic copy	
☒ NR 749	Review fee, if review by DNR is requested	See Section 7
Purpose NR 716.01		**Comments**
☒ NR 716.01	Proposed investigation will define the nature, degree and extent of contamination	See Section 3.14
☐ NR 716.01	Proposed investigation will define the source or sources of contamination	Not purpose of this SIWP
☒ NR 716.01	Proposed investigation will determine the need for an interim and/or remedial action	
☐ NR 716.01	Proposed investigation will provide information needed to select an interim and/or remedial action	Not purpose of this SIWP
Contents NR 716.09 (2)		**Comments**
☒ NR 716.09 (2) (a)	Site name and address	See Section 2
☒ NR 716.09 (2) (a)	Site location – ¼ ¼ section, Township, Range, County	See Section 2
☒ NR 716.09 (2) (a)	WTM coordinates	See Section 2
☒ NR 716.09 (2) (b)	RP's name and address (May be more than one RP – current property owner, lessee, operator, other RP.)	See Section 2
☒ NR 716.09 (2) (b)	Consultant or contractor's name and address	See Section 2
☒ NR 716.09 (2) (c)	Site location on a USGS topo map	See Figure 1
☒ NR 716.09 (2) (c)	Site layout map(s) with: buildings, roads, discharge location & other relevant site features	See Figure 2
☐ NR 716.09 (2) (d)	Scoping of the Investigation:	
☒ NR 716.07 (1)	• History of the site or facility, including land uses that may have one or more associated hazardous substance discharges or environmental pollution, including emerging contaminants such as PFAS	See Section 3.1
☒ NR 716.07 (2)	• Type and amount of contamination, if known	See Section 3.2

Contents (continue) NR 716.09 (2)		**Comments**
☒ NR 716.07 (3)	• History of previous hazardous substance discharges or environmental pollution	See Section 3.3
☒ NR 716.07 (4)	• Environmental media affected or potentially affected by contamination	See Section 3.4
☒ NR 716.07 (5)	• Location of the site or facility and its proximity to other sources of contamination	See Section 3.5
☒ NR 716.07 (6)	• Need for permission from property owners to allow access to the site or facility and to adjacent or nearby properties	See Section 3.6
☒ NR 716.07 (7)	• Potential or known impacts to receptors, including buildings, utilities or other subsurface improvements, and water supply wells within 1,200 feet of outermost edge of contamination	See Section 3.7
☒ NR 716.07 (8) (a), (b), (c), (d)	• Potential for impacts to sensitive species, habitats or ecosystems, wetlands, resource waters, sites of historical/archaeological significance	See Section 3.8
☒ NR 716.07 (9)	• Potential interim and remedial actions applicable to the contamination	See Section 3.9
☒ NR 716.07 (10)	• Immediate or interim actions taken or in progress, including any evaluations made of whether an interim action is necessary	See Section 3.10
☒ NR 716.07 (11)	• Any other items, including climatological conditions and background water or soil quality info that may affect the scope or conduct of the investigation	See Section 3.11
☐ NR 716.07 (12)	• Need to gather data to determine the hydraulic conductivity of materials where contaminated groundwater is found	See Section 3.12
☐ NR 716.09 (2) (e)	Physiographical and geological setting of the site necessary to choose sampling methods and locations, including:	
☒ NR 716.09 (2) (e) 1.	• Existing topography, including prominent topographic features	See Section 4.1
☒ NR 716.09 (2) (e) 2.	• Surface water drainage patterns and significant hydrologic features, such as surface waters, springs, drainage basins, divides, wetlands, floodplain or floodway	See Section 4.2
☒ NR 716.09 (2) (e) 3.	• Texture and classification of surficial soils	See Section 4.3
☒ NR 716.09 (2) (e) 4.	• Nature and distribution of geologic materials, including the thickness and type of unconsolidated materials and type and nature of bedrock	See Section 4.4
☒ NR 716.09 (2) (e) 5.	• General hydrogeologic information	See Section 4.5
☒ NR 716.09 (2) (e) 6.	• Potential hazardous substance migration pathways	See Section 4.6
☐ NR 716.09 (2) (f)	Sampling and analysis strategy to be used during the field investigation, including:	
☒ NR 716.09 (2) (f) 1.	• Description of the investigative techniques to be used to characterize the site or facility	See Section 5.1
☒ NR 716.09 (2) (f) 2.	• Site layout map(s), in planimetric and vertical views, with locations from which samples of environmental media will be obtained or a description of the strategy to be used for determining sample locations	See Figure 2

Contents (continue) NR 716.09 (2)		**Comments**
☒ NR 716.09 (2) (f) 3.	• Description of sampling methods to be used, including methods for collecting, preserving, and delivering samples and leak detection methods (for vapor sampling)	See Sections 5.3, 5.4, and 5.6
☒ NR 716.09 (2) (f) 4.	• List of the parameters for which samples will be analyzed, analytical methods to be used including method detection limits	See Section 5.6
☒ NR 716.09 (2) (f) 5.	• Description of quality control and quality assurance procedures to be used per sampling method, including the items listed in NR 716.13	See Section 5.7
☒ NR 716.09 (2) (f) 6.	• Description of procedures to prevent cross-contamination between samples	See Section 5.8
☒ NR 716.09 (2) (f) 7.	• Description of the type of investigative wastes that will be generated during the site investigation and how they will be collected, stored, transported, treated or disposed	See Sections 5.3, 5.4, and 5.9
☒ NR 716.09 (2) (f) 8.	• Discussion of how the sampling and analysis results will be related to previous investigations at the site or facility and how the results will be used to determine the degree and extent of contamination and the selection of a remedial action, including natural attenuation, where appropriate	See Section 6 including discussion of SWAC that involves using results of previous investigations.
☒ NR 716.09 (2) (g)	Description of other procedures to be used for site management, including erosion control and repair of structural, soil or ground disturbance	See Sections 5.3, 5.4 and 5.11
☒ NR 716.09 (2) (h)	Schedule for conducting the field investigation and reporting the results to the DNR	See Section 6
☒ NR 712	Certification of professional(s) that will conduct or supervise the work necessary to obtain data, develop conclusions and recommendations, and prepare the site investigation submittal, per Wis. Admin. Code NR 712	See Section 1

Appendix B: USGS Paper: Distribution and Transport of Polychlorinated Biphenyls and Associated Particulates in the Hayton Millpond, South Branch Manitowoc River, 1993-95

Distribution and Transport of Polychlorinated Biphenyls and Associated Particulates in the Hayton Millpond, South Branch Manitowoc River, 1993–95

By Jeffrey S. Steuer, David W. Hall, and Sharon A. Fitzgerald

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 99–4101

Prepared in cooperation with the
WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Middleton, Wisconsin
1999

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
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U.S. Geological Survey
Branch of Information Services
Box 25286
Denver, CO 80225-0286

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To Obtain
acre	0.4048	hectare
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
foot (ft)	0.3048	meter
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
millimeter	0.03937	inch
centimeter	.3937	inch
meter	3.281	foot
kilogram (kg)	2.205	pound
kilogram (kg)	.00326	ton
gram (g)	1×10^9	nanogram
gram (g)	1×10^6	microgram
gram (g)	1×10^3	milligram
liter (L)	0.2642	gallon
ton	0.9072	megagram

Temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) by use of the following equation:
°F = 1.8 (°C) + 32.

Abbreviated water-quality units used in this report: Chemical concentrations are given in metric units. Chemical concentration is given in milligrams per liter (mg/L), micrograms per liter (µg/L), nanograms per liter (ng/L), or micrograms per gram (µg/g). Milligrams per liter is a unit expressing the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter. Micrograms per gram are metric units expressing the concentration of chemical constituents in solution as mass (micrograms) of constituent per unit mass (gram) of dry sample. For concentrations less than 7,000 mg/L, the numerical value is the same as for concentrations in parts per million.

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Distribution and Transport of Polychlorinated Biphenyls and Associated Particulates in the Hayton Millpond, South Branch Manitowoc River, Wisconsin, 1993–95

By Jeffrey S. Steuer, David W. Hall, *and* Sharon A. Fitzgerald

Abstract

The distribution and transport of polychlorinated biphenyl (PCB) congeners was determined at two sites on Pine Creek and at the Hayton Millpond on the South Branch of the Manitowoc River in Wisconsin during 1993–95. PCB congener compositions were analyzed in the operationally defined dissolved phase, suspended particulate phase, and surficial bed sediments (0–2 centimeters depth) several times throughout the sampling period. The relative abundances of PCB congeners in the suspended particles and in surficial bed sediments were generally similar to each other and to a known Aroclor mixture (1254). PCB congener composites in the operationally defined dissolved phase were higher in the less chlorinated congeners in keeping with their lower hydrophobicity and higher predicted solubility relative to the more chlorinated congeners. Suspended particle-associated PCB concentrations exhibited two patterns: (1) a cyclical variation in spring and summer associated with algal growth, and (2) episodic increases associated with resuspension of bed sediments during storms. Computed total suspended-solids (TSS) load at the millpond outlet was as high as 920 tons over a 3-month period (June 30–Sept. 30, 1993). Annual TSS loads for the following two years were lower, 610 and 500 tons, respectively. Total PCB concentrations in the water column varied at the millpond outlet, ranging from 34 to 302 nanograms per liter, whereas concentrations upstream on Pine Creek were as high as 563 nanograms per liter. In general, 70 percent of PCB's in the water column were associated with suspended particles. The total congener-summation PCB (ΣPCB) concentration regression equation incorporated the universal soil loss coefficent to represent erosion of assumedly PCB-free sediment from fields upstream from the millpond. The ΣPCB load based on the regression relation was 3.4 kilograms during the 3-month high-flow interval (June 30–Sept. 30, 1993). Subsequent annual ΣPCB loads for the next two water years were 3.5 and 2.3 kilograms, respectively.

INTRODUCTION

Polychlorinated biphenyls (PCB's) were extensively used in the United States from 1929 until their manufacture was banned in 1977. PCB's are a class of compounds consisting of 209 individual congeners, which represent the set of chemical structures that can be formed by attaching from one to ten chlorine atoms to the available bonding sites on a biphenyl structure.

Various congener mixtures were formulated to provide optimal chemical and physical properties for specific uses and were marketed under names that included Aroclor and Askerel. It has been estimated that more than 1 million metric tons of PCB's have been produced worldwide (Schwarzenbach and others, 1993) for a wide variety of uses including lubricating and cutting oils, capacitor dielectrics, carbonless copy paper, transformer coolants, plasticizers, adhesives, and resins (Cairns and others, 1986). These PCB's may enter the environment from production, storage, and disposal sites and are a cause of concern because of deleterious effects associated with bioaccumulation (Yamashita and others, 1993; Koslowski and others, 1994; Rogers and Swain, 1983).

Research into contamination of sediment, water, and biota in the Lake Michigan basin has identified numerous source areas of PCB's. Rivers containing sediments that are contaminated with PCB's include: the Fox (House, 1995; Velleux and others, 1995; Steuer and others, 1995), the Sheboygan (David and others, 1994), and the Milwaukee (Steuer and others, 1999) in Wisconsin; the Grand Calumet in Indiana (Marti and Armstrong, 1990); and the Kalamazoo, Escanaba, and Manistique in Michigan (Marti and Armstrong, 1990).

Waukegan Harbor in Illinois has also been identified as being a source area of PCB contamination to Lake Michigan (Swackhamer and Armstrong, 1988). Atmospheric deposition of PCB's in the Lake Michigan basin has been an area of active research for many years (Sweet and others, 1993; Eisenreich and others, 1981).

Significant PCB contamination has been identified in the Hayton Millpond (hereafter referred to as the millpond), an impoundment on the South Branch of the Manitowoc River near Chilton, Wis., and in Pine Creek, a tributary to the millpond. The contaminated areas are upstream from the Killsnake State Wildlife Area in Calumet County, Wis., near the towns of Chilton, Hayton, and New Holstein (fig. 1). The millpond outlet flows to Lake Michigan by way of the Manitowoc River system.

Between 1987 and 1992, fish samples collected by Wisconsin Department of Natural Resources (WDNR) indicated elevated PCB concentrations in Hayton-area fish. The mean wet weight concentration of 16 µg/g (range, 0.5 to 77 µg/g) was above the 1.9 µg/g Division of Health level at which no fish should be eaten. The resulting "Do Not Eat" warning has been issued only one other time in Wisconsin. The lifetime additional cancer risk associated with Hayton-area fish exceeded 1 in 100 for all species collected; it was 1 in 35 for northern pike. Fish collected from the Manitowoc River upstream from the contaminated millpond area were virtually uncontaminated with respect to PCB; thus the probable PCB source was thought to be somewhere on Pine Creek (Wisconsin Department of Natural Resources, 1991). Despite the "Do Not Eat" warning, and the evidence for probable PCB source locations, the South Branch of the Manitowoc River, Millpond, and Pine Creek remain popular fishing spots.

During 1993–95, WDNR collected bottom sediments from Pine Creek and the millpond and found that the congener-summation PCB concentrations (ΣPCB)[1] averaged 45 µg/g and ranged from <0.05 to >2,000 µg/g. The August 1995 sampling identified an area in northeast New Holstein as the probable source of PCB's to the Hayton Millpond. ΣPCB concentrations in sediment cores obtained upstream from the three dams in Chilton were all less than the minimum detection limit (0.05 µg/g).

Table 1. Congener-summary PCB concentrations in bottom sediments from the Pine Creek and Hayton Millpond, east-central Wisconsin

[Data collected by Wisconsin Department of Natural Resources. µg/g, micrograms per liter; kg, kilogram]

Site	PCB concentration range (µg/g)	PCB mass (kg)
Upstream from Jordan to Pine Creek confluence (A)	<.05–1,900	376
Confluence to Limekiln Road (B)	4.2–19	136
Limekiln Road to millpond entrance	0.5–15	11
Millpond	0.6–7.3	58

In 1993, the U.S. Geological Survey (USGS), in cooperation with the Wisconsin Department of Natural Resources (WDNR), began the investigation to further understand the distribution and transport of polychlorinated biphenyls and associated particles in Hayton Millpond. Results from this study will be used to assist WDNR in Hayton Millpond and Pine Creek remediation efforts.

Purpose and Scope

The purpose of this report is to present results of the USGS and WDNR cooperative investigation into the occurrence and transport of PCB's in the South Branch Manitowoc River near the Hayton Millpond. Congener profiles are compared for the operationally defined dissolved phases, suspended particulate phases, and surficial bed sediments. Congener-summation total PCB loads and suspended-solids loads presented in the report are based on data from the Pine Creek and Hayton Millpond sites, whereas a ΣPCB concentration regression relation, based on total suspended solids and rainfall data was used to compute the reported ΣPCB load for the millpond outlet.

Environmental Setting and Hydrology

The Manitowoc River Basin encompasses approximately 526 mi^2 and comprises five major watersheds, one of which is the 192 mi^2 South Branch Manitowoc River Watershed. The millpond outlet is 2 mi down-

[1]Specifically, ΣPCB refers to the sum of all PCB congeners detected in a given phase (dissolved, suspended particulate, or bed sediment).

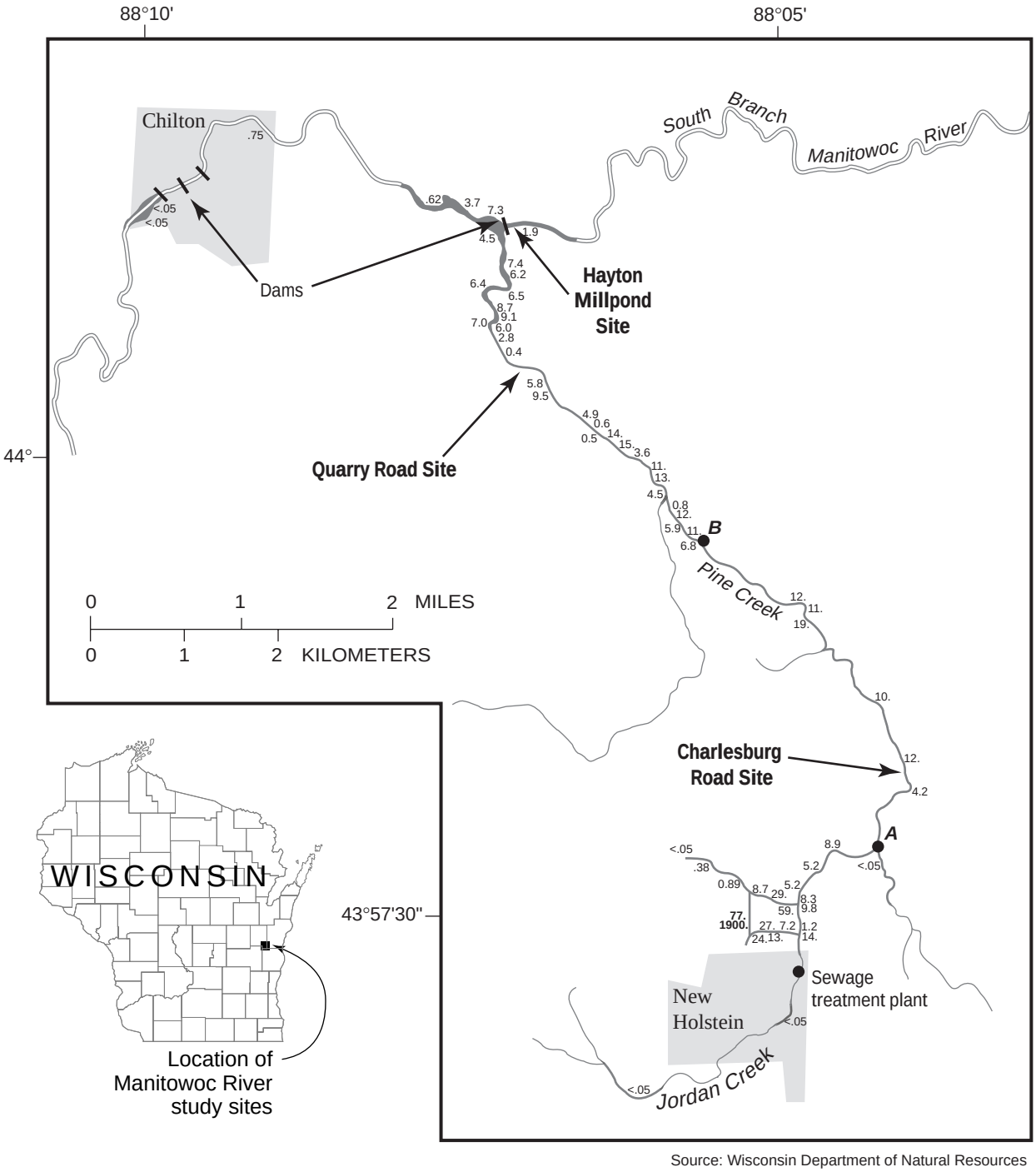

Figure 1. Location of USGS sampling sites at Hayton Millpond, Quarry Road, and Charlesburg Road, and location of Wisconsin Department of Natural Resources sites (A, B) on Pine Creek, Jordan Creek, and Hayton Millpond. (Concentrations of total PCB's in surficial bed sediments in parts per million (Aroclor 1254; dry weight basis) are noted at sampled locations.)

stream from Chilton, Wis. (fig. 1), and is part of the South Branch of Manitowoc River Basin. The 109-mi^2 watershed above the millpond outlet produces a mean annual discharge (3-year record) of 24 ft^3/s. Annual mean discharge during the study period was 31 and 17 ft^3/s during water years 1994 and 1995, respectively.

The New Holstein sewage treatment plant discharges to Jordan Creek, which joins Pine Creek just upstream from Charleston Road. Pine Creek discharges to the South Branch of the Manitowoc River at the millpond (fig. 1).

Agriculture is the predominant land use and 5 percent of this agricultural land is considered to have a high soil erosion potential. The South Branch of the Manitowoc River maintains a moderate stream gradient through most of Calumet County. The millpond is affected by sedimentation, algal blooms, and dense aquatic plant growth (Wisconsin Department of Natural Resources, 1991).

Site Descriptions

The three sites sampled during this investigation were the following (downstream to upstream):

1. South Branch of the Manitowoc River at the Hayton Millpond Outlet (USGS station 04085395): Water samples were collected approximately 100 ft downstream from the dam (fig. 1). An automated sampler, activated by a stage sensor, was installed at this site. Continuous temperature monitoring began in July 1994 and continued throughout the study period (June 30, 1993 to Sept. 11, 1995). Discharge has been measured continuously since 1993. Three seasonal bed-sediment samples (November 1993, February 1994, and May 1994) were collected from cross-sectional transects just upstream from the millpond dam (Fitzgerald and Steuer, 1997).

2. Pine Creek at Quarry Road (USGS station 040853936): From April 1995 to June 1995, three water samples were collected from this 31-mi^2, noninstrumented site located 1.8 mi upstream from the millpond site at the Quarry Road bridge. Pine Creek joins the South Branch of the Manitowoc River at the millpond (fig.1).

3. Pine Creek at Charlesburg Road (USGS station 040853926): From April 1995 to June 1995, water samples were collected from this 5-mi^2 noninstrumented Charlesburg Road bridge site (fig. 1).

SAMPLING AND ANALYTICAL METHODS

General methods of sample collection and field preparation for subsequent PCB determinations are discussed in detail in Fitzgerald and Steuer (1997) and in House and others (1993). For this investigation, 80-L samples were collected by dipping 20-L stainless steel canisters through the water column at four locations across each creek or river. Specific water collection and processing details are provided in Steuer and others (1999).

Samples for ancillary water-quality characteristics such as sediment organic carbon (SOC), dissolved organic carbon (DOC), chlorophyll *a*, chloride, volatile suspended solids (VSS), and total suspended solids (TSS) were collected in 1-L glass bottles submerged through the water column in the same manner and at the same locations as for PCB sampling. Subsamples for five of the ancillary characteristics (TSS,VSS, chlorophyll *a*, SOC, DOC) were composited in a churn splitter to obtain the final representative sample (Ward and Harr, 1990). These samples are referred to as CHURN samples. Subsequently, samples to be analyzed for SOC content were processed through a stainless steel filter apparatus with a 0.45-µm-pore-size filter. Chlorophyll *a* samples were processed through a 5.0-µm-pore-size mixed acetate and nitrate cellulose filter.

For comparison with the TSS sample resulting from the 80-L sample approach (CHURN), a second suspended-solids sample was collected and analyzed separately. This suspended-solids sample was collected with a 470-mL glass bottle and plastic nozzle that was submerged at four locations along a stream cross section either manually (wadable sites) or in a D-77 USGS sampler (nonwadable sites). Samples from the cross section—referred to as "equal-width-increment" (EWI) samples—were composited in the sample bottles themselves; no churn was used.

The automated point sampler (POINT) at the millpond collected samples daily at 1200 hours and more often during storm events. When the millpond was frozen, sampling was reduced to once every 2 or 3 days. Additionally, the point samplers were triggered at the time of EWI sample collection to provide pairs of sam-

ples for comparison of TSS concentrations. Ideally, POINT TSS concentrations would be comparable to those in EWI samples, indicating that point samples capture a representative sample of the streamwater.

Three core samples of surficial bed sediment were collected in November 1993, February 1994, and May 1994 along one transect in the millpond impoundment. All samples were collected using either an Ekman dredge or gravity corer. Field and analytical methods for ancillary characteristics and bed sediments are described in detail in Fitzgerald and Steuer (1997).

Congener-specific PCB, TSS, and ancillary-characteristic samples were collected from June 1993 through September 1995; on 16 of the 22 PCB sample days, discharge was greater than 14 ft^3/s, the 50-percent exceedance discharge (Holmstrom and others, 1995). This emphasis on high-flow conditions optimized the project data set for load estimation given that increased sediment and PCB contaminant loads are expected during high flow (Dolan and others, 1981).

The USGS software program CLOAD was used to estimate suspended-solids and ΣPCB loads. CLOAD employs a flow-integration approach to estimate loads, whereby concentration data are estimated by linear interpolation between existing data points and are subsequently multiplied by 15-minute discharge values (daily in winter) to obtain loads (Porterfield, 1972).

All PCB samples were analyzed on a congener-specific basis by use of capillary column gas chromatography with electron capture detection (HP 5890-II gas chromatograph with a 60-m DB5 column) at the State Laboratory of Hygiene (SLOH), Madison, Wis. (Degenhardt, 1996). This method can determine up to 85 congeners (with 26 co-elutions). Details on quantitation, generation of response factors, surrogate standards, matrix spikes, retention time reference peaks, and internal standards for PCB analyses are contained in Degenhardt (1996). The average recovery of these surrogates and matrix spikes for all samples analyzed during the period coincident with the analysis of the samples from the present study can be found in Fitzgerald and Steuer (1997). Concentrations of ΣPCB were not corrected for percent recovery of either the surrogates or matrix spikes. Detection limits, limits of quantification, IUPAC numbers, and congener descriptions used in sample analysis along with quality-control and field-equipment-blank results are reported in appendix 1 in Steuer and others (1999).

DISTRIBUTION AND TRANSPORT OF PCB'S AND ASSOCIATED PARTICULATES

PCB Congeners

PCB congeners in the operationally defined dissolved and particulate phases of water column and sediment core samples collected at Charlesburg Road, Quarry Road, and the millpond are presented as a percentage of the sum of all detected congeners (fig. 2). Appendix 2 contains a complete listing of the plotted congeners. All samples at a given site have been averaged together. The congener distributions appear to be similar between the three sites. In addition, the PCB congener pattern of suspended particles appears to be nearly identical to the millpond surficial bed sediment (compare figs. 2b and 2c); this similarity indicates interaction between the two media. There is also a similarity between these PCB congener suites and Aroclor 1254 (fig. 2c). The particulate-phase PCB compositions are substantially different from those of the dissolved phase at all sites (fig. 2).

PCB concentrations in the water column varied considerably. The total PCB concentration at the millpond outlet ranged from 34 to 302 ng/L; ΣPCB on suspended particles ranged from 0.3 to 10.7 μg/g (appendix 1). This is contrasted to the three seasonal surficial bed-sediment samples from the millpond (0–2 cm) with the narrow range of 2.6 to 3.7 μg/g. Seventy-four percent (plus or minus 11 percent) of total water-column PCB's were associated with suspended particles (appendix 1a).

The two-phase distribution computation is described in Steuer and others (1999). The sediment/water distribution coefficients (Kd) in figure 3 indicates that the more chlorinated congeners have a much greater affinity for particulate matter than the less chlorinated congeners do. For example, distribution coefficients differ by more than an order of magnitude in some cases, such as between IUPAC congener 18 (a less chlorinated congener) and congener 180 (a more chlorinated congener). These differences in congener-partitioning characteristics explain some of the differences in the dissolved and particle-associated congener distributions illustrated in figure 2.

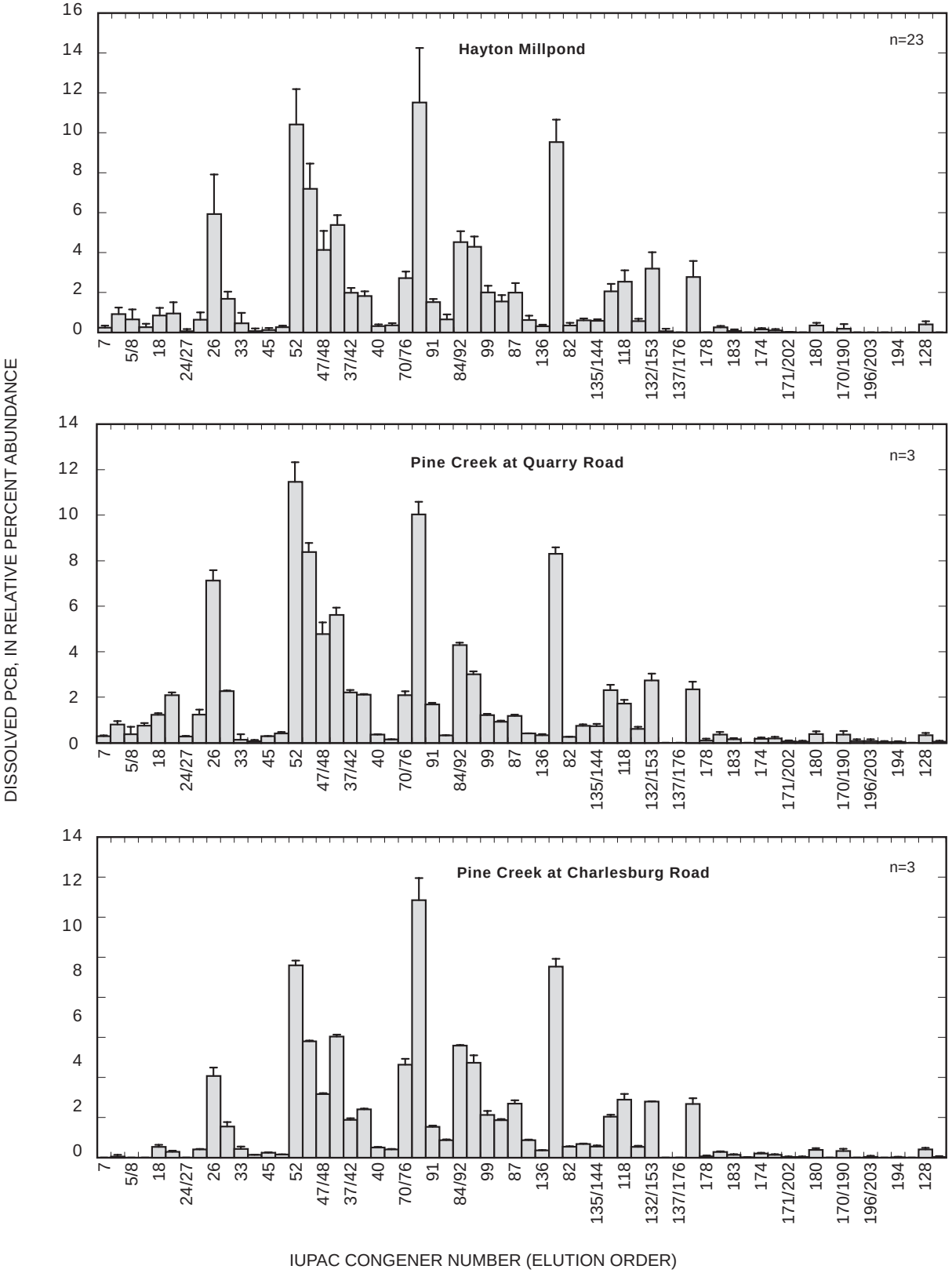

Figure 2a. PCB congener distributions in the dissolved phase at Hayton Millpond and two sites on Pine Creek, east-central Wisconsin. (Error bars represent 1 standard deviation.)

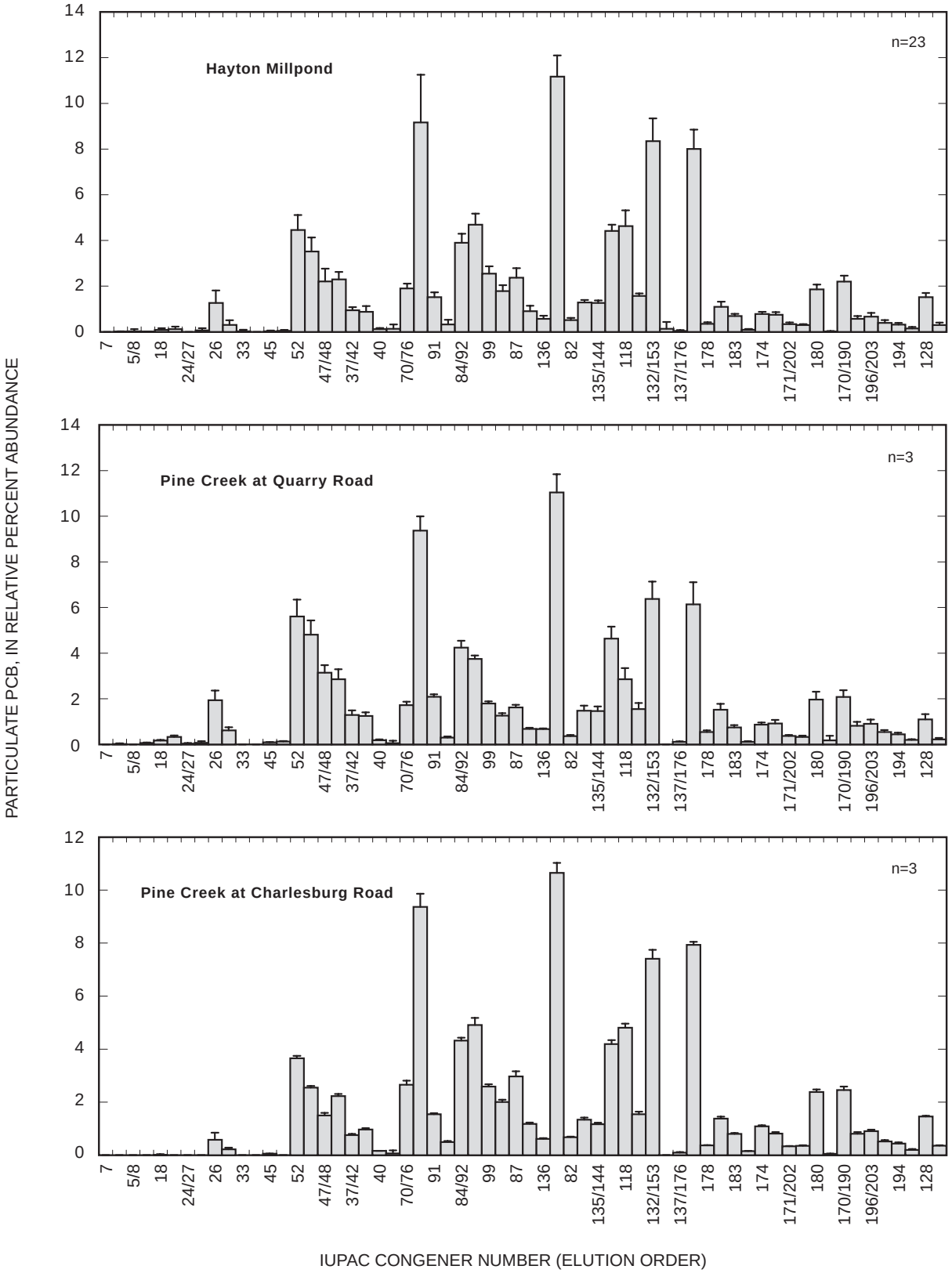

Figure 2b. PCB congener distributions in the particulate phase at Hayton Millpond and two sites on Pine Creek, east-central Wisconsin. (Error bars represent 1 standard deviation.)

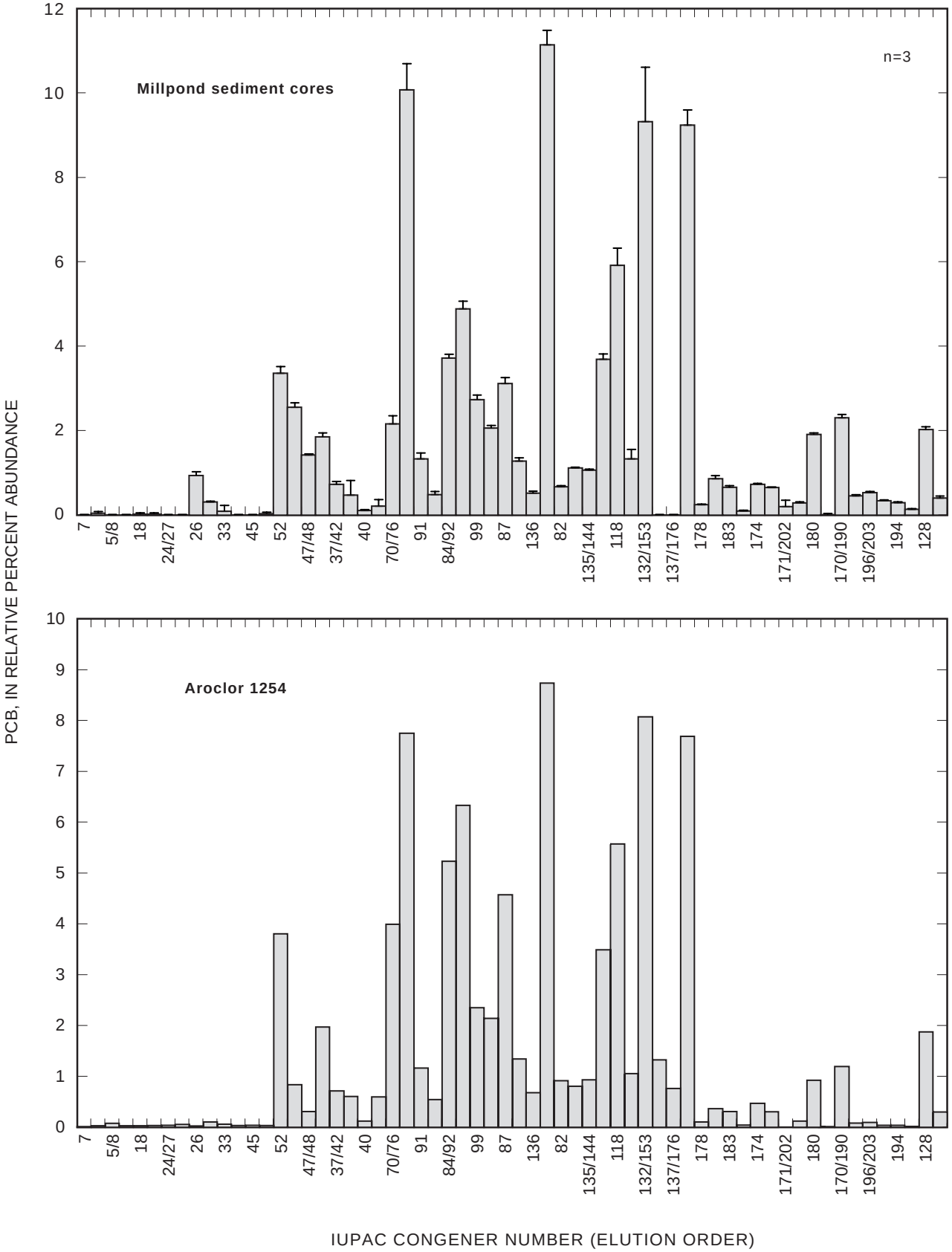

Figure 2c. PCB congener distributions in Hayton Millpond sediment cores, east-central Wisconsin, and congener composition of Aroclor 1254. (Error bars represent 1 standard deviation.)

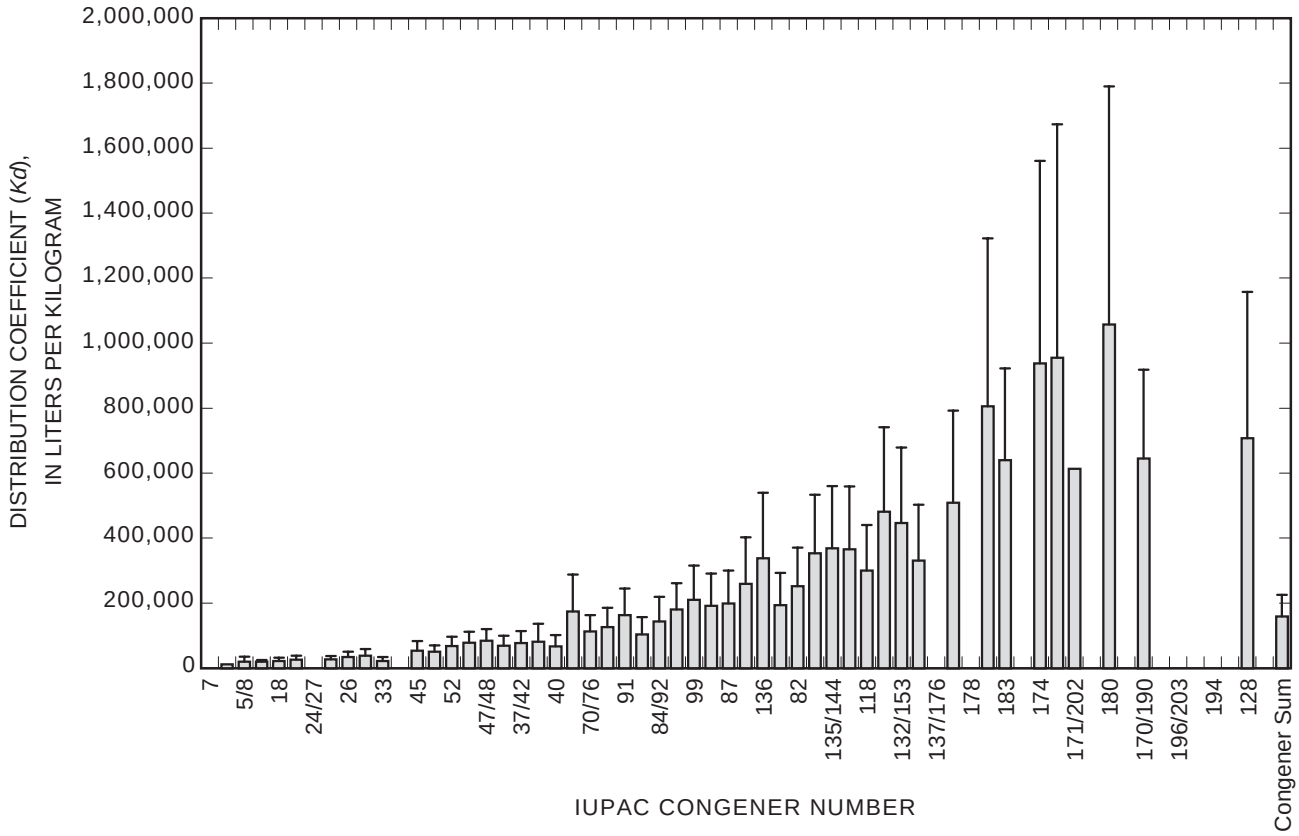

Figure 3. Two-phase distribution coefficients for PCB congeners at the Hayton Millpond outlet, east-central Wisconsin. (Error bars represent 1 standard deviation.)

Total Suspended Solids

The automated point TSS samples, which were collected from a single point in the river, provide a reasonable approximation of the EWI samples collected from the entire vertical and horizontal water column (fig. 4). Correlation between POINT and EWI data is strong when the sampled river is well mixed with respect to a constituent of interest; in this case, TSS. Turbulent flow below the millpond outlet dam—located just upstream from the monitoring site—may enhance water-column mixing. Additionally, agreement between the CHURN and EWI TSS data (appendix 1a) confirms that the PCB water-collection approach represented the entire water column.

TSS concentrations in the millpond outlet reflect both the rising limb of the hydrograph and the cyclical algal growth pattern represented by chlorophyll *a* concentrations (fig. 5).

Cumulative TSS load for the entire sampling period is displayed in figure 6 along with the discharge hydrography for the millpond outlet. The annual suspended solids loads for water years 1994 and 1995 were similar, 610 tons and 500 tons, respectively. These loads, however, were about two-thirds of the 920-ton suspended-solids load that was computed for the last 3 months of water year 1993 (June 30, 1993–Sept. 29, 1993), a high-streamflow interval.

Concentrations and Loads of Transported ΣPCB's in the Hayton Millpond System

All PCB congeners present in a sample were summed to obtain congener-summation PCB concentrations (ΣPCB). Congener-specific PCB data have been published (Holmstrom and others, 1995, 1996, 1997) and are stored in the USGS QWDATA base. Concentrations of PCB's in the operationally defined dissolved and particulate phases and total PCB concentrations (dissolved and particulate), along with the ancillary constituents, are listed in appendix 1a.

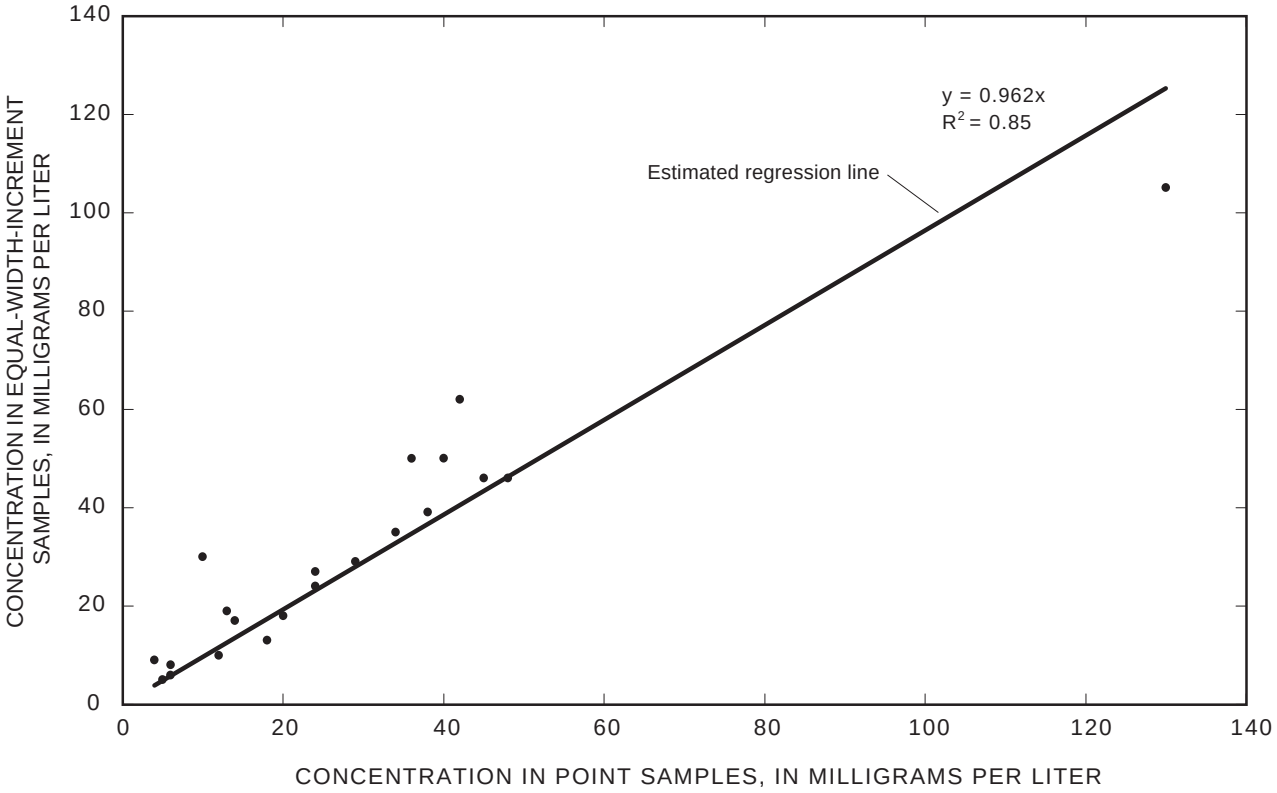

Figure 4. Correlation of total suspended solids resulting from two sampling methods at the Hayton Millpond outlet, east-central Wisconsin.

PCB's and other hydrophobic compounds typically sorb to riverine biotic material, sediments, and other solids; thus, the ΣPCB regressions initially focused on the TSS variable. POINT TSS samples were used in the ΣPCB load regression analyses because of the greater data density and potentially more accurate event coverage afforded by the frequency of automated sample collection. Regression efforts also examined PCB concentration as a function of discharge, time of year, temperature, and precipitation.

The concentrations of PCB's on suspended-solids particles (reported as micrograms per gram) are listed in appendix 1a. On five occasions, the particulate-phase PCB concentration dipped below 3.5 µg/g. For each of these occasions, precipitation had occurred within the previous two days. Cultivated fields in close proximity to reaches upstream from and adjacent to the millpond may supply a significant source of PCB-free sediment, resulting in a drop of particle-associated PCB. As a result, the ΣPCB regression was modified to include the universal soil loss coefficient (EI) (Wischmeier and Smith, 1978) in order to represent the tendency of watershed soil erosion to transform (reduce) the TSS variable:

$$EI = [916 + 331 \cdot \log(I_{60})] \cdot I_{30}, \qquad (1)$$

where

I_{30} is the 30-minute precipitation intensity[2] and
I_{60} is the 60-minute precipitation intensity[2].

Revised regression relations incorporating EI are listed in table 2. The universal soil loss equation uses EI as an exponential function; in this study the coefficient and exponent on the summed EI's (day of sample and previous two days) were selected to maximize the r^2 value. For example, on July 6, 1993, an intense rainstorm produced an EI of 29.6 (appendix 1a). The millpond TSS concentration based on POINT samples was high (115 to 145 mg/L); yet, the particle-associated PCB decreased to 0.3 µg/g (appendix 1a). A similar

[2]Precipitation intensities were computed from a rain gage on Otter Creek (USGS station 434907087573000) located 18 miles from the millpond.

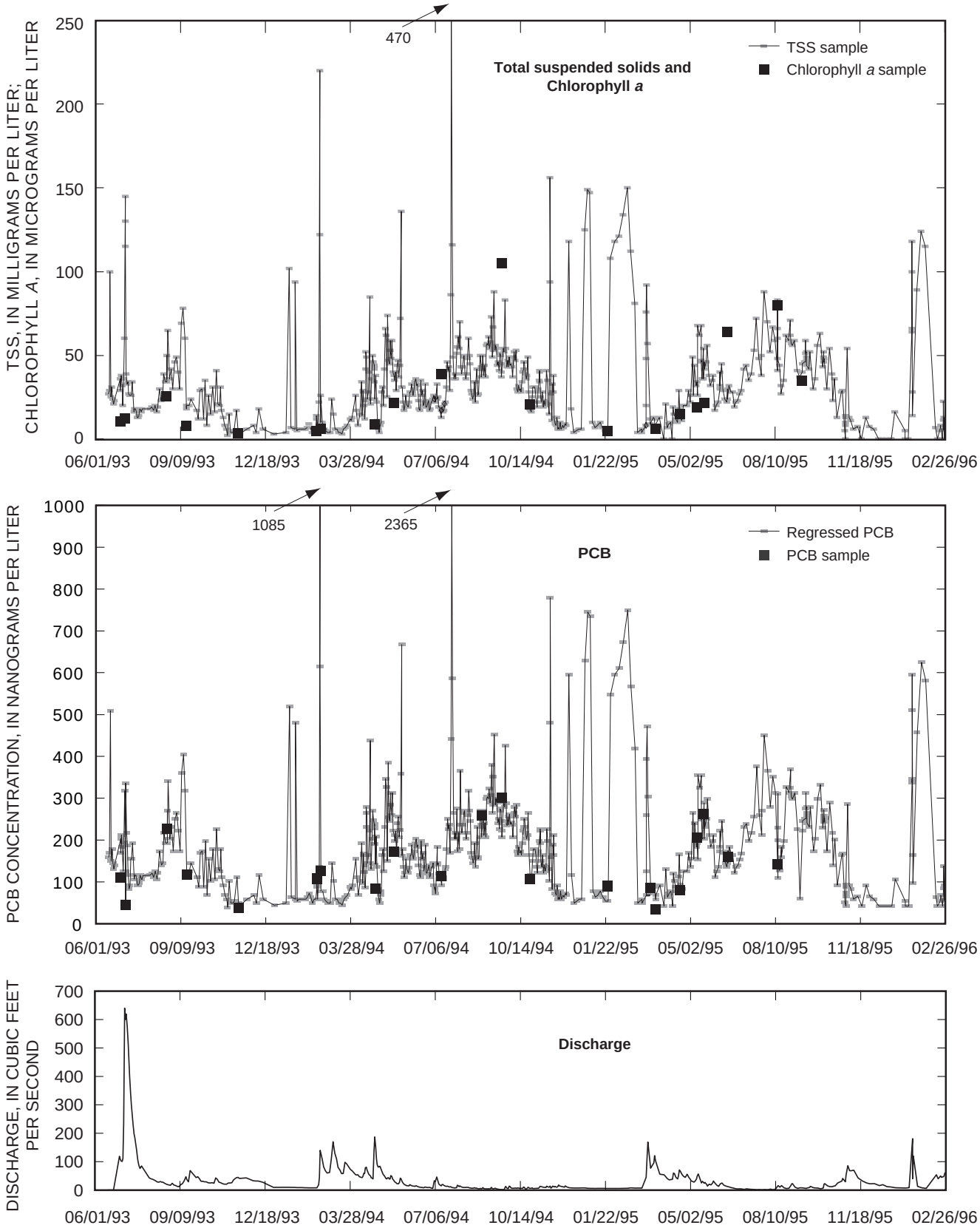

Figure 5. Discharge at Hayton Millpond outlet, east-central Wisconsin, and associated concentrations of total suspended solids (TSS), chlorophyll *a*, and total PCB.

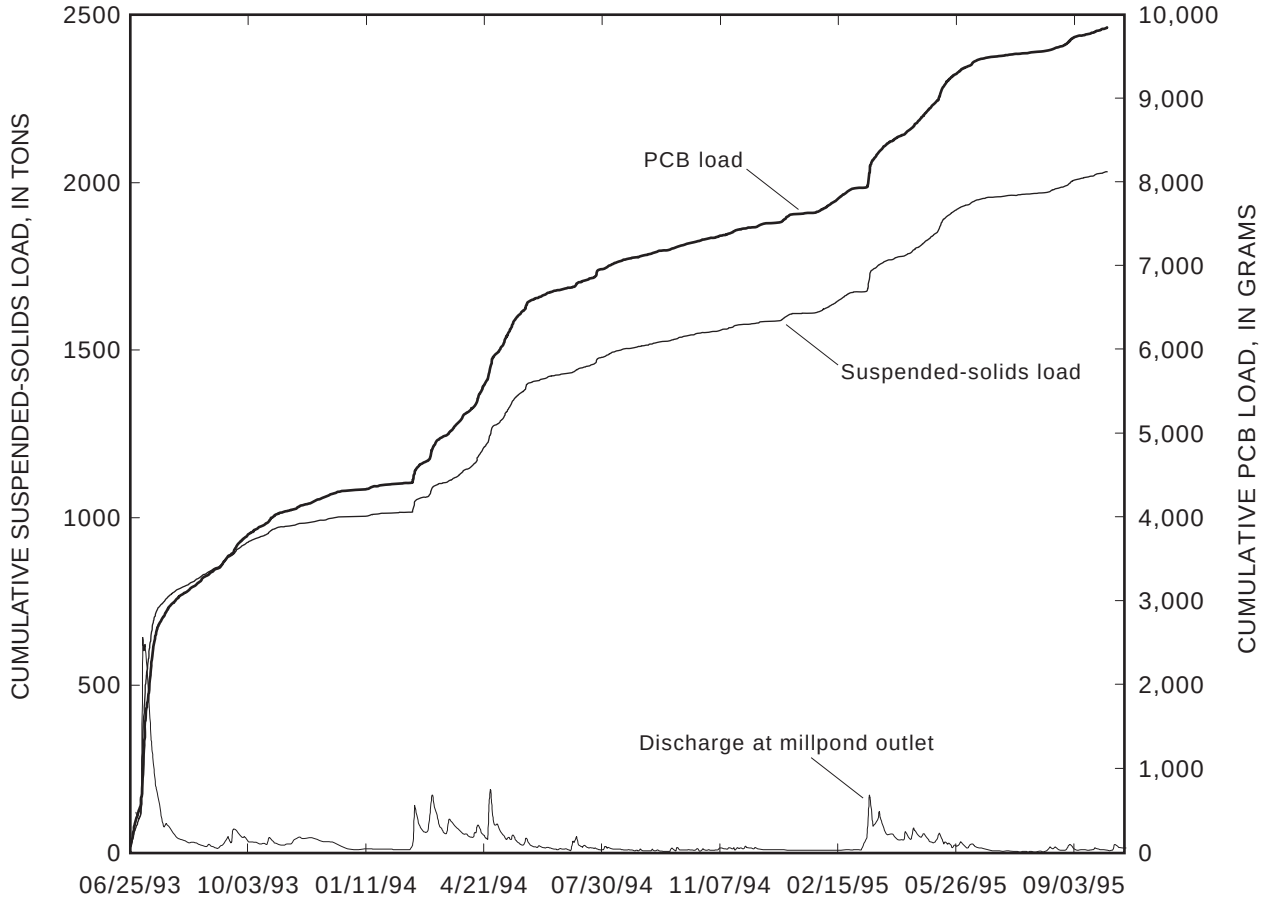

Figure 6. Cumulative PCB and suspended-solids loads at the Hayton Millpond outlet, east-central Wisconsin.

Table 2. Regression relations for total PCB concentration congener summation (ΣPCB) and selected congeners

[r^2, correlation coefficient; SE, standard error; μ_{PCB}, PCB mean; TSS, total suspended solids, in milligrams per liter; SL_2, summation of universal soil loss coefficient for the day of the PCB sample and the previous two days; %, percent]

Regression relation	r^2	$1.96 \times SE / \mu_{PCB}$
(Equation 2) $\Sigma PCB = 480[TSS - (0.05 \cdot SL_2^{2.31})] + 29.8$	0.77	53%
(Equation 3) Congeners 77/110 = $0.53[TSS - (0.05 \cdot SL_2^{2.31})] + 2.78$	.76	57%
(Equation 4) Congener 180 = $0.079[TSS - (0.05 \cdot SL_2^{2.31})] + 0.28$	.80	53%

dilution of PCB-laden solids by clean solids was observed on August 13, 1995.

The WDNR has found PCB-laden sediment in the flood-plain area of Pine and Jordan Creeks (fig. 1). These contaminated flood-plain areas—many of which are grassland, woodland or pastureland—may not be as erodible as the more steeply sloped uncontaminated cultivated fields. An example of one such high-sloped cultivated field that may produce uncontaminated solids is immediately adjacent to the millpond. If land use of the contaminated flood plain areas changes (for example, if cultivated area increased), the soil erosion potential could increase and the above TSS transform (reduction) and resulting PCB regression relation may not be appropriate.

The linear regression was not as reliable if the TSS variable was transformed by discharge (r^2= 0.63) instead of EI or not transformed at all (r^2= 0.24). ΣPCB loads were computed by means of the regression relation (table 2, eq. 2), 15-minute discharge, and the flow-integration method (CLOAD) to obtain ΣPCB loads (fig. 6). This regression-based approach is referred to hereafter as "RLOAD." Similar to TSS loads, the greatest PCB loads occurred during high flows.

The soil loss coefficient (EI) was also used in regressions for the co-eluting congeners 77/110 and congener 180 (table 2). The correlation coefficients are similar for both the congener-specific and congener-summation regressions. The 95-percent confidence interval was approximated by taking 1.96 times the normalized standard error (table 2); the actual interval width varies according to the independent variable.

For the purpose of comparing load-computation methods, ΣPCB loads were computed by means of two additional approaches (table 3). In the second approach, the flow-integration method was also used but computations involved individual-sample PCB concentrations rather than the regressed PCB concentrations. These results are referred to as "SLOAD." A third approach, the Stratified Beale Ratio Estimator (SBRE), involved time-based strata defined by minimizing loading error over specific time intervals (Preston and others, 1989). The SBRE estimates both a load and associated confidence interval based on the root mean square error of the load computations. The integration method applied to individual-sample PCB concentration data (SLOAD) yielded lower loads than for regressed PCB concentration values (RLOAD) because manual PCB sample collection did not capture the transport peaks as well as the automated TSS sample collection did. Thus, the intensive automated TSS sampling protocol (fig. 5) overcame a potential low that may result from the inability of manual operations to capture flow peaks.

Table 3. Computed PCB loads at the Hayton Millpond outlet, east-central Wisconsin, resulting from three computational approaches

[All loads in kilograms. () indicates a 95-percent confidence interval]

Interval (sampling interval)	3 months (6/30/93–9/30/93)	1 year (10/1/93–9/30/94)	1 year (10/1/94–9/30/95)
SLOAD	1.7	2.8	2.3
RLOAD	3.4	3.5	2.3
SBRE	1.4 (+/- 1.3)	2.8 (+/- 1.0)	1.8 (+/- 0.5)

In figure 7, ΣPCB concentrations are summarized for the three days when PCB samples were collected at the Pine Creek sites in conjunction with sampling at the millpond. ΣPCB concentrations increase from the Charlesburg Road site to the Quarry Road site, whereas ΣPCB concentrations decrease from the Quarry Road site to the millpond when Pine Creek inflow is diluted by streamflow from the relatively PCB-free upstream South Branch Manitowoc River (fig. 1).

Streamflow at the Pine Creek sites was not measured at the time of PCB sample collection; however, on five other occasions, streamflow was measured at Pine Creek sites in conjunction with sampling at the millpond outlet. From these measurements, approximate streamflow ratios for Quarry Road and Charlesburg Road are estimated at 0.41 ± 0.12 and 0.23 (one measurement) respectively, relative to the millpond outlet. The above approach, rather than basin-area ratios, was used to estimate streamflow because much of Pine Creek base flow may come from the New Holstein sewage treatment plant during times of low flow.

Multiplying the above streamflow estimates by the ΣPCB concentration data results in a consistent ΣPCB load increase from the Charlesburg Road to the Quarry Road site. This ΣPCB concentration and load increase from the Charlesburg Road site to the Quarry Road site is consistent with the observed increase in ΣPCB concentrations in surficial bed sediment in this same reach (fig. 1). This pattern indicates active interaction between the water column and bed sediments through processes such as resuspension, settling, and diffusion. Quarry Road to the millpond outlet is a much more hydrodynamically complex reach; this reach does not indicate a consistent ΣPCB loss or gain (fig. 7). On two of the three sample days, net ΣPCB transport through the Quarry Road to millpond outlet reach was negative

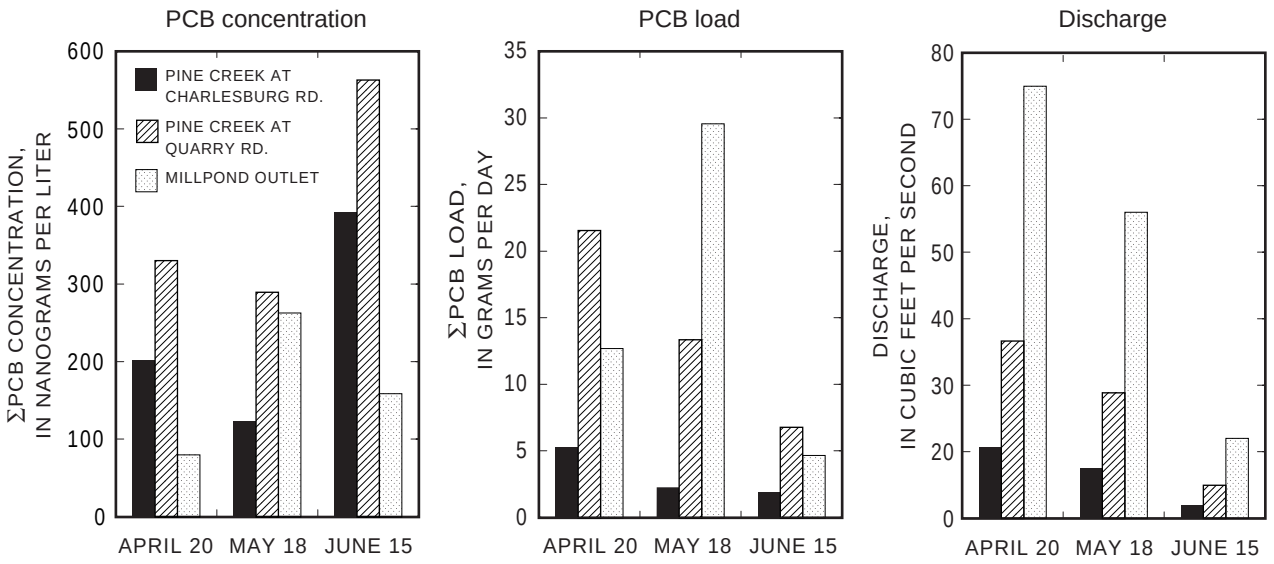

Figure 7. PCB concentrations, estimated loading, and discharge on three sample days, Pine Creek and Hayton Millpond outlet, east-central Wisconsin, 1995.

indicating ΣPCB deposition in the millpond. On May 18, 1995, however, there was positive net ΣPCB transport from the millpond. This positive net transport occurred near the peak of a chlorophyll *a* and TSS concentration cycle (fig. 5), and it may illustrate the importance of algal growth in the PCB transport dynamics.

SUMMARY

Concentrations of ΣPCB (the sum of all PCB congeners) in the water column operationally defined dissolved and particulate phases and in surfical bed sediment (0–2 cm depth) were determined at two sites on Pine Creek and at the Hayton Millpond in the South Branch of the Manitowoc River in Wisconsin to examine the distribution and loads of total PCB's in the river.

Total PCB concentrations in the water column varied considerably; at the millpond outlet, concentrations ranged from 34 to 302 ng/L. In general, 74 percent of the total water-column PCB was associated with suspended particles. PCB congener compositions appeared to be similar between the millpond outlet and the two upstream Pine Creek sites. In addition, the suspended-particle-associated PCB congener pattern appears to be nearly identical to that in the millpond surficial bed sediment; this similarly indicates interaction between the two media. There was also a similarity in these PCB congener suites to Aroclor 1254.

The apparent sediment/water distribution coefficients (Kd) varied by more than an order of magnitude over the range of congeners.

Computed total suspended-solids loads (TSS) at the millpond outlet were as high as 920 tons over a 3-month period (June 30–Sept. 30, 1993). Annual TSS loads for the following two water years were lower, 610 and 500 tons, respectively.

The ΣPCB concentration regression equation incorporated the universal soil loss coefficient to represent erosion of assumedly PCB-free sediment from fields upstream from the millpond. The ΣPCB load based on the regression relation was 3.4 kg during a 3-month high-flow interval (June 30–Sept. 30, 1993). Annual ΣPCB loads for the next two water years were 3.5 and 2.3 kg, respectively. Two alternative load-computation methods yielded similar but somewhat lower results.

Limited sampling at the two Pine Creek sites typically indicated higher ΣPCB concentrations than at the millpond outlet, some as high as 563 ng/L. Net ΣPCB loads between the Pine Creek sites and the millpond outlet did not show a consistent pattern, indicating that PCB-contaminated sediments are irregularly deposited and resuspended between Quarry Road and the millpond outlet.

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APPENDIXES 1–2

Appendix 1a. Transport data for polychlorinated biphenyls and related physical and water-quality characteristics at South Branch Manitowoc River at Hayton Millpond outlet (USGS station 04085395), 1993–95

[ft^3/s, cubic feet per second; ng/L, nanograms per liter; mg/L, milligrams per liter; µg/g, micrograms per gram; g/d, grams per day; SL_2, modified universal soil loss coefficient summed for sample day and two previous days; TOC, total organic carbon; DOC, dissolved organic carbon; SOC, suspended organic carbon; FOC, fraction organic carbon; POINT, collected with point sampler; CHURN, processed from churn splitter; EWI, equal-width-increment sample; --, no data]

			Total suspended solids				Carbon			ΣPCB					
Date of sampling	Time of sampling	Instantaneous streamflow (ft^3/s)	POINT (mg/L)	CHURN (mg/L)	EWI (mg/L)	Chlorophyll *a* (µg/L)	SOC (mg/L)	DOC (mg/L)	FOC (%)	Particulate (ng/L)	Particulate (µg/g)	Dissolved (ng/L)	Total (ng/L)	Load (g/d)	SL_2
06/30/93	0745	123	[1]29	36	29	10.7	0.4	17	1.1	92.1	2.6	18.3	110.4	33	0.2
07/06/93	1130	644	[2]115/145	124	105	12.4	3.9	11	3.1	38.2	0.3	5.7	43.9	69	29.6
08/24/93	1000	22	[3]36	34	50	25.4	2.1	12	6.2	190.2	5.6	36.6	226.8	12	.7
09/16/93	1350	46	20	18	18	7.7	--	--	--	80.6	4.5	35.8	116.4	13	--
11/16/93	1120	45	4	4	9	3.15	.5	11	12.5	18.8	4.7	19.5	38.3	4	.1
02/16/94	1345	8	[4]6	12	8	4.83	.7	5.4	5.8	69.8	5.8	36.4	106.2	2	--
02/16/94	1500	8	[4]6	14	8	4.78	.5	5.3	3.6	73.4	5.2	35.3	108.7	2	--
02/21/94	1345	140	[5]10	26	30	5.88	2.0	13	7.7	100.1	3.9	26.1	126.2	43	.5
04/26/94	1015	193	24	24	24	8.60	1.2	13	5.0	55.4	2.3	27.7	83.1	39	3.1
05/18/94	1045	33	[6]38	39	39	21.1	1.9	13	4.9	145.8	3.7	26.7	172.5	14	--
07/13/94	0940	15	13	20	19	38.9	2.0	12	10.0	76.1	3.8	40.0	114.1	4	--
08/30/94	0945	3.8	[7]42	58	62	194	2.3	9.3	4.0	225.9	3.9	32.1	258.0	2	1.1
09/22/94	0955	2.5	40	71	50	105	4.4	8.5	6.2	264.7	3.7	36.9	301.6	2	--
10/25/94	1045	6.5	18	14	13	20.7	1.6	8.2	11.4	84.1	6.0	21.9	106.0	2	--
01/25/95	0830	5.8	5	5	--	4.72	.5	7.4	10.0	52.6	10.6	37.5	90.1	2	--
01/25/95	0835	5.8	5	5	5	4.24	.5	7.4	10.0	53.3	10.7	35.3	88.6	2	--
03/16/95	1000	76	12	10	10	--	--	--	--	60.5	6.0	25.1	85.6	16	--
03/22/95	1445	103	6	7	6	6.37	--	--	--	19.6	2.8	14.4	34.0	9	.8
04/20/95	1315	65	14	18	17	15.0	0.6	13	3.3	60.0	3.3	20.3	80.3	13	3.3
05/10/95	1100	50	34	35	35	18.9	2.1	12	6.0	167.1	4.9	38.6	205.7	25	.8
05/18/95	0915	46	[8]36/54	46	46	21.5	2.6	14	5.7	221.3	4.9	41.4	262.7	30	--
06/15/95	0920	12	24	30	27	63.9	1.9	5.9	6.3	121.8	4.1	36.8	158.6	5	--
08/13/95	2230	30	48	46	46	79.5	3.5	7.7	16.4	122.5	2.6	20.2	142.7	11	14.6
09/11/95	1715	7.6	[9]40	45	--	35.0	2.1	13	4.7	--	--	--	--	--	--
Median	--	32	22	25	26	15.0	1.9	11.0	6.0	80.6	4.1	32.1	110.4	11	--

[1]Sample collected at 1400.
[2]Samples collected at 0000 and 1450.
[3]Sample collected at 1200.
[4]Estimated value based on 2/15/94 and 2/17/94 samples.
[5]Sample collected at 1145.
[6]Estimated value based on 5/17 and 5/19/94 samples.
[7]Sample collected at 1200.
[8]Rapidly changing streamflow, samples taken at 0830 and 1315.
[9]Sample collected at 1200.

Appendix 1b. Transport data for polychlorinated biphenyls and related physical and water-quality characteristics at Pine Creek at Quarry Road (USGS station 040853936), 1995

[ft^3/s, cubic feet per second; ng/L, nanograms per liter; mg/L, milligrams per liter; µg/g, micrograms per gram; g/d, grams per day; Q_m, estimated daily streamflow based on streamflow ratio with Manitowoc River at Hayton Millpond outlet; TOC, total organic carbon; DOC, dissolved organic carbon; SOC, suspended organic carbon; FOC, fraction organic carbon; POINT, collected with point sampler; CHURN, processed from churn splitter; EWI, equal-width-increment sample]

			Total suspended solids				Carbon			ΣPCB				
Date of sampling	Time of sampling	Q_m (ft^3/s)	POINT (mg/L)	CHURN (mg/L)	EWI (mg/L)	Chlorophyll *a* (µg/L)	SOC (mg/L)	DOC (mg/L)	FOC (%)	Particulate (ng/L)	Particulate (µg/g)	Dissolved (ng/L)	Total (ng/L)	Load (g/d)
04/20/95	1230	27	7	10	8	4.87	0.70	10	7	217.9	21.8	112.4	330.0	22
05/18/95	1200	19	6	5	5	5.14	.60	9.2	12	144.3	28.9	144.5	289.2	13
06/15/95	1020	5	26	28	22	14.7	1.6	12	5.7	388.8	13.9	174.8	562.9	7

Appendix 1c. Transport data for polychlorinated biphenyls and related physical and water-quality characteristics at Pine Creek at Charlesburg Road (040853926), 1995

[ft^3/s, cubic feet per second; ng/L, nanograms per liter; mg/L, milligrams per liter; µg/g, micrograms per gram; g/d, grams per day; Q_m, estimated daily streamflow based on streamflow ratio with Manitowoc River at Hayton Millpond Outlet; TOC, total organic carbon; DOC, dissolved organic carbon; SOC, supended organic carbon; FOC, fraction organic carbon; POINT, collected with point sampler; CHURN, processed from churn splitter; EWI, equal-width-increment sample; --, no data]

			Total suspended solids				Carbon			ΣPCB				
Date of sampling	Time of sampling	Q_m (ft^3/s))	POINT (mg/L)	CHURN (mg/L)	EWI (mg/L)	Chlorophyll *a* (µg/L)	SOC (mg/L)	DOC (mg/L)	FOC (%)	Particulate (ng/L)	Particulate (µg/g)	Dissolved (ng/L)	Total (ng/L)	Load (g/d)
04/20/95	1015	11	--	6	4	3.92	0.60	11	10.0	153.6	25.6	46.7	200.3	5
05/18/95	1030	8	5	6	6	11.8	.70	9.4	11.7	69.3	11.5	53.7	123	2
06/15/95	1214	2	16	18	26	6.65	1	5.6	5.6	261.1	14.5	131.7	392.8	2

Appendix 2. PCB congeners found during laboratory analysis of water and sediments in the Hayton Millpond Basin and their respective limits of detection and quantification in nanograms per liter

[From Degenhardt (1996). LOD; limit of detection, LOQ, limit of quantification; () indicates positions of chlorine substitution on biphenyl nucleus]

LOD	LOQ	Congener number and chlorine substitution position	LOD	LOQ	Congener number and chlorine substitution position
0.020	0.060	7 (2, 4)	0.035	0.11	85 (2, 2', 3, 4, 4')
.080	.27	6 (2, 3')	.030	.10	136 (2, 2', 3, 3', 6, 6')
.090	.30	5/8 (2, 3/2, 4')	.035	.11	77/110 (3, 3', 4, 4' /2, 3, 3', 4', 6)
.025	.070	19 (2, 2', 6)	.035	.11	82 (2, 2', 3, 3', 4)
.030	.090	18 (2, 2', 5)	.020	.070	151 (2, 2', 3, 5, 5', 6)
.030	.10	17 (2, 2', 4)	.025	.070	135/144 (2, 2', 3, 3', 5, 6' /2, 2', 3, 4, 5', 6)
.025	.070	24/27 (2, 3, 6/2, 3', 6)	.025	.070	149 (2, 2', 3, 4', 5', 6)
.035	.11	16/32 (2, 2', 3/2, 4', 6)	.030	.090	118 (2, 3', 4, 4', 5)
.035	.11	26 (2, 3', 5)	.030	.11	146 (2, 2', 3, 4', 5, 5')
.080	.27	28/31 (2, 4, 4' /2, 4', 5)	.030	.11	132/153 (2, 2', 3, 3', 4, 6' /2, 2', 4, 4', 5, 5')
.035	.11	33 (2', 3, 4)	.020	.070	141 (2, 2', 3, 4, 5, 5')
.055	.18	22 (2, 3, 4')	.030	.090	137/176 (2, 2', 3, 4, 4', 5/2, 2', 3, 3', 4, 6, 6')
.025	.070	45 (2, 2', 3, 6)	.035	.11	138/163 (2, 2', 3, 4, 4', 5' /2, 3, 3', 4', 5, 6)
.030	.090	46 (2, 2', 3, 6')	.040	.12	178 (2, 2', 3, 3', 5, 5', 6)
.025	.070	52 (2, 2', 5, 5)	.020	.070	182/187 (2, 2', 3, 4, 4', 5, 6' /2, 3, 4', 5, 5', 6)
.025	.070	49 (2, 2', 4, 5')	.035	.12	183 (2, 2', 3, 4, 4', 5', 6)
.035	.11	47/48 (2, 2', 4, 4' /2, 2', 4, 5)	.030	.11	185 (2, 2', 3, 4, 5, 5', 6)
.025	.070	44 (2, 2', 3, 5')	.025	.090	174 (2, 2', 3, 3', 4, 5, 6')
.035	.11	37/42 (3, 4, 4' /2, 2', 3, 4')	.030	.11	177 (2, 2', 3, 3', 4', 5, 6)
.040	.12	41/64/71 (2, 2', 3, 4/2, 3, 4', 6/2, 3', 4', 6)	.035	.11	171/202 (2, 2', 3, 3', 4, 4', 6/2, 2', 3, 3', 5, 5', 6, 6')
.030	.090	40 (2, 2', 3, 3')	.045	.14	172/197 (2, 2', 3, 3', 4, 5, 5' /2, 2', 3, 3', 4, 4'. 6, 6')
.030	.090	74 (2, 4, 4', 5)	.030	.11	180 (2, 2', 3, 4, 4', 5, 5')
.040	.12	70/76 (2, 3', 4', 5/2', 3, 4, 5)	.020	.070	199 (2, 2', 3, 3', 4, 5, 6, 6')
.050	.16	66/95 (2, 3, 4, 4'/2, 2', 3, 5', 6)	.080	.27	170/190 (2, 2', 3, 3', 4, 4', 5/2, 3, 3', 4, 4', 5, 6)
.030	.090	91 (2, 2', 3', 4', 6)	.040	.14	201 (2, 2', 3, 3', 4, 5, 5', 6)
.050	.16	56/60 (2, 3, 3', 4' /2, 3, 4, 4')	.080	.27	196/203 (2, 2', 3, 3', 4, 4', 5, 6' /2, 2', 3, 4, 4', 5, 5', 6)
.050	.16	84/92 (2, 2', 3, 3', 6/2, 2', 3, 5, 5')	.080	.27	195/208 (2, 2', 3, 3', 4, 4', 5, 6/2, 2', 3, 3', 4, 5, 5', 6, 6')
.025	.070	101 (2, 2', 4, 5, 5')	.030	.11	194 (2, 2', 3, 3', 4, 4', 5, 5')
.025	.070	99 (2, 2', 4, 4', 5)	.040	.14	206 (2, 2', 3, 3', 4, 4', 5, 5', 6)
.030	.090	97 (2, 2', 3', 4, 5)	.035	.11	128 (2, 2', 3, 3', 4, 4')
.035	.11	87 (2, 2', 3, 4, 5')	.080	.27	167 (2, 3', 4, 4', 5, 5')