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REPORT

Allied Paper, Inc. Operable Unit

Biota and Surface Water Investigations and Wetlands Assessment

Technical Memorandum 11

Volume 1 of 3

Allied Paper, Inc./Portage Creek/
Kalamazoo River Superfund Site
Remedial Investigation/Feasibility Study
Kalamazoo, MI

May 2000

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

TECHNICAL REPORT

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6723 Towpath Road, P.O. Box 66
Syracuse, NY 13214-0066
(315) 446-9120

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1. Introduction

1.1 Operable Unit Description

The Allied Paper, Inc. Operable Unit (Allied OU) is one of several OUs associated with the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site), and is located along Portage Creek within the City of Kalamazoo and Kalamazoo County, Michigan (Figure 1). The Allied OU encompasses 73 acres along the Creek between Cork and Alcott Streets, and includes the following study areas, as shown on Figure 2:

- Bryant historical residuals dewatering and storage lagoon (HRDL) and former residuals dewatering lagoons (FRDLs);
- Monarch HRDL;
- A former Michigan Type III Landfill for dewatered residuals;
- The Western Disposal Area;
- The Former Bryant Mill Pond; and
- Portage Creek.

The history of the Allied OU, the disposal areas, and prior environmental investigations is presented in the *Description of the Current Situation* report (DCS; Blasland & Bouck Engineers, P.C. [BBEPC], 1992) and the *Addendum to the Current Situation* (BBEPC, 1993a).

1.2 Objectives of the Remedial Investigation

The primary objective of the Allied OU Remedial Investigation (RI) is to assess the nature and extent of polychlorinated biphenyls (PCB) present in residuals, native soil in on-site and off-site residential areas, groundwater, air, sediments, and surface water, and the potential threat to public health, welfare, or the environment caused by the release or threatened release of hazardous substances, pollutants, or regulated substances from the area.

1.3 Scope of the Technical Memorandum

The scope of this technical memorandum includes the presentation of results and findings of surface water and biota investigations, and an assessment of wetlands present in and around the Allied OU. In addition, field data, analytical data, and the results of the Quality Assurance/Quality Control (QA/QC) review of analytical data are presented. Also included in this memorandum are the results of a matrix-specific method detection limit (MDL) study for PCB, as requested by the Michigan Department of Environmental Quality [MDEQ, formerly Michigan Department of Natural Resources (MDNR)]

The results of RI activities conducted to evaluate other media at the Allied OU have been submitted in other reports to the MDEQ, including:

- *Technical Memorandum 4 - Allied Paper, Inc. Operable Unit, Results of the Air Investigation* [Blasland, Bouck & Lee, Inc. (BBL), 1994] which presents the air investigation;

- *Technical Memorandum 7 - Allied Paper, Inc. Operable Unit* (BBL, 1997) which presents residuals, sediment, soils, groundwater and leachate characterization;

- *Addendum to Technical Memorandum 7 - Allied Paper, Inc. Operable Unit* (BBL, 1999) which presents additional groundwater sampling.

1.4 Former Bryant Mill Pond Removal Action

In May, 1999, the U.S. Environmental Protection Agency (USEPA) completed a time-critical Removal Action at the Former Bryant Mill Pond area of the Site which resulted in the excavation of approximately 150,000 cubic yards of PCB-containing residuals, soil, and sediment from the Former Bryant Mill Pond, and placement of this material into the Bryant HRDL and FRDLs on site. The excavated material was replaced with clean backfill. The Removal Action cleanup performance standard was 10 milligrams per kilogram (mg/kg), with a goal of 1 mg/kg.

As determined during the RI, the materials containing the highest detected concentrations of PCB at the OU were found in the Former Bryant Mill Pond, and this area historically (i.e., prior to the Removal Action) presented a significant source of PCB to Portage Creek. The Removal Action completed by the USEPA has substantially mitigated the potential for PCB releases to Portage Creek from the soils/sediment in the Former Bryant Mill Pond.

2. Investigation Activities

2.1 Surface Water Investigation

The objectives of the Surface Water Investigation are to assess water quality conditions and to characterize rates of PCB transport in Portage Creek. Sampling during periods of above average flow and during baseflow was conducted to generally characterize PCB concentrations during a wide range of flow conditions. To achieve these objectives, surface water samples and flow measurements were taken in Portage Creek at Cork Street (SWP-1), located near the upstream boundary of the Allied OU, and at Alcott Street (SWP-2), located near the downstream boundary of the Allied OU. The sampling locations are shown on Figure 2.

Target flow rates for periods of higher than average flow and baseflow sampling were determined by an analysis of available data from the Reed Street United States Geologic Survey (USGS) Gage No. 04106500 (Reed Street gage) for the period of June 1975 through September 1986. The Reed Street gage is located approximately 0.3 miles downstream of the Alcott Street sampling location. Gage data from USGS Gage No. 04106300 (Lovers Lane gage) for the period of October 1964 through September 1992 were also reviewed. The Lovers Lane gage is located approximately 0.9 miles upstream of the Cork Street sampling location.

Figure 3 presents daily mean flow duration curves based on the associated data for the stated time periods for both the Reed Street and Lovers Lane gages. The flow duration curves allow the identification of "exceedance flows," defined as the percent time a given flow rate is exceeded. Target flows were determined from the Reed Street gage, and target flow rates for surface water sampling location SWP-2 (Alcott Street) were determined as follows:

High-flow: Flow exceeding 75 cubic feet per second (cfs) (10 percent exceedance flow); and
Baseflow: Flow less than or equal to 40 cfs (80 percent exceedance flow).

Historical flow data for the Reed Street gage station are provided in Appendix A.

The Cork Street sampling location is located approximately one mile upstream of the Alcott Street location, and there are no significant tributaries to Portage Creek between the two locations. Flow rates at the Alcott Street sampling location are generally comparable to flow rates at the Cork Street sampling location, and therefore, target flow rates were not determined for the Cork Street sampling location. Where flow was measured at the Alcott Street sampling location but not at the Cork Street sampling location, flow at Cork Street was assumed to be 0.93 times the flow measured at Alcott Street. This assumption is based on a regression analysis of the flow data.

Sampling consisted of collecting water quality samples and performing direct in-stream flow measurements at one or both sampling locations.

2.1.1 Baseflow Sampling

Baseflow sampling was conducted at both the Cork Street and Alcott Street sampling locations. Higher than average flow conditions were observed throughout sampling activities conducted during the period of August through December 1993 and during September 1994. This resulted in baseflow rates that exceeded the target baseflow criterion that was determined from the historic Reed Street gage data. The higher than average flow rates observed during these sampling activities were confirmed by comparing historic flow data recorded at the Lovers Lane USGS gage to the flow data recorded for these sampling periods. The Lovers Lane Gage data are also included in Appendix A.

Based on these conditions, the criteria for baseflow sampling were modified to allow for sampling at flows greater than the target baseflow rate, but only after a five-day period with no significant precipitation or runoff. Surface water samples were collected under baseflow conditions for PCB and total suspended solids (TSS) analysis on seven separate occasions, including August 24, 1993; December 15, 1993; December 28, 1993; June 9, 1994; September 8, 1994; September 21, 1994; and May 19, 1997.

The Work Plan called for six to eight baseflow surface water sampling events, beginning in mid-June 1993, and occurring on a bi-weekly basis during the summer low-flow conditions. The intent of the proposed sampling plan was to characterize the ambient water column during summer months. Ambient PCB concentrations during the summer are expected to reflect exposure of aquatic biota to PCB when transfer processes are generally at their annual peak. However, only three baseflow sampling events were conducted during summer months, including one event on August 24, 1993, and two events the following year (September 8, 1994, and September 21, 1994).

2.1.2 High-Flow Sampling

Water samples were collected over a period of days, during four separate periods of higher than average flow, including September 15-18, 1993; October 17-21, 1993; December 2-3, 1993; and April 11-14, 1994. The number of surface water samples that were collected and analyzed for PCB varied from five (December 2 through 3, 1993) to ten (April 11 through 14, 1994). In total, 31 samples were collected from each location for laboratory analysis of PCB and TSS.

For the April 1994 sampling event, 16 surface water samples were collected at each of the sampling locations. However, only ten samples from each location were selected by BBL to represent the high flow event. As such, flow and field parameter measurements are available for surface water samples that were not analyzed for PCB or TSS.

The Work Plan called for collecting samples during three 'high-flow' sampling events in late summer and autumn 1993. Samples were to be collected when the water level was rising (rising limb of hydrograph), at peak flow, and during the declining limb of the hydrograph. A total of eight surface water samples from each sampling location and for each high-flow event were required. The sampling plan called for one to three samples being collected daily, from each sampling location.

2.1.3 Surface Water Sampling Methods

Surface water sampling was conducted by Limno-Tech, Inc. (LTI) utilizing grab sampling methodology due to the shallowness (less than 2 feet) of water in the creek. The grab sampling methodology varied slightly from the procedures specified in the *Quality Assurance Project Plan* (QAPP; Blasland & Bouck, 1993d). Rather than utilizing a beaker as a sample gathering device (as specified in the QAPP), laboratory-supplied bottles were filled directly by submerging them in the creek and allowing them to fill. Samples were analyzed for PCB and TSS. One water sample was collected from each location during the period of higher than average flow on October 20, 1993 and the baseflow event on June 9, 1994 and analyzed for the USEPA Contract Laboratory Program (CLP) Target Compound List/Target Analyte List (TCL/TAL) parameters (Table 2-1). All samples retained for PCB and TSS analysis were shipped to the project laboratory, Aquatec Laboratories, Inc./Inchcape Testing Services Environmental (ITS), located in Colchester, Vermont.

Measurements of field parameters and flow were conducted at the approximate time of sample collection. Measurements of flow and the field parameters; dissolved oxygen (DO), water temperature, specific conductivity, turbidity and pH, were made using standard instrumentation as specified in the QAPP. Flow rates were estimated

using an electromagnetic velocity meter and cross-sectional area measurements. Stream stage was also recorded by "taping down" from fixed reference marks on the Cork and Alcott Street bridges. Hourly flow data for the USGS gage at Lovers Lane also were obtained for each period of higher than average flow. These data are included in Appendix A.

Collection of QA/QC samples followed the guidelines presented in the QAPP. All surface water sampling field documentation is provided in Appendix B.

2.1.4 Method Detection Limit Study

BBL collected twenty-four liters of surface water from Lake Allegan on January 13, 1994 for a matrix-specific MDL study for PCB. The analysis of surface water samples collected from Lake Allegan is appropriate for use in the assessment of MDLs for surface waters of the Allied OU because of the similar surface water quality and matrix interference. The sample analyses were conducted by the project laboratory, and the MDL study was conducted by BBL in accordance with the procedures set forth in 40 CFR Part 136 (USEPA, 1992), Appendix B, steps 1 through 6. The purpose of the study was to determine the lowest MDL achievable specifically for surface water using USEPA SW-846 Method 8081 for analysis of PCB Aroclors 1242 and 1248.

2.2 Biota Investigation

Camp Dresser & McKee prepared a Biota Sampling Plan (BSP) for the Site in 1993 under contract to the MDEQ. The BSP established a total of 12 Aquatic Biota Sampling Areas (ABSAs) on the Kalamazoo River (ABSA #1 through #11) and Portage Creek (ABSA #12). The objective of the biota investigation at the Allied OU is to assess the concentrations of PCB in fish within ABSA #12, which is located within the historical limits of the Former Bryant Mill Pond (see Figure 2).

Prior to 1976, flow through Alcott Street Dam was regulated to form the 22-acre Bryant Mill Pond. The Pond was drawn down in 1976, leaving the original creek channel as the only remaining aquatic habitat. The Former Bryant Mill Pond area currently consists of a creek channel varying in width from 20 to 75 feet flowing through a floodplain 30 to 400 feet wide.

2.2.1 Biota Sampling Methods

Sample collection efforts were completed by BBL in accordance with the BSP, which are consistent with historical biota sampling at the OU. The investigation focused on carp, smallmouth bass, and white suckers.

Carp are one of the most abundant and widespread fish species in the Kalamazoo River drainage basin, making it a good indicator species for trend analysis. White suckers represent a forage fish species available for consumption by piscivorous predators. Smallmouth bass were selected because they are a popular game fish species commonly used for human consumption. A sample size of 11 fish of these three species in Portage Creek was targeted for collection. However, only one smallmouth bass was captured during the investigation, and therefore, bass data are not included in this report.
Included in the sampling event was a mark/recapture effort utilizing procedures similar to past MDNR mark/recapture studies. This method for sampling resident fish from Portage Creek was initiated by the MDNR in 1986 after the agency concluded that the high variability in PCB content of carp sampled the previous year (1985) might be attributable to fish migration into the sample area from upstream locations (Creal, 1994). The method involved

capturing fish two to three months before the final recapture date and marking each fish with a plastic floy tag just behind the dorsal fin, and with a pelvic fin clip. Only recaptured marked fish were submitted for laboratory analysis.

Field processing of fish samples was completed in accordance with the procedures listed in the BSP. Prior to shipment to the project laboratory, each fish was weighed and measured to determine live weight and length. All fish were examined for external abnormalities and observations were recorded on an appropriate Fish Condition Survey Form in the field notebook. Photographs of each individual fish were also taken prior to packaging for overnight shipment to the laboratory.

Each fish was wrapped in aluminum foil, placed in a sealed plastic bag and preserved on ice. The samples were recorded on a chain-of-custody form and shipped to the laboratory via overnight courier. Biota field documentation, including photographs, is presented in Appendix C.

2.2.2 Biota Tissue Preparation Method

Sample processing protocols for carp included a modified tissue preparation method that is used to generate sufficient sample so that constituent concentrations can be characterized in both fillet (skin-off) and remaining carcass samples. Sucker species were analyzed as whole-body samples only, and were not subjected to this modification.

Fillet analyses included PCB/pesticides, total mercury, and percent lipids. In addition, each carp remaining-carcass sample was analyzed for percent lipids as well. Six of the carp remaining-carcass samples were included in a pilot study conducted to examine the correlation between PCB concentrations and lipid content for the purpose of estimating whole-body PCB concentrations from fillet PCB concentrations and lipid measurements. These six samples were analyzed for the same parameters as the carp fillets. White suckers were analyzed as discrete whole-body samples for PCB/pesticides, percent lipids, and total mercury. During tissue processing activities, each fish was also examined to determine gender.

2.3 Wetlands Assessment

Wetlands assessment efforts were conducted at the Allied OU to characterize wetland areas with respect to the presence of hydrophilic vegetation, hydric soils, and wetland hydrologic features according to the criteria outlined in the Work Plan. The U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) Map (USFWS, 1991) and the USGS topographic map for the Kalamazoo Quadrangle (USGS, 1973) were used to develop desktop information prior to field investigations.

BBL conducted a field investigation on October 7, 1993 to verify existing desktop information regarding wetlands at the OU. Vegetation, hydrology, and soils were evaluated at five locations (AL-1 through AL-5) at the OU. The evaluation locations are depicted on Figure 4. These parameters are standard wetland indicators according to the U.S. Army Corps of Engineers (USACE) *Wetlands Delineation Manual* (1987). The wetlands assessment methodology relied on visual observations of the indicator parameters, and the understanding of historical land use. Vegetation was evaluated by noting which dominant wetland plant indicator species were present, and the approximate percent of wetland area covered by these species. Hydrology was evaluated by observing the degree of soil saturation, and noting field evidence of surface inundation. The soils parameter was evaluated by noting hydric soil characteristics, mottling, gleying, color, and by professional judgement as to whether the soil was a histosol, using an auger to examine soils to a depth of 20 inches. Information was recorded on wetland data forms, included in Appendix D.

In accordance with the Work Plan, BBL investigated the presence of threatened, endangered, and rare species concurrently with the wetlands assessment task. Investigation for the presence of threatened, endangered, and rare species was conducted by obtaining available information on these species from the State of Michigan, and performing field reconnaissance to identify their presence or absence.

2.4 QA/QC Review of Data

BBL reviewed and evaluated sample analytical data packages to assess overall analytical precision and accuracy. These packages include data for samples of surface water and fish. Analytical data, organized into 14 sample delivery groups (SDGs), were reviewed using techniques appropriate to the various media and constituents tested. Table E-1 of Appendix E presents these SDGs and their associated samples and matrices.

Laboratory analytical precision was assessed by comparing the analytical results between matrix spike (MS) and matrix spike duplicate (MSD) samples for organic compounds, and MS and laboratory duplicates for inorganic constituents. Field duplicates were also used, and relative percent differences (RPD) were calculated for each pair of duplicate analyses. To assess the analytical accuracy of each method, other indicators such as surrogate spike and blank spike recovery data were also examined.

Appendix E presents a precision and accuracy summary, as assessed through review of QA/QC information, including MS/MSD recovery data, RPD between recoveries, matrix spike blank recovery data, field duplicate RPD calculation results, surrogate spike recovery data, blank spike recovery data, and blank contamination detection. The QA/QC review of surface water and fish analytical data in Appendix E generally indicated the data to be acceptable with qualifications. Pesticide analytical data for several fish samples were rejected due primarily to matrix interference.

Laboratory data are included in Appendix F. Data review procedures derive from applicable USEPA guidance (1989; 1991a; 1991b; 1991c; and 1991d) and the QAPP. Chain-of-custody forms also are presented in Appendix F.

3. Investigation Results

3.1 Surface Water Investigation

3.1.1 Field Data

Field data collected during surface water sampling include physical data and certain water quality field measurements. Physical data include water depth, width, and flow velocity. Water quality field measurements include water temperature, pH, specific conductivity, DO, and turbidity. These results are summarized in Table 3-1.

3.1.1.1 Surface Water Flow Data

Baseflow

Surface water flow measurements that were collected during the baseflow sampling events in 1993 and 1994 indicate that flow was measurably greater than the pre-determined target baseflow. Consequently, only two baseflow sampling episodes were conducted during target baseflow conditions.

High Flow

Figures 5A and 5B depict Portage Creek hydrographs, including USGS gage data from the upstream Lovers Lane (Gage No. 04106300) location and flow measurements recorded during sampling events. A total of four high-flow events were sampled; however, the December 1993 high flow event was insufficient to produce adequate data. Therefore, these data are not depicted in Figures 5A and 5B, but were included in the data set used to estimate PCB loading to Portage Creek.

Sampling of higher-than-average flow events was initiated after flow exceeded the 10 percent exceedance criterion of 75 cfs at the Alcott Street location, except during the April 1994 event during which sampling was initiated at 69 cfs. By beginning the sampling in this manner, surface water samples were collected as water levels increased on only one occasion (April 1994).

Figure 5A depicts three high-flow events for the Alcott Street sampling. The rising limb of the hydrograph was not adequately sampled in two of the three events. Figure 5B depicts two high-flow sampling events for the Cork Street sampling location. As the graph indicates, sampling was initiated after peak flow had occurred.

Figures 5A and 5B depict samples in which both PCB and flow data were collected, as well as those with only flow measurements. Three samples that were collected on April 14, 1994 are not shown in these figures. These samples were analyzed for PCB, but a corresponding flow measurement is unavailable. Consequently, the PCB data from those samples are not included in the PCB load estimate summarized in Table 4-2.

3.1.1.2 Surface Water Quality Data

In general, surface water quality parameters were measured during each sampling event. Table 3-1 presents general surface water quality results. Measured parameters included pH, water temperature, specific conductivity, DO, and turbidity. Measurements of pH ranged from 7.59 to 8.49 Standard Units (SU). Water temperature ranged from 2.8 to 26.6 degrees Celsius. Turbidity ranged from 3.21 to 18.9 nephelometric turbidity units (NTU). Specific

conductivity ranged from 307 to 892 milliSiemens per centimeter. DO values ranged from 7.5 to 11.80 milligrams per liter (mg/L).

3.1.2 Biota Investigation

3.1.2.1 Fish Marking Data

Marking efforts for the Biota Investigation were initiated in July 1993. Fish were captured with a backpack electrofishing unit. During two days of electrofishing, 51 carp, 109 white suckers, and one rock bass were captured and marked.

Carp were tagged with a plastic floy tag inserted posterior to the dorsal fin and marked by clipping a pelvic fin. White suckers and the rock bass were marked by clipping a pelvic fin. In general, carp were captured in shallow weedy areas, or along undercut banks thick with vegetation. White suckers were common in deep runs and also along undercut banks. Both carp and suckers also were found where in-stream structures offered cover, such as snags in the channel or deadfalls along the banks.

3.1.2.2 Fish Recapture Data

Recapture efforts took place in November 1993, 103 days after marking. Sampling efforts were again completed with the use of a backpack electrofishing unit. A complete sample of marked carp was obtained the first day of sampling. Marked suckers were not as numerous, and two days of electrofishing were required to obtain a complete sample (i.e., 11) of this species.

Based on visual inspection by BBL, all fish retained from Portage Creek for laboratory analyses were free of external abnormalities. Individual carp samples ranged from 1,300 to 3,400 grams (g) in weight, and 47 to 61 centimeters (cm) in length. Mean weight and length were approximately 2,000 g and 51 cm, respectively.

White sucker samples were all less than 30 cm (12 inches) in length. Individual white suckers ranged from 32 to 220 g in weight, and 15 to 27 cm in length. Mean weight and length were 99 g and 20 cm, respectively. Results of the field measurements for individual fish are summarized in Table 3-2.

3.2 Surface Water Analytical Results

3.2.1 PCB

PCB were detected only in two (September 16, 1993 at 0.064 micrograms per liter [μg/L] and April 14, 1994 at an estimated 0.095 μg/L) of 38 surface water samples collected at the Cork Street sampling location. PCB were detected in 33 of 38 surface water samples collected at the downstream Alcott Street sampling location at concentrations ranging from an estimated 0.023 μg/L to 0.23 μg/L.

In addition, another surface water sample (Sample No. A64593) collected from within the Former Bryant Mill Pond area, upstream of Alcott Street, contained PCB at a concentration of 0.066 μg/L. This sample was obtained as a split

aliquot of a sample collected by the MDEQ for purposes outside of the RI. The analytical result for this sample therefore was not used in surface water PCB load calculations conducted for the Cork Street and Alcott Street locations in this study.

Aroclor-specific and total PCB data are shown in Table 3-3.

3.2.1.1 Method Detection Limit Study

The results of the site-specific MDL study showed a MDL of 0.023 μg/L for Aroclor 1242. The MDL for Aroclor 1248 was 0.016 μg/L. The results of the study are shown in Table 3-4. The data review reports and laboratory analytical results for the samples collected for the MDL study are included in Appendix F.

3.2.1.2 Total Suspended Solids

TSS can be an important indicator of erosion and flow velocity. It is often closely related to in-stream PCB concentrations due to the tendency for PCB to adsorb to organic particles in the water column and sediment. TSS concentrations were analyzed in most samples.

Samples that were collected during periods of higher than average flow contain higher TSS concentrations at both Cork Street (averaged 17.7 mg/L) and Alcott Street (averaged 17.6 mg/L) sampling locations, as expected, with some variability relative to baseflow events. In general, there was little change in the TSS concentrations between upstream and downstream sampling points during the periods of higher than average flow that were sampled. During the baseflow conditions that were sampled, the average TSS concentrations at the downstream Alcott Street sampling location (13.7 mg/L) was almost double the average TSS concentration that was detected in baseflow samples collected at the Cork Street sampling location (7.6 mg/L).

Table 3-1 summarizes the TSS and flow monitoring data. Figure 6 shows three graphs that illustrate measured TSS concentrations and stream flow; PCB concentrations and stream flow; and, PCB concentrations and TSS.

3.2.1.3 TCL/TAL

Water samples were collected on October 20, 1993 and June 9, 1994 from the Alcott Street and Cork Street locations and were analyzed for TCL/TAL parameters. No volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), or pesticides were detected in these samples. TAL constituents detected at both locations include aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium and zinc. TAL results are presented in Table 3-5.

3.2.2 Results of Biota Investigation

A summary of the analytical results for Portage Creek carp and white suckers is presented along with the field data in Table 3-6. PCB and mercury were consistently detected in fish samples from the creek. Eight halogenated organic compounds were not detected in any of the fish sampled from the creek. These include four polybrominated biphenyl (PBB) isomers, as well as gamma-BHC, hexachlorobenzene, DDT, and toxaphene. Consequently, the results are not summarized in Table 3-6.

Tables 3-6 through 3-9 present summaries of the target compounds/analytes detected for each species and preparation method (i.e., tissue sample type).

3.2.2.1 PCB Concentrations in Fish Samples

The Michigan Department of Community Health (MDCH) issues fish consumption advisories that are published annually by the MDNR (MDNR, 1999). The following is excerpted from MDCH supporting documentation for the 1999 advisory:

> The MDCH establishes fish consumption advisories based on fish sampling results. The MDCH issues advisories for the general population, and for women of child-bearing age and children under 15 years of age.
>
> General Population
>
> For any of the organic contaminants (including PCB), when between 11 and 49 percent of samples exceed an MDCH trigger level (2.0 mg/kg), a "One meal per week" advisory is issued. When 50 percent or more exceed a trigger level, a "No Consumption" advisory is issued. Attempts are made to provide site-specific advice wherever possible.
>
> Women of Child-Bearing Age and Children Under 15 Years of Age
>
> For PCB, when the concentration exceeds 0.05 mg/kg, a "One meal per week" advisory is issued; above 0.2 mg/kg, a "One meal per month" advisory is issued; above 1.0 mg/kg, a "Six meals per year" advisory is issued; and above 2.0 mg/kg, a "No Consumption" advisory is issued. Attempts are made to provide site-specific advice wherever possible.
>
> For any of the other organic contaminants, when more than 11 percent of samples exceed an MDCH trigger level, a "No Consumption" advisory is issued. Attempts are made to provide site-specific advice wherever possible.
>
> When data are too limited to judge the necessity for an advisory, but where some indication of contamination exists, an advisory is usually not issued but additional samples are requested. With small sample sizes a great deal of professional judgement is required in applying the above criteria. The average concentration is also considered.

PCB were detected in each carp sample analyzed (11 fillets, 6 remaining-carcass). Summaries of total PCB concentrations in carp fillet and remaining-carcass samples are presented in Tables 3-6, 3-7 and 3-8. In carp fillets, total PCB ranged from an estimated 1.5 to an estimated 8.8 mg/kg, with a mean concentration of 3.4 mg/kg. Remaining-carcass PCB concentrations ranged from 2.4 to an estimated 12 mg/kg. The mean total PCB concentration for remaining-carcass samples was 8.1 mg/kg. Tables 3-7 and 3-8 also report lipid data for fillet and remaining-carcass samples, respectively. Lipid concentrations ranged from 0.75 percent to 2.3 percent (mean of 1.5 percent) in carp fillets, and from 1.5 to 4.1 percent (mean of 2.6 percent) in remaining-carcass samples.

Detectable concentrations of PCB were also found in all white sucker samples. The results of whole-body analyses of suckers are presented in Table 3-6 and 3-9. Total PCB concentrations ranged from 0.44 to 2.4 mg/kg, with a mean concentration of 1.4 mg/kg. Lipid concentrations ranged from 0.70 to 2.4 percent, with a mean of 1.3 percent.

3.2.2.2 Pesticide Concentrations in Fish Samples

Carp

Summaries of the pesticide concentrations detected in carp fillet and remaining carcass samples from the OU are presented in Pages 1 and 2 of Table 3-6, respectively. Aldrin was detected in all 11 carp fillet samples at concentrations ranging from an estimated 0.037 to an estimated 0.22 mg/kg, with a mean concentration of 0.088 mg/kg. Dieldrin was detected in one fillet sample at an estimated concentration of 0.064 mg/kg. DDE was detected in 10 fillet samples, with reported estimated concentrations ranging from 0.021 to 0.090 mg/kg, and averaging 0.056 mg/kg. DDD was detected in two samples at concentrations of 0.015 mg/kg and 0.011 mg/kg. Heptachlor epoxide, a degradation product of heptachlor, was detected in all 11 fillet samples at estimated concentrations ranging from 0.012 to 0.097 mg/kg. The mean concentration was 0.036 mg/kg. Chlordane compounds were detected in all 11 fillet samples. Reported concentrations of the individual chlordane compounds (alpha- and gamma-chlordane, and cis- and trans-nonachlor) range from not detected to an estimated 0.044 mg/kg.

Aldrin was detected in all six remaining-carcass carp samples with a range of an estimated 0.079 to 0.42 mg/kg, and a mean of 0.21 mg/kg. DDE was detected in all six samples, and DDD was detected in three samples. Reported concentrations of DDE ranged from an estimated 0.075 to an estimated 0.18 mg/kg, with a mean of 0.12 mg/kg. DDD concentrations ranged from not detected to 0.039 mg/kg. Heptachlor epoxide was detected in all six remaining-carcass carp samples at estimated concentrations ranging from 0.031 to 0.16 mg/kg, with a mean concentration of 0.91 mg/kg. Chlordane compounds were detected in five remaining-carcass samples. Reported concentrations of the individual chlordane compounds ranged from not detected to an estimated 0.069 mg/kg.

White Sucker

Aldrin was detected in 10 out of 11 white sucker whole-body samples, with reported concentrations ranging from an estimated 0.0085 to an estimated 0.10 mg/kg, and mean concentration of 0.044 mg/kg. DDE and DDD were detected in 11 and three samples, respectively. DDE concentrations ranged from an estimated 0.020 to 0.12 mg/kg, with a mean of 0.059 mg/kg. The three reported DDD concentrations were 0.021, 0.014, and 0.023 mg/kg. Heptachlor epoxide was detected in nine out of ten samples (one was rejected) at concentrations ranging from 0.014 to 0.10 mg/kg with a mean of 0.040 mg/kg. Chlordane compounds were detected in five whole-body samples. Reported concentrations of the individual chlordane compounds ranged from not detected to 0.028 mg/kg. Page three of Table 3-6 summarizes the white sucker sample pesticide data.

3.2.2.3 Mercury Concentrations in Fish

All fish samples analyzed contained detectable concentrations of mercury. Carp fillet estimated mercury concentrations ranged from 0.04 to 0.13 mg/kg, with a mean of 0.081 mg/kg. Carp remaining-carcass estimated mercury concentrations ranged from 0.04 to 0.20 mg/kg, with a mean concentration of 0.082 mg/kg. White sucker whole-body mercury concentrations ranged from 0.03 to 0.07 mg/kg, with a mean concentration of 0.037 mg/kg.

A summary of mercury detections is presented in Table 3-6.

3.3 Wetlands Assessment

3.3.1 Wetland Map Review

Initial review of the USFWS NWI Map for Kalamazoo Quadrangle indicated four general types of wetlands in 12 areas within the Allied OU. These wetland areas identified on the NWI map are shown on Figure 7. The NWI Map is based primarily on stereoscopic analysis of aerial photography of the Kalamazoo area in May 1991. Since the criteria used by the USFWS for defining and mapping wetlands are not the same as those currently in use by the USACE and USEPA, there is an inherent potential for some discrepancy in wetland assessment results.

Within the approximately 73 acres along Portage Creek that comprise the Allied OU, four palustrine wetland types are identified in 12 areas on the NWI Map (Figure 7):

- PEMF - Palustrine emergent semipermanently flooded (Areas 1 and 4);
- PSS1C - Palustrine scrub-shrub broad-leaved deciduous seasonally flooded (Areas 2 and 3);
- PEMC - Palustrine emergent seasonally flooded (Areas 5, 8 and 10); and
- PUBF - Palustrine unconsolidated bottom semi-permanently flooded and subject to excavation (Areas 6, 7, 9, 11, and 12);.

Of these four wetland classifications, PEMF is shown on the USFWS NWI Map as the dominant wetland type at the Allied OU.

3.3.2 Field Evaluation

Vegetative species observed and the approximate area addressed at each location are summarized on data forms presented in Appendix D. Open water areas within the FRDLs were evaluated for the presence of wetlands and were not observed to be supporting wetland vegetation. Field investigations revealed three existing wetland areas (Areas 1, 2 and 3) shown in Figure 4. Each of these wetland areas is identified to be "man-induced." As defined in the *Wetlands Delineation Manual* (USACE, 1987), a man-induced wetland is an area where characteristics of naturally-occurring wetlands develop due either to intentional or incidental human activities. For man-induced wetlands, indicators of hydric soils usually are absent. Therefore, in accordance with the USACE guidance, wetland determinations of these areas were based only on the presence of hydrophytic vegetation and wetland hydrology. General characteristics of the OU and notes regarding hydrologic features and soil characteristics are described in Appendix D, Tables 1 through 10. Wetland types were identified based on the experience and professional judgement of the BBL field team in accordance with NWI wetland definitions, as presented below.

Area 1, located within the Former Bryant Mill Pond, consists of emergent cattail marsh (PEMF). This area generally coincides with the outline of NWI mapping units 1 through 5 (Figure 7). Wetlands associated with Area 1 had thin organic soils (Histosols) to a depth of approximately 1-foot, underlain either by residuals or pond sediments. These soils were saturated to the surface or inundated throughout the duration of the OU investigation and likely remain so throughout the year.

Area 2 is a palustrine scrub-shrub wetland (PSS1C), and is located in the floodplain area adjacent to the Bryant HRDL (Figure 4). The soils observed in this area consist of floodplain deposits with an apparent seasonal high water table of 1-foot below the surface. These soils are also subject to seasonal flooding as evidenced by the scoured surface (lack of leaf litter) observed in this area.

Area 3 also is a palustrine scrub-shrub wetland (PSS1C), and is composed of two sub-areas located on the Bryant HRDL that were inundated during the field assessment (Figure 4). These areas were not identified on the NWI Map,

but have developed on a substrate of loose, wet residuals and support cattails, sedges, willows, and other wetland plant species.

Conditions observed during the wetlands assessment reflect man-made changes subsequent to features depicted on the NWI Map. The field investigation results indicated that three wetland areas (Areas 10, 11 and 12) that were identified on the NWI Map (Figure 7) have been subject to landfilling activities and are no longer present.

According to the MDNR National Heritage Program's Natural Features Inventory (MDNR, 1993), no state or federally listed endangered or threatened species occur on the OU. No threatened or endangered species were observed during field reconnaissance conducted concurrently with the wetlands investigation. The Allied OU is affected by human activity related to ongoing site maintenance.

4. Findings

A convention used in this memorandum for calculations involving PCB data (e.g., average PCB concentrations) is to represent "non-detect" results by the value of one-half the MDL. BBL believes that this is an acceptable method when estimating the transport of PCB in surface water. MDLs for PCB in surface water samples often are significantly higher than the Surface Water Quality Criterion of 0.000026 μg/L. This criterion is based on the human cancer value for the protection of human health.

4.1 Surface Water Investigation

Overall, PCB data collected as part of the RI are consistent with historic data: PCB originating from the Allied OU result in concentrations that exceed the State of Michigan surface water values of 0.000026 μg/L (Human Carcinogen Value) and 0.00012 μg/L (Wildlife Chronic Exposure Value). Once released into Portage Creek the PCB migrate downstream.

Elevated concentrations of PCB were detected in 33 of 36 (excluding the "CLP" PCB data which used an elevated MDL) surface water samples collected from the downstream Alcott Street sampling location. The average estimated PCB concentrations during baseflow and high flow events are 0.011 μg/L and 0.056 μg/L, respectively. In contrast, just two of the samples collected from the upstream Cork Street location have detectable (0.064 and an estimated 0.095 μg/L) concentrations of PCB. These data indicate that the Allied OU was a significant source of PCB to Portage Creek at the time of sampling.

The highest PCB concentrations that were detected during this surface water investigation were from baseflow samples collected during the summer months. The highest PCB concentrations recorded during high flow events occurred during the rising limb of the hydrograph.

4.1.1 Relationship Between PCB Concentration and Flow

Only one period of higher than average flow was sampled during both the rising and falling flow phases (see Figure 5A and 5B). However, numerous samples were collected during periods of higher than average flow in Portage Creek. The resulting data suggest that a dilution effect may occur during the periods of higher than average flow. This is supported by calculations that show the average estimated PCB concentration in surface water samples collected from the Alcott Street sampling location is approximately 0.056 μg/L during the periods of higher than average flow, and 0.11 μg/L during baseflow.

Figure 6 includes a graph depicting PCB concentrations versus flow. This graph shows that the highest three PCB concentrations in surface water were detected during baseflow conditions. In addition, two of the lower PCB concentrations, although still orders of magnitude above the Surface Water Quality Criterion, were detected during periods of higher than average flow. This indicates a possible dilution effect; however, additional data would be required to confirm this hypothesis.

4.1.2 Relationship Between PCB and TSS Concentrations

The data indicate that TSS generally increases during periods of increased flow, when PCB-containing residuals, sediment and soil are likely scoured and re-suspended. Analytical results indicate average TSS concentrations of approximately 18 mg/L at both Cork Street and Alcott Street sampling locations during the measured periods of higher than average flow. However, analytical results of TSS concentrations in surface water samples collected

during the baseflow sampling events indicate that average TSS concentrations at the downstream Alcott Street (13.7 mg/L) location are nearly double those detected at the Cork Street (7.6 mg/L) location.

4.1.3 Other Constituents

Two water samples from the October 1993 high-flow sampling event were analyzed for TCL/TAL parameters. No TCL parameters were detected; ten of the 24 TAL constituents were detected, including: arsenic, barium, calcium, iron, lead, magnesium, manganese, potassium, sodium, and zinc. Analytical results of baseflow surface water samples collected on June 9, 1994 indicated the presence of aluminum, chromium, copper, mercury, nickel, and vanadium in addition to the above constituents. For both rounds of sampling, constituent concentrations were generally equal at the upstream and downstream sampling locations.

Detected concentrations of TAL constituents in surface water were compared to Michigan Rule 57 surface water quality criteria in Table 3-5. The results of this comparison indicate that only mercury was detected at a concentration exceeding the Rule 57 criteria, and only in one sample collected from the Cork Street location.

4.1.4 PCB Transport in Portage Creek

PCB transport in surface water may occur in the particulate phase adsorbed to suspended solids, and in the dissolved phase. The total concentration of PCB in surface water is dependent on several factors, including flow conditions, suspended solids, organic matter, and the chemical characteristics of PCB. The Work Plan called for the collection of several surface water samples during the summer months, when rates of PCB desorption from sediments to surface water may be expected to be highest. However, fewer samples were collected than planned during the summer period.

PCB load estimates for Portage Creek were calculated for the Cork Street and Alcott Street locations using the available PCB and flow data. PCB transport via bedload was not evaluated as part of this assessment. Where flow was measured at Alcott Street but not Cork Street, flow at Cork Street was assumed to be 0.93 times the Alcott Street flow based on a regression analysis of data from both locations (included in Appendix A). If either flow or PCB data were not available for a given sampling event, it was not included in the load calculation (e.g., the end of the April 1994 period of higher than average flow did not include flow measurements). Additional data collection, especially during the summer season, may reduce uncertainty of this load calculation.

The method used to estimate PCB loads in Portage Creek at the Cork Street and Alcott Street locations involves determining the PCB concentrations observed at the various rates of flow (in "stratified" increments) which occur in Portage Creek, and weighting the PCB load by the frequency that each flow increment occurs. Using this method, called the "stratified flow method," the mass loading at the 80 percent exceedance flow is weighted more heavily than the mass loading for the 40 percent exceedance flow because it occurs more often. The stratified flow method is inherently an unbiased method of calculating the transported mass of PCB. Using this method, the estimated annual PCB loads are 0.59 kilograms per year (kg/yr) at Cork Street and 4.7 kg/yr at Alcott Street. Table 4-1 presents the Portage Creek flow and PCB analytical results that are used to estimate the annual PCB load at Cork Street and Alcott Street according to the stratified flow method (Table 4-2). As previously discussed, this evaluation does not consider other factors that could affect PCB load.

The relative contributions of varying flow increments are presented in Figure 8. As shown in the first graph in Figure 8, the flow frequency curve indicates that flows of 55 cfs or less occur 64 percent of the time on an annual basis. The second graph in Figure 8 illustrates the relatively narrow range of flows in which a majority of the annual PCB

transport occurs. Approximately 74 percent of the annual PCB load is associated with flows between 40 and 55 cfs. In contrast, flows greater than 80 cfs contribute less than 5 percent of the total annual PCB load and occur less than 6 percent of the time. It should be noted that the 80 percent and 10 percent exceedance flows during the early 1990s, during which most of the PCB load data were obtained, were higher than the period of 1975 to 1986 from which the target sampling flows were determined.

4.2 Biota Investigation

The State of Michigan currently has a consumption advisory in effect for all species of fish captured from a section of Portage Creek that includes the entire sampling area (i.e., Former Bryant Mill Pond). This advisory recommends that both carp and white suckers from this section of the creek not be eaten. The 1999 Michigan Fishing Guide (MDNR, 1999) lists PCB as the constituent responsible for the advisory on Portage Creek fish. The fish in Portage Creek contain PCB levels above the human consumption U.S. Food and Drug Administration (FDA) limit (2.0 mg/kg) and the dietary threshold (0.64 mg/kg) for the protection of mink that has been used to set ambient water quality criteria (e.g., USEPA, 1980).

The State of Michigan determines the need for fish consumption advisories at a given location by comparing concentrations in individual fish and mean concentrations for a given fish sample to a predetermined "trigger concentration" which the State of Michigan has established as protective of human health. The decision to issue a health advisory is based upon the number of exceedances in fish samples, an evaluation of the mean concentration of those samples, and professional judgement.

Carp fillet samples were analyzed for PCB, aldrin, mercury, dieldrin, DDT, heptaclor epoxide, and total chlordane. PCB are the only constituent analyzed with concentrations that exceed the applicable criteria. In all carp fillet samples, PCB concentrations exceed trigger levels for a "women and children" fish consumption advisory. Because the "trigger concentrations" apply only to the edible portions of fish (e.g., fillets), this comparison was not made for the carp carcass and white sucker whole body data. Table 4-3 presents a comparison of the carp fillet sample analytical results to MDCH trigger levels.

Although pesticides were detected in several white sucker samples, in no case were the concentrations above the most stringent fish consumption advisory trigger levels.

According to the MDEQ, PCB exposure from consuming carp could occur for those individuals who might access the area and catch fish, for consumption; although the area is fenced off, there is still a potential for access by trespassers on the site by crossing over the fence in the backyards on the east side of the creek and under the fence at Cork Street.

4.3 Wetlands Assessment

Three wetland areas were identified at the Allied OU as shown in Figure 7. These areas consist of the Former Bryant Mill Pond, a small area of the Portage Creek floodplain adjacent to the Bryant HRDL, and small inundated areas within the Bryant HRDL. The Former Bryant Mill Pond and Bryant HRDL areas consist of emergent marsh, while the floodplain area consists of scrub-shrub vegetation. Several wetland areas (Areas 10, 11, and 12) identified on the NWI Maps are not presently found at the OU due to alteration of the area.

5. References

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Tables

TABLE 2-1

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

USEPA CONTRACT LABORATORY PROGRAM-TARGET COMPOUND LIST/TARGET ANALYTE LIST

TARGET COMPOUND LIST		
VOCs		
acetone	chloromethane	methylene chloride
benzene	dibromochloromethane	4-methyl-2-pentanone
bromodichloromethane	1,1-dichloroethane	styrene
bromoform	1,2-dichloroethane	1,1,2,2-tetrachloroethane
bromomethane	1,1-dichloroethene	tetrachloroethene
2-butanone	1,2-dichloroethene (total)	toluene
carbon disulfide	1,2-dichloropropane	1,1,1-trichloroethane
carbon tetrachloride	cis-1,3-dichloropropene	1,1,2-trichloroethane
chlorobenzene	trans-1,3-dichloropropene	trichloroethene
chloroethane	ethylbenzene	vinyl chloride
chloroform	2-hexanone	xylenes (total)
SVOCs		
acenaphthene	dibenz(a,h)anthracene	hexachloroethane
acenaphthylene	dibenzofuran	indeno(1,2,3-cd)pyrene
anthracene	di-n-butylphthalate	isophorone
benzo(a)anthracene	1,2-dichlorobenzene	2-methylnaphthalene
benzo(b)fluoranthene	1,3-dichlorobenzene	2-methylphenol
benzo(k)fluoranthene	1,4-dichlorobenzene	4-methylphenol
benzo(g,h,i)perylene	3,3'-dichlorobenzidine	naphthalene
benzo(a)pyrene	2,4-dichlorophenol	2-nitroaniline
4-bromophenyl phenyl ether	diethyl phthalate	3-nitroaniline
butyl benzyl phthalate	2,4-dimethylphenol	4-nitroaniline
carbazole	4,6-dinitro-2-methyl phenol	nitrobenzene
4-chloroaniline	dimethyl phthalate	2-nitrophenol
bis(2-chloroethoxy)methane	2,4-dinitrophenol	4-nitrophenol
bis(2-chloroethyl)ether	2,4-dinitrotoluene	n-nitrosodiphenylamine
4-chloro-3-methyl phenol	2,6-dinitrotoluene	n-nitroso-di-n-propylamine
2-chloronaphthalene	di-n-octyl phthalate	pentachlorophenol
2-chlorophenol	bis(2-ethylhexyl)phthalate	phenanthrene
4-chlorophenyl phenyl ether	fluoranthene	phenol
2,2'-oxybis(1-chloropropane)	fluorene	pyrene
chrysene	hexachlorobenzene	1,2,4-trichlorobenzene
	hexachlorobutadiene	2,4,5-trichlorophenol
	hexachlorocyclopentadiene	2,4,6-trichlorophenol

(See References on Page 2)

TABLE 2-1

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

USEPA CONTRACT LABORATORY PROGRAM-TARGET COMPOUND LIST/TARGET ANALYTE LIST

Pesticides/PCB Compounds		
aldrin	beta-BHC	endosulfan I
alpha-BHC	gamma-BHC (lindane)	endosulfan II
Aroclor - 1016*	delta-BHC	endosulfan sulfate
Aroclor - 1221*	alpha-chlordane	endrin
Aroclor - 1232*	gamma-chlordane	endrin aldehyde
Aroclor - 1242*	4,4'-DDD	endrin ketone
Aroclor - 1248*	4,4'-DDE	heptachlor
Aroclor - 1254*	4,4'-DDT	heptachlor epoxide
Aroclor - 1260*	dieldrin	methoxychlor
		toxaphene
TARGET ANALYTE LIST		
Metals/Other Compounds		
aluminum	cobalt	nickel
antimony	copper	potassium
arsenic	cyanide	selenium
barium	iron	silver
beryllium	lead	sodium
cadmium	magnesium	thallium
calcium	manganese	vanadium
chromium	mercury	zinc

References:
TCL: USEPA, 1991a.
TAL: USEPA, 1991b.
*PCB were included in the TCL/TAL analyses but were analyzed separately for some samples.

TABLE 3-1

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SURFACE WATER MONITORING DATA

ID	Dup ID	Date	Approx. Time (1)	Depth (ft)	Width (ft)	Flow (cfs)	pH (SU)	Water Temperature (degrees C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Total Suspended Solids (mg/L)
Cork Street Baseflow												
A64002		08/24/93	1740	2.2	14.2	56.9	8.47	26.6	541	8.2	5.50	5.2
A64004		12/15/93	1230	2.1	14.2	52.7	8.18	7.2	633	NS	3.21	4.7
A64006		12/28/93	1310	2.1	14.2	54.8	8.31	3.2	678	NS	5.98	9.1
A64009		06/09/94	1445	1.9	14.2	34.7	8.10	22.1	616	8.60	8.46	11.2
A64010		09/08/94	1640	2.1	14.2	42.6	8.22	21.5	612	7.83	9.82	6.4
A64014		09/21/94	1300	NS	NS	NS	8.22	21.5	630	8.00	8.94	7.2
A64591		05/19/97	1700	2.2	14.2	34	8.44	18.2	574	NS	9.95	9.6
Cork Street High Flow												
A66501		09/15/93	1610	2.5	14.2	89.9	7.82	17.4	518	8.80	10.5	16.3
A66503		09/16/93	1040	2.4	14.2	74.8	8.11	14.4	595	9.10	9.25	10.0
A66506		09/16/93	1425	2.4	14.2	79.9	8.43	15.3	595	9.30	8.44	8.4
A66508		09/16/93	1750	2.4	14.2	80.2	8.35	16.1	600	9.59	7.09	25.0
A66510		09/17/93	0915	2.3	14.2	73.0	8.24	14.5	612	8.95	9.98	10.8
A66512		09/17/93	1240	2.4	14.2	77.9	8.27	15.1	608	9.20	9.55	8.8
A66514		09/17/93	1605	2.4	14.2	77.9	8.34	16.8	609	9.79	8.44	11.5
A66516		09/18/93	0950	2.3	14.2	69.8	8.28	14.6	603	8.62	11.2	13.0
A66522		10/17/93	1445	NS	14.2	NS	7.85	14.2	341	NS	15.5	12.7
A66524		10/17/93	1745	NS	14.2	NS	7.89	13.9	329	NS	15.6	11.0
A66526		10/18/93	1010	2.6	14.2	112	7.66	10.6	515	NS	6.81	NA
A66528		10/18/93	1455	2.6	14.2	104	7.74	13.9	532	NS	7.10	6.1
A66530		10/18/93	1835	2.5	14.2	94.6	7.71	14.2	550	NS	7.18	NA
A66532		10/19/93	1240	NS	14.2	NS	7.99	12.9	575	NS	6.12	5.8
A66534		10/19/93	1745	NS	14.2	NS	8.07	14.5	591	NS	5.83	5.4
A66537		10/20/93	1045	NS	14.2	NS	7.93	12.9	598	NS	7.83	8.6
A66539		10/20/93	1430	2.4	14.2	84.7	8.01	13.4	598	9.89	8.66	10.3
A66541		10/21/93	1140	2.5	14.2	88.9	NS	11.6	547	9.85	10.9	10.6
A66543		12/02/93	1440	2.3	14.2	73.3	8.10	10.1	656	10.40	9.79	7.3
A66545		12/02/93	1820	2.3	14.2	75.3	8.13	9.9	773	10.20	9.57	9.1
A66547		12/02/93	2145	2.3	14.2	74.0	8.22	8.7	703	10.30	10.3	8.0
A66549		12/03/93	0940	2.2	14.2	66.1	8.19	7.4	630	11.20	7.63	6.7
A66551		12/03/93	1540	2.2	14.2	64.2	8.03	7.8	637	11.60	8.69	5.8
A66554		04/11/94	2215	NS	NS	NS	NS	NS	NS	NS	NS	6.7
A66556		04/12/94	0900	NS	NS	NS	NS	NS	NS	NS	NS	15.0
A66558		04/12/94	1110	NS	NS	NS	NS	NS	NS	NS	NS	14.0
A66561		04/12/94	1300	NS	NS	NS	NS	NS	NS	NS	NS	19.0
A66563		04/12/94	1500	NS	NS	NS	NS	NS	NS	NS	NS	16.0
A66569		04/12/94	2130	NS	NS	NS	NS	NS	NS	NS	NS	230
A66581		04/13/94	2300	NS	NS	NS	NS	NS	NS	NS	NS	12.0
A66584		04/14/94	1245	NS	NS	NS	NS	NS	NS	NS	NS	10.5
A66586		04/14/94	1700	NS	NS	NS	NS	NS	NS	NS	NS	6.5
A66588		04/14/94	2350	NS	NS	NS	NS	NS	NS	NS	NS	6.5
Alcott Street Baseflow												
A64000	A64001	08/24/93	1640	1.3	22.9	54.8	8.08	25.8	478	7.5	11.5	20.0
A64001	A64000	08/24/93	1640	1.3	22.9	54.8	8.08	25.8	478	7.5	11.5	17.3
A64003		12/15/93	1145	1.5	22.9	58.5	7.68	7.2	611	NS	3.22	3.6
A64005	A64007	12/28/93	1235	1.5	22.9	57.6	8.14	2.8	669	NS	5.43	10.9
A64007	A64005	12/28/93	1235	1.5	22.9	57.6	8.14	2.8	669	NS	5.43	8.9
A64008		06/09/94	1330	0.94	22.9	39.8	8.25	18.7	589	8.30	9.34	14.3
A64011		09/08/94	1555	1.1	22.9	47.6	8.24	20.5	590	8.50	11.0	13.2
A64013		09/21/94	1225	NS	NS	49	8.23	21.0	602	8.40	9.95	12.5
A64590	A64592	05/19/97	1755	1.5	22.9	43	8.49	18.0	583	NS	10.4	23.6
A64592	A64590	05/19/97	1755	1.5	22.9	43	8.49	18.0	583	NS	10.4	23.5

(See Notes on Page 2)

TABLE 3-1

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SURFACE WATER MONITORING DATA

ID	Dup ID	Date	Approx. Time (1)	Depth (ft)	Width (ft)	Flow (cfs)	pH (SU)	Water Temperature (degrees C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Total Suspended Solids (mg/L)
Alcott Street High Flow												
A66500		09/15/93	1445	1.9	22.9	99.8	7.59	17.2	464	8.99	9.64	21.0
A66502		09/16/93	1000	1.7	22.9	84.3	8.28	14.4	593	9.42	14.2	11.6
A66504	A66505	09/16/93	1340	1.7	22.9	82.7	8.34	15.1	601	9.25	9.24	9.6
A66505	A66504	09/16/93	1340	1.7	22.9	82.7	8.34	15.1	601	9.25	9.24	9.5
A66507		09/16/93	1725	1.7	22.9	83.1	8.38	15.8	601	9.25	8.34	9.4
A66509		09/17/93	0850	1.7	22.9	80.0	8.09	14.6	606	9.45	10.3	12.9
A66511		09/17/93	1210	1.7	22.9	80.0	8.20	15.0	611	9.38	9.74	11.5
A66513		09/17/93	1535	1.7	22.9	83.5	8.27	16.4	614	9.55	10.6	8.5
A66515		09/18/93	0905	1.7	22.9	77.2	8.14	14.7	613	9.25	10.7	14.8
A66521		10/17/93	1420	3.7	22.9	240	7.90	14.2	307	NS	18.9	12.3
A66523		10/17/93	1720	3.6	22.9	212	7.90	14.2	339	NS	16.3	9.4
A66525		10/18/93	0925	2.2	22.9	120	7.74	10.8	514	NS	10.4	NA
A66527		10/18/93	1415	2.1	22.9	111	7.64	12.8	532	NS	6.76	10.1
A66529		10/18/93	1810	2.0	22.9	100	7.80	14.4	545	NS	10.1	NA
A66531		10/19/93	1145	1.9	22.9	107	8.09	12.8	586	NS	7.58	7.0
A66533	A66535	10/19/93	1720	1.9	22.9	94.2	8.14	14.3	594	NS	6.41	5.7
A66535	A66533	10/19/93	1720	1.9	22.9	94.2	8.14	14.3	594	NS	6.41	5.3
A66536		10/20/93	1005	1.9	22.9	91.6	7.98	12.8	606	NS	8.88	9.2
A66538		10/20/93	1400	1.8	22.9	87.2	8.03	13.2	609	9.94	9.94	11.2
A66540		10/21/93	1110	2.0	22.9	96.2	NS	11.5	533	9.70	13.8	14.1
A66542		12/02/93	1400	1.8	22.9	81.8	8.02	9.6	647	10.80	9.39	9.3
A66544		12/02/93	1745	1.7	22.9	80.9	8.02	10.1	892	10.05	11.7	12.6
A66546		12/02/93	2115	1.8	22.9	77.8	8.25	8.8	726	10.40	10.5	10.8
A66548		12/03/93	0915	1.6	22.9	69.0	7.81	7.5	635	11.80	7.90	7.6
A66550	A66552	12/03/93	1450	1.6	22.9	66.3	7.76	7.9	637	11.10	8.94	6.1
A66552	A66550	12/03/93	1450	1.6	22.9	66.3	7.76	7.9	637	11.10	8.94	4.8
A66553		04/11/94	2145	NS	NS	69	NS	NS	NS	NS	NS	8.5
A66555		04/12/94	0830	NS	NS	95	NS	NS	NS	NS	NS	27.0
A66557	A66559	04/12/94	1030	NS	NS	105	NS	NS	NS	NS	NS	30.0
A66559	A66557	04/12/94	1030	NS	NS	105	NS	NS	NS	NS	NS	26.0
A66560		04/12/94	1230	NS	NS	118	NS	NS	NS	NS	NS	33.0
A66562		04/12/94	1430	NS	NS	128	NS	NS	NS	NS	NS	30.0
A66564		04/12/94	1700	NS	NS	128	NS	NS	NS	NS	NS	NS
A66566		04/12/94	1900	NS	NS	121	NS	NS	NS	NS	NS	NS
A66568		04/12/94	2100	NS	NS	118	NS	NS	NS	NS	NS	133
A66570		04/12/94	2100	NS	NS	118	NS	NS	NS	NS	NS	NS
A66574		04/13/94	0800	NS	NS	105	NS	NS	NS	NS	NS	NS
A66576		04/13/94	1230	NS	NS	98	NS	NS	NS	NS	NS	NS
A66578		04/13/94	1700	NS	NS	92	NS	NS	NS	NS	NS	NS
A66580	A66582	04/13/94	2230	NS	NS	85	NS	NS	NS	NS	NS	21.0
A66582	A66580	04/13/94	2230	NS	NS	85	NS	NS	NS	NS	NS	13.0
A66583		04/14/94	1230	NS	NS	NS	NS	NS	NS	NS	NS	14.0
A66585		04/14/94	1645	NS	NS	NS	NS	NS	NS	NS	NS	13.0
A66587	A66589	04/14/94	2330	NS	NS	NS	NS	NS	NS	NS	NS	10.5
A55589	A66587	04/14/94	2330	NS	NS	NS	NS	NS	NS	NS	NS	25.5

Notes:

(1) Sample time represents time at which field parameters or flow were measured; sample collection generally occurred within 30 minutes of the shown time.

NA - Not analyzed.

NS - Not sampled.

cfs - cubic feet per second

SU - standard units

mS/cm - microSiemens/centimeter

NTU - Nephelometric Turbidity Units

TABLE 3-2

ALLIED PAPER, INC/PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF FIELD DATA RESULTS FOR PORTAGE CREEK
CARP AND WHITE SUCKERS

Sample Number	Species	Gender	Length (cm)	Weight (g)
P40399	Carp	Female	61	3400
P40400	Carp	Female	49	1900
P40401	Carp	Female	48	1800
P40402	Carp	Male	53	2000
P40403	Carp	Male	53	2300
P40404	Carp	Female	52	2100
P40405	Carp	Male	49	1700
P40406	Carp	Male	49	1600
P40407	Carp	Female	47	1700
P40408	Carp	Male	48	1700
P40409	Carp	Female	47	1300
Mean			51	2000
SD			4.0	550
P40410	White Sucker	Female	27	220
P40411	White Sucker	Female	25	160
P40412	White Sucker	Female	25	180
P40413	White Sucker	Male	23	120
P40414	White Sucker	Male	21	110
P40415	White Sucker	Male	18	54
P40416	White Sucker	Male	16	39
P40417	White Sucker	Male	21	87
P40418	White Sucker	Male	18	48
P40419	White Sucker	Female	16	37
P40420	White Sucker	Female	15	32
Mean			20	99
SD			4.1	65

Notes:
SD - Standard deviation.
Data are rounded to 2 significant digits.

TABLE 3-3

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF DETECTED PCB RESULTS FOR SURFACE WATER

Sample ID	Duplicate	Date Sampled	Approximate Time Sampled	Aroclor (ug/L) 1016	1242	1248	Total PCB (ug/L) (1)
Cork Street Baseflow							
A64002		08/24/93	1740	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A64004		12/15/93	1230	ND (0.051 UJ)	ND (0.051 UJ)	ND (0.051 UJ)	ND J
A64006		12/28/93	1310	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A64009		06/09/94	1445	ND (1.0 U)	ND (1.0 U)	ND (1.0 U)	ND
A64010		09/08/94	1640	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A64014		09/21/94	1300	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A64591		05/19/97	1700	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
Cork Street High Flow							
A66501		09/15/93	1610	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66503		09/16/93	1040	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66506		09/16/93	1425	0.064	ND (0.050 U)	ND (0.050 U)	**0.064**
A66508		09/16/93	1750	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66510		09/17/93	0915	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66512		09/17/93	1240	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66514		09/17/93	1605	ND (0.050 UJ)	ND (0.050 UJ)	ND (0.050 UJ)	ND J
A66516		09/18/93	0950	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66522		10/17/93	1445	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
A66524		10/17/93	1745	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66528		10/18/93	1455	ND (0.050 UJ)	ND (0.050 U)	ND (0.050 U)	ND J
A66532		10/19/93	1240	ND (0.051 UJ)	ND (0.051 U)	ND (0.051 U)	ND J
A66534		10/19/93	1745	ND (0.050 UJ)	ND (0.050 U)	ND (0.050 U)	ND J
A66537		10/20/93	1045	ND (1.0 U)	ND (1.0 U)	ND (1.0 U)	ND
A66539		10/20/93	1430	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66541		10/21/93	1140	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
A66543		12/02/93	1440	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66545		12/02/93	1820	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
A66547		12/02/93	2145	ND (0.050 UJ)	ND (0.050 UJ)	ND (0.050 UJ)	ND J
A66549		12/03/93	0940	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
A66551		12/03/93	1540	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
A66554		04/11/94	2215	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66556		04/12/94	0900	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
A66558		04/12/94	1110	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66561		04/12/94	1300	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66563		04/12/94	1500	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66569		04/12/94	2130	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66581		04/13/94	2300	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
A66584		04/14/94	1245	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66586		04/14/94	1700	0.073	ND (0.050 U)	0.022 J	**0.095J**
A66588		04/14/94	2350	ND (0.051 U)	ND (0.051 U)	ND (0.051 U)	ND
Alcott Street Baseflow							
A64000	A64001	08/24/93	1640	ND (0.051 U)	0.23	ND (0.051 U)	**0.23**
A64001	A64000	08/24/93	1640	ND (0.051 U)	0.22	ND (0.051 U)	**0.22**
A64003		12/15/93	1145	ND (0.051 UJ)	ND (0.051 UJ)	ND (0.051 UJ)	ND J
A64005	A64007	12/28/93	1235	0.037 J	ND (0.050 U)	0.021 J	**0.058J**
A64007	A64005	12/28/93	1235	0.042 J	ND (0.050 U)	0.023 J	**0.065J**
A64008		06/09/94	1330	ND (1.0 U)	ND (1.0 U)	ND (1.0 U)	ND
A64011		09/08/94	1555	ND (0.050 U)	0.16	ND (0.050 U)	**0.16**
A64013		09/21/94	1225	ND (0.050 U)	0.21	ND (0.050 U)	**0.21**
A64590	A64592	05/19/97	1155	ND (0.050 U)	0.065	ND (0.050 U)	**0.065**
A64592	A64590	05/19/97	1155	ND (0.050 U)	0.069	ND (0.050 U)	**0.069**

(See Notes on Page 2)

TABLE 3-3

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF DETECTED PCB RESULTS FOR SURFACE WATER

Sample ID	Duplicate	Date Sampled	Approximate Time Sampled	Aroclor (ug/L) 1016	1242	1248	Total PCB (ug/L) (1)
Alcott Street High Flow							
A66500		09/15/93	1445	0.086	ND (0.050 U)	ND (0.050 U)	**0.086**
A66502		09/16/93	1000	0.035 J	ND (0.050 U)	ND (0.050 U)	**0.035J**
A66504	A66505	09/16/93	1340	0.034 J	ND (0.050 U)	ND (0.050 U)	**0.034J**
A66505	A66504	09/16/93	1340	0.052	ND (0.050 U)	ND (0.050 U)	**0.052**
A66507		09/16/93	1725	0.032 J	ND (0.050 UJ)	ND (0.050 UJ)	**0.032J**
A66509		09/17/93	0850	ND (0.050 U)	0.081	ND (0.050 U)	**0.081**
A66511		09/17/93	1210	ND (0.050 U)	0.086	ND (0.050 U)	**0.086**
A66513		09/17/93	1535	ND (0.050 U)	0.094	ND (0.050 U)	**0.094**
A66515		09/18/93	0905	ND (0.050 U)	0.10	ND (0.050 U)	**0.10**
A66521		10/17/93	1420	0.041 J	ND (0.051 U)	ND (0.051 U)	**0.041J**
A66523		10/17/93	1720	0.041 J	ND (0.051 U)	ND (0.051 U)	**0.041J**
A66527		10/18/93	1415	0.055 J	ND (0.050 U)	ND (0.050 U)	**0.055J**
A66531		10/19/93	1145	0.037 J	ND (0.050 U)	ND (0.050 U)	**0.037J**
A66533	A66535	10/19/93	1720	0.030 J	ND (0.050 U)	ND (0.050 U)	**0.030J**
A66535	A66533	10/19/93	1720	0.029 J	ND (0.050 U)	ND (0.050 U)	**0.029J**
A66536		10/20/93	1005	ND (1.0 U)	ND (1.0 U)	ND (1.0 U)	ND
A66538		10/20/93	1400	ND (0.050 U)	0.067	ND (0.050 U)	**0.067**
A66540		10/21/93	1110	ND (0.050 U)	0.071	ND (0.050 U)	**0.071**
A66542		12/02/93	1400	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66544		12/02/93	1745	ND (0.050 UJ)	0.040 J	ND (0.050 UJ)	**0.040J**
A66546		12/02/93	2115	0.034 J	ND (0.050 U)	ND (0.050 U)	**0.034J**
A66548		12/03/93	0915	0.039 J	ND (0.050 U)	ND (0.050 U)	**0.039J**
A66550	A66552	12/03/93	1450	0.030 J	ND (0.051 U)	ND (0.051 U)	**0.030J**
A66552	A66550	12/03/93	1450	0.028 J	ND (0.051 U)	ND (0.051 U)	**0.028J**
A66553		04/11/94	2145	0.048 J	ND (0.050 U)	ND (0.050 U)	**0.048J**
A66555		04/12/94	0830	ND (0.050 U)	0.10	ND (0.050 U)	**0.10**
A66557	A66559	04/12/94	1030	ND (0.050 U)	0.10	ND (0.050 U)	**0.10**
A66559	A66557	04/12/94	1030	ND (0.050 U)	0.11	ND (0.050 U)	**0.11**
A66560		04/12/94	1230	0.075	ND (0.050 U)	0.037 J	**0.11J**
A66562		04/12/94	1430	0.052	ND (0.050 U)	0.039 J	**0.091J**
A66568		04/12/94	2100	ND (0.051 U)	0.023 J	ND (0.051 U)	**0.023J**
A66580	A66582	04/13/94	2230	ND (0.050 U)	0.059	ND (0.050 U)	**0.059**
A66582	A66580	04/13/94	2230	ND (0.050 U)	0.074	ND (0.050 U)	**0.074**
A66583		04/14/94	1230	0.038 J	ND (0.050 U)	ND (0.050 U)	**0.038J**
A66585		04/14/94	1645	ND (0.050 U)	ND (0.050 U)	ND (0.050 U)	ND
A66587	A66589	04/14/94	2330	ND (0.050 U)	0.062	ND (0.050 U)	**0.062**
A66589	A66587	04/14/94	2330	ND (0.050 U)	0.054	ND (0.050 U)	**0.054**

Notes:

(1) - Total PCB data in bold exceed Michigan surface water criteria of 0.000026 ug/L (Human Carcinogen Value) and 0.00012 ug/L (Wildlife Chronic Exposure Value).

Practical quantitation limits are shown in parentheses.

Analytical results are rounded to two significant digits.

The samples were analyzed for Aroclors 1221, 1232, 1254, and 1260, but no detections were found. The samples were not analyzed for Aroclors 126 or 1268 because they are not included in the standard Method 8081 analysis. It is appropriate for these Aroclors not to be analyzed because they are uncommon and are not known to be associated with paper products.

ND - Not detected.

Notes Explaining Data Qualifiers:

J - The compound was positively identified; however, the associated numerical value is an estimated concentration only.

U - The compound was analyzed for but not detected. The associated value is the compound quantitation limit.

UJ - The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.

TABLE 3-4

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF PCB METHOD DETECTION LIMIT STUDY

Compound	Concentrations (ug/L)						
	Rep. 1	Rep. 2	Rep. 3	Rep. 4	Rep. 5	Rep. 6	Rep. 7
Aroclor 1242	0.057	0.062	0.056	0.055	0.045	0.069	0.060
Aroclor 1248	0.043	0.043	0.046	0.048	0.044	0.034	0.049

Compound	Mean (ug/L)	SD (ug/L)	True (ug/L)	Recovery (%)	Percent RSD (%)	MDL* (ug/L)
Aroclor 1242	0.058	0.0074	0.050	120	13	0.023
Aroclor 1248	0.043	0.0049	0.050	90	7	0.016

Notes:
SD - Standard deviation.
RSD - Relative standard deviation.
MDL - Method detection limit
*MDL = 3.143 x SD
MDL calculated according to procedures set forth in Appendix B to 40 CFR Part 136 - Definition and Procedure for the Determination of the Method Detection Limit, Revision 1.11.
Samples were collected by BBL on January 13, 1994 from Lake Allegan and submitted for PCB analysis by USEPA SW-846 Method 8081 by Inchcape Testing Services/Aquatec Laboratories in Colchester, Vermont.

TABLE 3-5

ALLIED PAPER, INC/PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF SURFACE WATER TAL DATA (ug/L)

Location Sample ID Date	ALCOTT ST A66536 10/20/93	CORK ST A66537 10/20/93	ALCOTT ST A64008 06/09/94	CORK ST A64009 06/09/94	Rule 57 Criteria (ug/L) (1)
aluminum	ND (45 U)	ND (45 U)	200	180 B	NA
antimony	ND (53 U)	ND (53 U)	ND (1.3 U)	ND (1.3 U)	1.7 HNV Drink
arsenic	5.9 B	6.9 B	6.2 B	5.2 B	50 HNV Drink
barium	84 B	83 B	100 B	100 B	190 FCV
beryllium	ND (0.30 U)	ND (0.30 U)	ND (0.10 U)	ND (0.10 U)	160 HNV Drink
cadmium	ND (3.3 U)	ND (3.3 U)	ND (0.20 U)	ND (0.20 U)	2.5 HNV Drink
calcium	74000	74000	80000	78000	NA
chromium	ND (2.5 U)	ND (2.5 U)	1.3 B	1.2 B	120 HNV Drink
cobalt	ND (4.9 U)	ND (4.9 U)	ND (0.50 U)	ND (0.50 U)	100 FCV
copper	ND (3.7 U)	ND (3.7 U)	2.1 B	1.3 B	790 HNV Drink
cyanide	ND (10 U)	ND (10 U)	ND (5.0 U)	ND (5.0 U)	5.2 FCV
iron	1000	1100	1100	1100	NA
lead	2.7 B	1.3 B	5.0	1.5 B	14 HNV Drink
magnesium	22000	22000	25000	25000	NA
manganese	110	130	120	140	3600 HNV Drink
mercury	ND (0.07 U)	ND (0.07 U)	ND (0.03 U)	0.04 B	0.0013 WV
nickel	ND (4.1 U)	ND (4.1 U)	1.1 B	0.87 B	2600 HNV Drink
potassium	1400 B	1400 B	1500 B	1400 B	NA
selenium	ND (1.1 UJ)	ND (1.1 UJ)	ND (2.7 U)	ND (2.7 U)	5 FCV
silver	ND (6.7 U)	ND (6.7 U)	ND (0.50 U)	ND (0.50 U)	0.06 FCV
sodium	20000	20000	21000 J	20000 J	NA
thallium	ND (1.8 U)	ND (1.8 U)	ND (1.9 U)	ND (1.9 U)	1.2 HNV Drink
vanadium	ND (3.3 U)	ND (3.3 U)	1.1 B	1.0 B	12 FCV
zinc	3.4 B	4.0 B	6.9 B	7.4 B	4500 HNV Drink

Notes:

ND - Not detected.
HNV - Human noncancer value.
FCV - Final chronic value.
WV - Wildlife value.
NA - Not applicable.
(1) MDEQ, 1999.
Data are rounded to 2 significant digits.

Notes Explaining Data Qualifiers:

B -The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
J - The compound was positively identified; however, the associated numerical value is an estimated concentration only.
U -The analyte was analyzed for but not detected. The associated value is the analyte instrument detection limit.

TABLE 3-6

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF BIOTA FIELD DATA AND CLP TCL/TAL ANALYTICAL RESULTS

	Carp Fillet Samples (1, 2)										
Sample Number:	P40399F	P40400F	P40401F	P40402F	P40403F	P40404F	P40405F	P40406F	P40407F	P40408F	P40409F
Sample Date:	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93
Field Data											
Gender	Female	Female	Female	Male	Male	Female	Male	Male	Female	Male	Female
Length (cm)	61	49	48	53	53	52	49	49	47	48	47
Weight (g)	3400	1900	1800	2000	2300	2100	1700	1600	1700	1700	1300
Laboratory Data (3)											
Lipids (percent)	2.3	1.4	2.2	0.75	1.5	1.6	1.7	1.4	1.3	1.3	1.1
PCB											
Aroclor 1016	ND(0.50U)	ND(0.50U)	ND(0.25U)	ND(0.10U)	ND(0.25U)	ND(0.50U)	ND(0.25U)	ND(0.75U)	ND(0.25U)	ND(0.25UJ)	ND(0.10U)
Aroclor 1242	ND(0.50U)	ND(0.50U)	ND(0.25U)	ND(0.10U)	ND(0.25U)	ND(0.50U)	ND(0.25U)	ND(0.75U)	ND(0.25U)	ND(0.25UJ)	ND(0.10U)
Aroclor 1248	3.8	3.8	1.6	1.4	1.6	4.4	2.9	8.1	2.6	1.1 J	1.4
Aroclor 1254	0.60	ND(0.50U)	0.39	ND(0.10U)	0.53	ND(0.50U)	ND(0.25U)	ND(0.75U)	ND(0.25U)	0.42 J	0.33
Aroclor 1260	ND(0.50U)	0.51	ND(0.25U)	0.19	ND(0.25U)	0.29 J	0.24 J	0.69 J	0.46	ND(0.25UJ)	0.27
Total PCB	4.4	4.3	2.0	1.6	2.1	4.7J	3.1J	8.8J	3.1	1.5J	2.0
Pesticide											
Aldrin	0.14 J	0.10 J	0.061 JN	0.037 J	0.071 J	0.11 J	0.087	0.22 J	0.062 J	0.044 J	0.038 JN
Dieldrin	ND(0.050U)	ND(0.020U)	ND(0.020U)	ND(0.010U)	ND(0.020U)	ND(0.020U)	ND(0.020U)	0.064 JN	ND(0.010U)	ND(0.010UJ)	R
4,4'-DDE	0.072 J	0.052 JN	0.055 J	0.021 J	0.073 J	0.053 J	ND(0.020U)	0.090 J	0.051 J	0.040 J	0.052 J
4,4'-DDD	ND(0.050U)	ND(0.020U)	ND(0.020U)	ND(0.010U)	ND(0.020U)	ND(0.020U)	ND(0.020U)	ND(0.050U)	0.015	ND(0.010UJ)	0.011
Heptachlor Epoxide	0.047 J	0.047 J	0.025 J	0.015 J	0.028 J	0.044 J	0.039 J	0.097 J	0.025 J	0.019 J	0.012 JN
gamma-Chlordane	0.031 JN	0.022 JN	0.018 J	0.0085 J	0.018 JN	R	0.018 JN	0.044 JN	0.016 JN	0.011 JN	0.013 J
alpha-Chlordane	ND(0.025U)	ND(0.010U)	0.015	0.0057	0.019	0.016	0.019	ND(0.025U)	0.012	0.010 J	0.0089
trans-Nonachlor	0.032	R	0.020	0.0064 JN	0.024	0.016 JN	0.024	0.026 JN	0.016 J	0.012 J	0.013 J
cis-Nonachlor	ND(0.025U)	ND(0.10U)	ND(0.010U)	ND(0.0050U)	0.011 JN	0.010 JN	0.011 J	ND(0.025U)	0.0087 JN	0.0065 JN	0.0076 JN
TAL											
Mercury	0.08 J,N	0.04 J,N	0.05 J,N	0.11 J,N	0.05 J,N	0.13 J,N	0.06 J,N	0.11 J,N	0.11 J,N	0.06 J,N	0.09 J,N

(See Notes on Page 3)

TABLE 3-6

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF BIOTA FIELD DATA AND CLP TCL/TAL ANALYTICAL RESULTS

	Carp Remaining Carcass Samples (1)										
Sample Number:	P40399R	P40400R	P40401R	P40402R	P40403R	P40404R	P40405R	P40406R	P40407R	P40408R	P40409R
Sample Date:	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93
Field Data											
Gender	Female	Female	Female	Male	Male	Female	Male	Male	Female	Male	Female
Length (cm)	61	49	48	53	53	52	49	49	47	48	47
Weight (g)	3400	1900	1800	2000	2300	2100	1700	1600	1700	1700	1300
Laboratory Data (3)											
Lipids (percent)	2.8	2.6	3.3	1.9	2.1	4.1	3.2	2.3	2.3	2.2	1.5
PCB											
Aroclor 1016	NA	ND(1.0U)	ND(0.25U)	NA	NA	ND(1.5U)	ND(0.50U)	ND(1.0U)	NA	ND(0.50U)	NA
Aroclor 1242	NA	ND(1.0U)	ND(0.25U)	NA	NA	ND(1.5U)	ND(0.50U)	ND(1.0U)	NA	ND(0.50U)	NA
Aroclor 1248	NA	9.2	2.0	NA	NA	11	6.4	11	NA	4.7	NA
Aroclor 1254	NA	ND(1.0U)	0.44	NA	NA	ND(1.5U)	ND(0.50U)	ND(1.0U)	NA	ND(0.50U)	NA
Aroclor 1260	NA	0.98 J	ND(0.25U)	NA	NA	1.0 J	0.53	0.97 J	NA	0.62	NA
Total PCB	NA	10J	2.4	NA	NA	12J	6.9	12J	NA	5.3	NA
Pesticide											
Aldrin	NA	0.24 J	0.079 JN	NA	NA	0.42	0.16	0.28 J	NA	0.10 J	NA
4,4'-DDE	NA	0.12 JN	0.075 J	NA	NA	0.18 JN	0.13	0.12 J	NA	0.11 J	NA
4,4'-DDD	NA	ND(0.050U)	0.023	NA	NA	ND(0.11U)	0.039	ND(0.050U)	NA	0.027	NA
Heptachlor Epoxide	NA	0.10 J	0.031 J	NA	NA	0.16 J	0.074	0.14 J	NA	0.040 J	NA
gamma-Chlordane	NA	R	0.023 J	NA	NA	R	0.038	0.058 JN	NA	0.027 JN	NA
alpha-Chlordane	NA	ND(0.025U)	0.021	NA	NA	0.056	0.041	0.029	NA	0.025	NA
trans-Nonachlor	NA	R	0.027	NA	NA	0.069 J	0.055	0.037 JN	NA	0.033 J	NA
cis-Nonachlor	NA	ND(0.025U)	0.013 J	NA	NA	ND(0.050U)	0.023	0.026 JN	NA	0.017 JN	NA
TAL											
Mercury	NA	0.20 J,N	0.07 JN	NA	NA	0.06 J,N	0.04 J,N	0.06 J,N	NA	0.06 J,N	NA

(See Notes on Page 3)

TABLE 3-6

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

SUMMARY OF BIOTA FIELD DATA AND CLP TCL/TAL ANALYTICAL RESULTS

	White Sucker Whole Body Samples (1)										
Sample Number:	P40410	P40411	P40412	P40413	P40414	P40415	P40416	P40417	P40418	P40419	P40420
Sample Date:	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93
Field Data											
Gender	Female	Female	Female	Male	Male	Male	Male	Male	Male	Female	Female
Length (cm)	27	25	25	23	21	18	16	21	18	16	15
Weight (g)	220	160	180	120	110	54	39	87	48	37	32
Laboratory Data (3)											
Lipids (percent)	1.1	1.7	2.4	1.0	1.0	1.1	0.70	0.87	0.83	1.8	1.5
PCB											
Aroclor 1016	0.14	ND(0.50U)	ND(0.25U)	ND(0.25U)	ND(0.10U)	ND(0.10U)	ND(0.050U)	0.17	ND(0.10U)	ND(0.25U)	ND(0.10U)
Aroclor 1242	ND(0.050U)	ND(0.50U)	ND(0.25U)	ND(0.25U)	ND(0.10U)	ND(0.10U)	ND(0.050U)	ND(0.050U)	0.50	2.4	ND(0.10U)
Aroclor 1248	ND(0.050U)	2.4	2.1	1.0	1.2	0.86	0.34	ND(0.050U)	1.4	ND(0.25U)	0.86
Aroclor 1254	0.23	ND(0.50U)	ND(0.25U)	0.31	0.15	ND(0.10U)	0.36	0.25	ND(0.10U)	ND(0.25U)	0.21
Aroclor 1260	0.072	ND(0.50U)	0.19 J	ND(0.25U)	ND(0.10U)	0.11	ND(0.050U)	0.022 J	0.18	ND(0.25U)	0.13
Total PCB	0.44	2.4	2.3J	1.3	1.4	0.97	0.70	0.44J	2.1	2.4	1.2
Pesticide											
Aldrin	ND(0.050U)	0.10 JN	0.056	0.034 JN	0.050 JN	0.065 JN	0.012 JN	0.0085 JN	0.039	0.048	0.024
4,4'-DDE	0.11	0.11	0.12	0.049 J	0.053 J	0.073	0.023 J	0.040	0.025 J	0.027	0.020 J
4,4'-DDD	ND(0.10U)	ND(0.10U)	0.021	ND(0.020U)	0.014	0.023	ND(0.010U)	ND(0.010U)	ND(0.010U)	ND(0.020U)	ND(0.010U)
Heptachlor Epoxide	ND(0.050U)	0.10	0.058	0.031 J	0.023 J	0.027 JN	0.014	R	0.034	0.052	0.020
gamma-Chlordane	ND(0.050U)	ND(0.050U)	R	ND(0.010U)	0.016 J	0.021 J	ND(0.0050U)	ND(0.0050U)	R	ND(0.010U)	0.0073 JN
alpha-Chlordane	ND(0.050U)	ND(0.050U)	0.022	ND(0.010U)	0.014	0.020	ND(0.0050U)	ND(0.0050U)	ND(0.0050U)	ND(0.010U)	0.0058
trans-Nonachlor	ND(0.050U)	ND(0.050U)	0.028	ND(0.010U)	0.019 J	0.026	ND(0.0050U)	0.0054	ND(0.0050U)	ND(0.010U)	0.0059 J
cis-Nonachlor	ND(0.050U)	ND(0.050U)	0.013	ND(0.020U)	0.0085 JN	0.011 JN	ND(0.0050U)	ND(0.0050U)	ND(0.0050U)	ND(0.010U)	ND(0.0050U)
TAL											
Mercury	0.07 *	0.04 *	0.04 *	0.04 *	0.03 *	0.03 *	0.04 *	0.03 *	0.03 *	0.03 *	0.03 *

Notes:
(1) Showing only the results for compounds/analytes detected above quantitation limit. Carp and white sucker samples were analyzed for Aroclors 1221 and 1232, but no samples were quantitated as these Aroclors.
(2) Skin-off fillets.
(3) All laboratory data reported in mg/kg except where noted otherwise.
NA - Sample not analyzed.
Data are rounded to two significant digits.

Notes Explaining Data Qualifiers:
J - The compound was positively identified; however, the associated numerical value is an estimated concentration only.
JN - The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
N - Matrix spike recovery outside of control limits.
U - The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
UJ - The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.
R - The sample results were rejected.
* - Duplicate analysis not within control limit.

TABLE 3-7

ALLIED PAPER, INC/PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT
SUMMARY OF DETECTED PCB IN PORTAGE CREEK
CARP FILLET SAMPLES

Sample Number	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
P40399F	Female	61	3400	2.3	4.4
P40400F	Female	49	1900	1.4	4.3
P40401F	Female	48	1800	2.2	2.0
P40402F	Male	53	2000	0.75	1.6
P40403F	Male	53	2300	1.5	2.1
P40404F	Female	52	2100	1.6	4.7
P40405F	Male	49	1700	1.6	3.1
P40406F	Male	49	1600	1.4	8.8
P40407F	Female	47	1700	1.3	3.1
P40408F	Male	48	1700	1.3	1.5
P40409F	Female	47	1300	1.1	2.0
Mean		51	2000	1.5	3.4
SD		4	550	0.44	2.1

Notes:
Data are rounded to two signficant digits.
Samples analyzed as skin-off fillets.
SD - Standard deviation.

TABLE 3-8

ALLIED PAPER, INC/PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT
SUMMARY OF DETECTED PCB IN PORTAGE CREEK
CARP REMAINING CARCASS SAMPLES

Sample Number	Gender	Length (cm)	Weight (g)	Lipids (%)	Total PCB (mg/kg)
P40399R	Female	61	3400	2.8	NA
P40400R	Female	49	1900	2.6	10.2
P40401R	Female	48	1800	3.3	2.4
P40402R	Male	53	2000	1.9	NA
P40403R	Male	53	2300	2.1	NA
P40404R	Female	52	2100	4.1	12
P40405R	Male	49	1700	3.2	6.9
P40406R	Male	49	1600	2.3	12
P40407R	Female	47	1700	2.3	NA
P40408R	Male	48	1700	2.2	5.3
P40409R	Female	47	1300	1.5	NA
Mean		51	2000	2.6	8.1
SD		4	550	0.74	3.9

Notes:
Data are rounded to two signficant digits.
SD - Standard deviation.
NA - No Analysis Performed

TABLE 3-9

ALLIED PAPER, INC/PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT
SUMMARY OF DETECTED PCB IN PORTAGE CREEK
WHITE SUCKER WHOLE BODY SAMPLES

Sample Number	Gender	Length (cm)	Weight (g)	Lipids (%)	Total PCB (mg/kg)
P40410	Female	27	220	1.1	0.44
P40411	Female	25	160	1.7	2.4
P40412	Female	25	180	2.4	2.3
P40413	Male	23	120	1	1.3
P40414	Male	21	110	1	1.4
P40415	Male	18	54	1.1	0.97
P40416	Male	16	39	0.7	0.7
P40417	Male	21	87	0.87	0.44
P40418	Male	18	48	0.83	2.1
P40419	Female	16	37	1.8	2.4
P40420	Female	15	32	1.5	1.2
Mean		20	99	1.3	1.4
SD		4.1	65	0.52	0.77

Note:
SD - Standard deviation.
Data are rounded to 2 significant digits.

TABLE 4-1

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

FLOW AND PCB DATA PAIRS USED IN PORTAGE CREEK PCB LOAD ESTIMATE
SORTED BY FLOW

Alcott Street Samples						Cork Street Samples					
Sample ID	Duplicate ID	Date	Time	Flow (cfs)	PCB (ug/L)	Sample ID	Duplicate ID	Date	Time	Flow (cfs)	PCB (ug/L)
A64590	A64592	5/19/97	1155	43	0.067	A64591		5/19/97	1700	34	0.0125
A64011		9/8/94	1555	48	0.16	A64010		9/8/94	1640	43	0.0125
A64013		9/21/94	1225	49	0.21	A64014		9/21/94	1300	46	0.0125
A64000	A64001	8/24/93	1640	55	0.23	A64004		12/15/93	1230	53	0.0125
A64005	A64007	12/28/93	1235	58	0.062	A64006		12/28/93	1310	55	0.0125
A64003		12/15/93	1145	59	0.0125	A64002		8/24/93	1740	57	0.0125
A66550	A66552	12/3/93	1450	66	0.029	A66551		12/3/93	1540	64	0.0125
A66548		12/3/93	0915	69	0.039	A66554		4/11/94	2215	64	0.0125
A66553		4/11/94	2145	69	0.048	A66549		12/3/93	0940	66	0.0125
A66515		9/18/93	0905	77	0.10	A66516		9/18/93	0950	70	0.0125
A66546		12/2/93	2115	78	0.034	A66510		9/17/93	0915	73	0.0125
A66509		9/17/93	0850	80	0.081	A66543		12/2/93	1440	73	0.0125
A66511		9/17/93	1210	80	0.086	A66547		12/2/93	2145	74	0.0125
A66544		12/2/93	1745	81	0.040	A66503		9/16/93	1040	75	0.0125
A66542		12/2/93	1400	82	0.0125	A66545		12/2/93	1820	75	0.0125
A66504	A66505	9/16/93	1340	83	0.043	A66514		9/17/93	1605	78	0.0125
A66507		9/16/93	1725	83	0.032	A66512		9/17/93	1240	78	0.0125
A66513		9/17/93	1535	83	0.094	A66581		4/13/94	2300	79	0.0125
A66502		9/16/93	1000	84	0.035	A66506		9/16/93	1425	80	0.064
A66580	A66582	4/13/94	2230	85	0.067	A66508		9/16/93	1750	80	0.0125
A66538		10/20/93	1400	87	0.067	A66539		10/20/93	1430	85	0.0125
A66533	A66535	10/19/93	1720	94	0.030	A66534		10/19/93	1745	88	0.0125
A66555		4/12/94	0830	95	0.10	A66541		10/21/93	1140	89	0.0125
A66540		10/21/93	1110	96	0.071	A66556		4/12/94	0900	89	0.0125
A66500		9/15/93	1445	100	0.086	A66501		9/15/93	1610	90	0.0125
A66557	A66559	4/12/94	1030	105	0.11	A66558		4/12/94	1110	98	0.0125
A66531		10/19/93	1145	107	0.037	A66532		10/19/93	1240	100	0.0125
A66527		10/18/93	1415	111	0.055	A66528		10/18/93	1455	104	0.0125
A66560		4/12/94	1230	118	0.11	A66561		4/12/94	1300	110	0.0125
A66568		4/12/94	2100	118	0.023	A66569		4/12/94	2130	110	0.0125
A66562		4/12/94	1430	128	0.091	A66563		4/12/94	1500	119	0.0125
A66523		10/17/93	1720	212	0.041	A66524		10/17/93	1745	198	0.0125
A66521		10/17/93	1420	240	0.041	A66522		10/17/93	1445	224	0.0125

Notes:

Where flow was measured at Alcott Street, but not Cork Street, flow at Cork Street was calculated to be 0.93 times the flow at Alcott Street based on regression analysis of data from both locations.

If either flow or PCB concentration data were not available for a given sample event, it was not included in the load calculations.

Results of duplicate samples have been arithmetically averaged.

PCB non-detections were counted as approximately one-half the method detection limit, 0.0125 ug/L.

TABLE 4-2

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

CALCULATIONS FOR THE FLOW - STRATIFIED ESTIMATES OF ANNUAL PCB LOAD IN PORTAGE CREEK

Alcott Street							Cork Street						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
Flow Range (cfs)	Annual Fraction of Time Flow Occurs	Cumulative Occurrence Frequency	Average PCB Concentration Observed (ug/L)	Daily Load For Increment (kg)	Annual Load For Increment (kg)	Fraction of Annual Load From Increment (kg)	Flow Range (cfs)	Annual Fraction of Time Flow Occurs	Cumulative Occurrence Frequency	Average PCB Concentration Observed (ug/L)	Daily Load For Incremen (kg)	Annual Load For Increment (kg)	Fraction of Annual Load From Increment (kg)
<= 30	0.0200	0.0200	0.0670	0.0049	1.79	0.036	<= 30	0.0200	0.0200	0.0125	0.0009	0.33	0.007
31 - 35	0.0400	0.0600	0.0670	0.0053	1.94	0.078	31 - 35	0.0400	0.0600	0.0125	0.0010	0.36	0.015
36 - 40	0.1400	0.2000	0.0670	0.0061	2.24	0.314	36 - 40	0.1400	0.2000	0.0125	0.0011	0.42	0.059
41 - 45	0.1400	0.3400	0.0670	0.0070	2.54	0.356	41 - 45	0.1400	0.3400	0.0125	0.0013	0.47	0.066
46 - 50	0.1600	0.5000	0.1850	0.0215	7.84	1.255	46 - 50	0.1600	0.5000	0.0125	0.0015	0.53	0.085
51 - 55	0.1450	0.6450	0.2300	0.0295	10.78	1.563	51 - 55	0.1450	0.6450	0.0125	0.0016	0.59	0.085
56 - 60	0.0950	0.7400	0.0373	0.0052	1.91	0.182	56 - 60	0.0950	0.7400	0.0125	0.0018	0.64	0.061
61 - 65	0.0600	0.8000	0.0206	0.0031	1.15	0.069	61 - 65	0.0600	0.8000	0.0125	0.0019	0.70	0.042
66 - 70	0.0600	0.8600	0.0387	0.0064	2.33	0.140	66 - 70	0.0600	0.8600	0.0125	0.0021	0.75	0.045
71 - 75	0.0400	0.9000	0.0570	0.0101	3.69	0.148	71 - 75	0.0400	0.9000	0.0125	0.0022	0.81	0.032
76 - 80	0.0400	0.9400	0.0753	0.0143	5.20	0.208	76 - 80	0.0400	0.9400	0.0125	0.0024	0.86	0.035
81 - 85	0.0150	0.9550	0.0462	0.0093	3.40	0.051	81 - 85	0.0150	0.9550	0.023	0.0046	1.69	0.025
86 - 90	0.0100	0.9650	0.0670	0.0143	5.23	0.052	86 - 90	0.0100	0.9650	0.0125	0.0027	0.98	0.010
91 - 95	0.0050	0.9700	0.0650	0.0147	5.37	0.027	91 - 95	0.0050	0.9700	0.0125	0.0028	1.03	0.005
96 - 100	0.0150	0.9850	0.0785	0.0187	6.83	0.102	96 - 100	0.0150	0.9850	0.0125	0.0030	1.09	0.016
101 - 110	0.0050	0.9900	0.0735	0.0189	6.89	0.034	101 - 110	0.0050	0.9900	0.0125	0.0032	1.17	0.006
111 - 120	0.0020	0.9920	0.0633	0.0178	6.50	0.013	111 - 120	0.0020	0.9920	0.0125	0.0035	1.28	0.003
121 - 130	0.0020	0.9940	0.0910	0.0278	10.15	0.020	121 - 130	0.0020	0.9940	0.0125	0.0038	1.39	0.003
131 - 240	0.0030	0.9970	0.0410	0.0185	6.77	0.020	131 - 240	0.0030	0.9970	0.0125	0.0057	2.06	0.006
Total Flow-Stratified PCB Load Estimate (kg) =						4.7	Total Flow-Stratified PCB Load Estimate (kg) =						0.60

Notes:

A Flow increment for individual PCB load estimate, which will be weighted by frequency of occurrence to derive an estimate of annual PCB load.

B Approximate fraction of time, on an annual basis, that flow in Portage Creek is within the flow range. Obtained from Line B-B on Figure 3

C Cumulative flow frequency in the fraction of time on an annual basis, that flow in Portage Creek is equal to or less than the upper limit of the flow increment. These values were obtained from curve B-B on Fig

D Average observed PCB concentration for the flow increment, obtained from the data in Table 4-1. If no samples were collected from a given flow increment, the average PCB concentration from the nearest fl increments for which data were collected was used.

E Daily average PCB load based on the average flow within the given flow increment and the corresponding average PCB concentration observed within that flow increment. Calculated as the average flow in the flow increment in Column A times the PCB concentration in Column D times 0.002445, where 0.002445 is a conversion factor to produce a load estimate in units of kg/day. 30 cfs was used as the flo for the first increment.

F Annual PCB load if the flow increment were to occur all year. This is the daily PCB load (Column E) times 365 days/year.

G Fraction of the actual total annual PCB load that is attributed to the occurrence of the flow increment in Column A. Calculated by multiplying the fraction of a year a given flow range is expected to occur (Column B) by the annual PCB load expected to occur within that flow increment (Column F). This weights the individual PCB loads by the expected frequency of occurrence. The sum of Column G accounts for 100% of the expected annual flow and PCB load.

TABLE 4-3

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER
SUPERFUND SITE

ALLIED PAPER, INC. OPERABLE UNIT

COMPARISON OF CONSTITUENT CONCENTRATIONS IN PORTAGE CREEK CARP FILLET SAMPLES
TO MDCH TRIGGER CONCENTRATIONS

Sample Number:	Total Mercury (mg/kg)	Aldrin (mg/kg)	Dieldrin (mg/kg)	DDT(1) (mg/kg)	Heptachlor epoxide (2) (mg/kg)	Total chlordane (mg/kg) (3)	Total PCB (mg/kg) (4)
P40399F	0.08	0.14	0.025	0.072	0.047	0.063	4.4
P40400F	0.04	0.10	0.010	0.052	0.047	0.022	4.3
P40401F	0.05	0.061	0.010	0.055	0.025	0.053	2.0
P40402F	0.11	0.037	0.0050	0.021	0.015	0.021	1.6
P40403F	0.05	0.071	0.010	0.073	0.028	0.072	2.1
P40404F	0.13	0.11	0.010	0.053	0.044	0.042	4.7
P40405F	0.06	0.087	0.010	0.010	0.039	0.072	3.1
P40406F	0.11	0.22	0.064	0.090	0.097	0.070	8.8
P40407F	0.11	0.062	0.0050	0.066	0.025	0.053	3.1
P40408F	0.06	0.044	0.0050	0.040	0.019	0.040	1.5
P40409F	0.09	0.038	R	0.063	0.012	0.043	2.0
Mean (5)	0.081	0.088	0.015	0.054	0.036	0.050	3.4
Trigger Level	0.50	0.30	0.30	5.0	0.30	0.30	0.05 - 2.0
No. Exceeding Trigger Level	0	0	0	0	0	0	11

Notes:

Carp fillets were all skin-off fillets.

MDCH - Michigan Department of Community Health.

R - Data not usable.

(1) MDCH trigger concentration for DDT includes degradation products DDD and DDE.

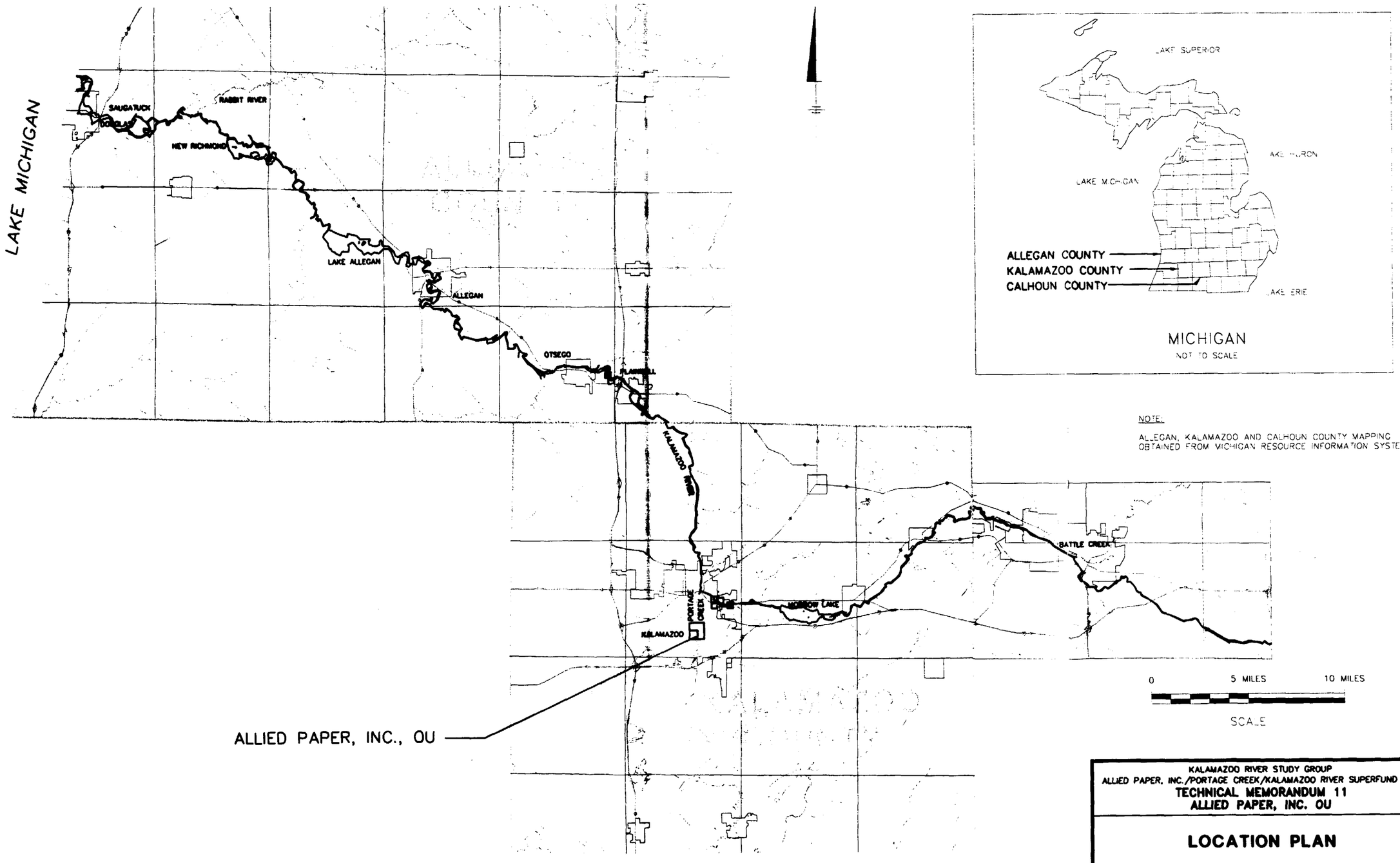
(2) MDCH trigger concentration listed is for Heptachlor; comparisons are made to 1993 RI data for Heptachlor epoxide (a heptachlor degradation product).

(3) Total chlordane consists of gamma-chlordane, alpha-chlordane, trans-nonachlor, and cis-nonachlor.

(4) The Michigan Department of Community Health (MDCH) establishes fish consumption advisories based on fish sampling results. The MDCH issues advisories for the general population, and for pregnant women, nursing mothers, women who plan to have children, and children under 15 years of age. For any of the organic contaminants (including PCB), when between 11 and 49 percent of samples exceed an MDCH trigger level (2.0 mg/kg), a "One meal per week" advisory is issued. When 50 percent or more exceed a trigger level, a "No Consumption" advisory is issued. Attempts are made to provide site-specific advice wherever possible. For any of the other organic contaminants, when more than 11 percent of samples exceed an MDCH trigger level, a "No Consumption" advisory is issued. Attempts are made to provide site-specific advice wherever possible. When data are too limited to judge the necessity for an advisory, but where some indication of contamination exists, an advisory is usually not issued but additional samples are requested. With small sample sizes a great deal of professional judgement is required in applying the above criteria. The average concentration is also considered.

(5) Assumes arithmetic mean where non-detections were counted as one-half of the method detection limit.

Figures



NOTE:

ALLEGAN, KALAMAZOO AND CALHOUN COUNTY MAPPING OBTAINED FROM MICHIGAN RESOURCE INFORMATION SYSTEM.

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TECHNICAL MEMORANDUM 11
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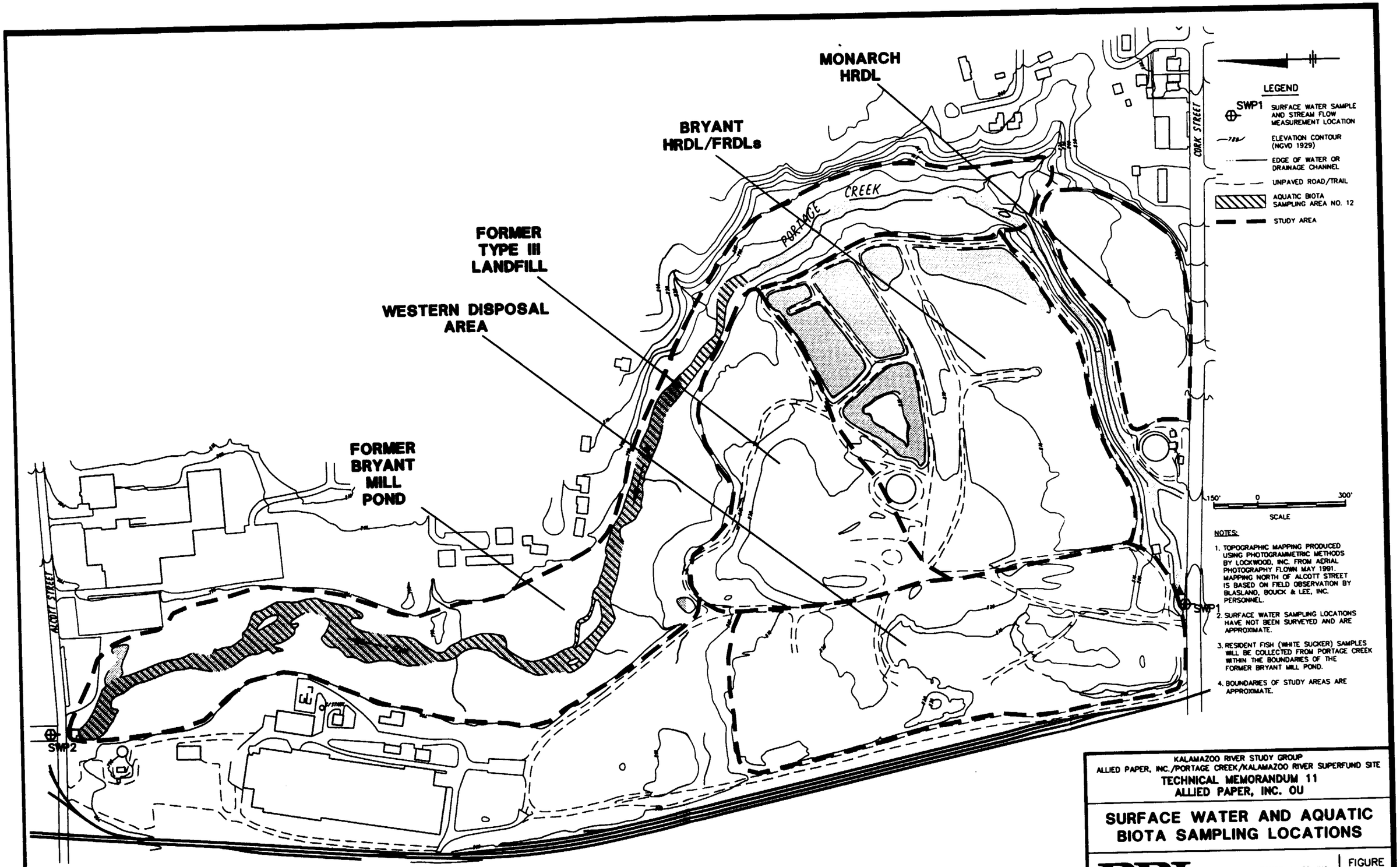
LOCATION PLAN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1

P:6450J897
L:ON=*,OFF=*REF*
5/13/98 SYR-54-RLP NES
64551403\64551G04.DWG



NOTES:

1. TOPOGRAPHIC MAPPING PRODUCED USING PHOTOGRAMMETRIC METHODS BY LOCKWOOD, INC. FROM AERIAL PHOTOGRAPHY FLOWN MAY 1991. MAPPING NORTH OF ALCOTT STREET IS BASED ON FIELD OBSERVATION BY BLASLAND, BOUCK & LEE, INC. PERSONNEL.
2. SURFACE WATER SAMPLING LOCATIONS HAVE NOT BEEN SURVEYED AND ARE APPROXIMATE.
3. RESIDENT FISH (WHITE SUCKER) SAMPLES WILL BE COLLECTED FROM PORTAGE CREEK WITHIN THE BOUNDARIES OF THE FORMER BRYANT MILL POND.
4. BOUNDARIES OF STUDY AREAS ARE APPROXIMATE.

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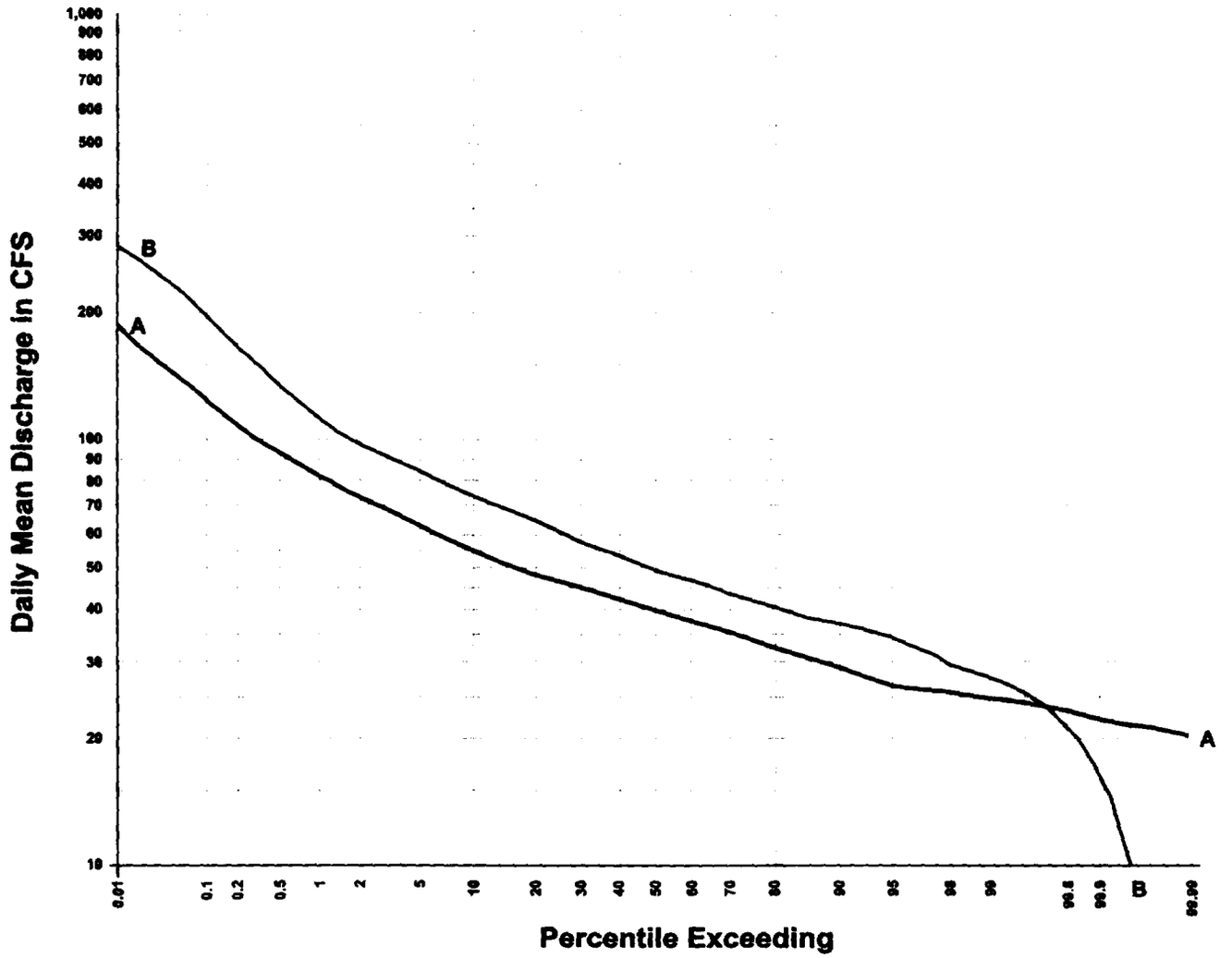
SURFACE WATER AND AQUATIC BIOTA SAMPLING LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2

X: 64551X01.DWG
L: ON=*, OFF=*REF*
P: STD-PCP/BL
5/22/00 SYR-54-NES OMS LAS
64551403/64551G07.DWG



LEGEND:

A-A PORTAGE CREEK AT LOVERS LANE
(USGS GAGE NO. 04106300), OCTOBER 1964 - SEPTEMBER 1992

B-B PORTAGE CREEK AT REED STREET
(USGS GAGE NO. 04106500), JUNE 1975 - SEPTEMBER, 1986

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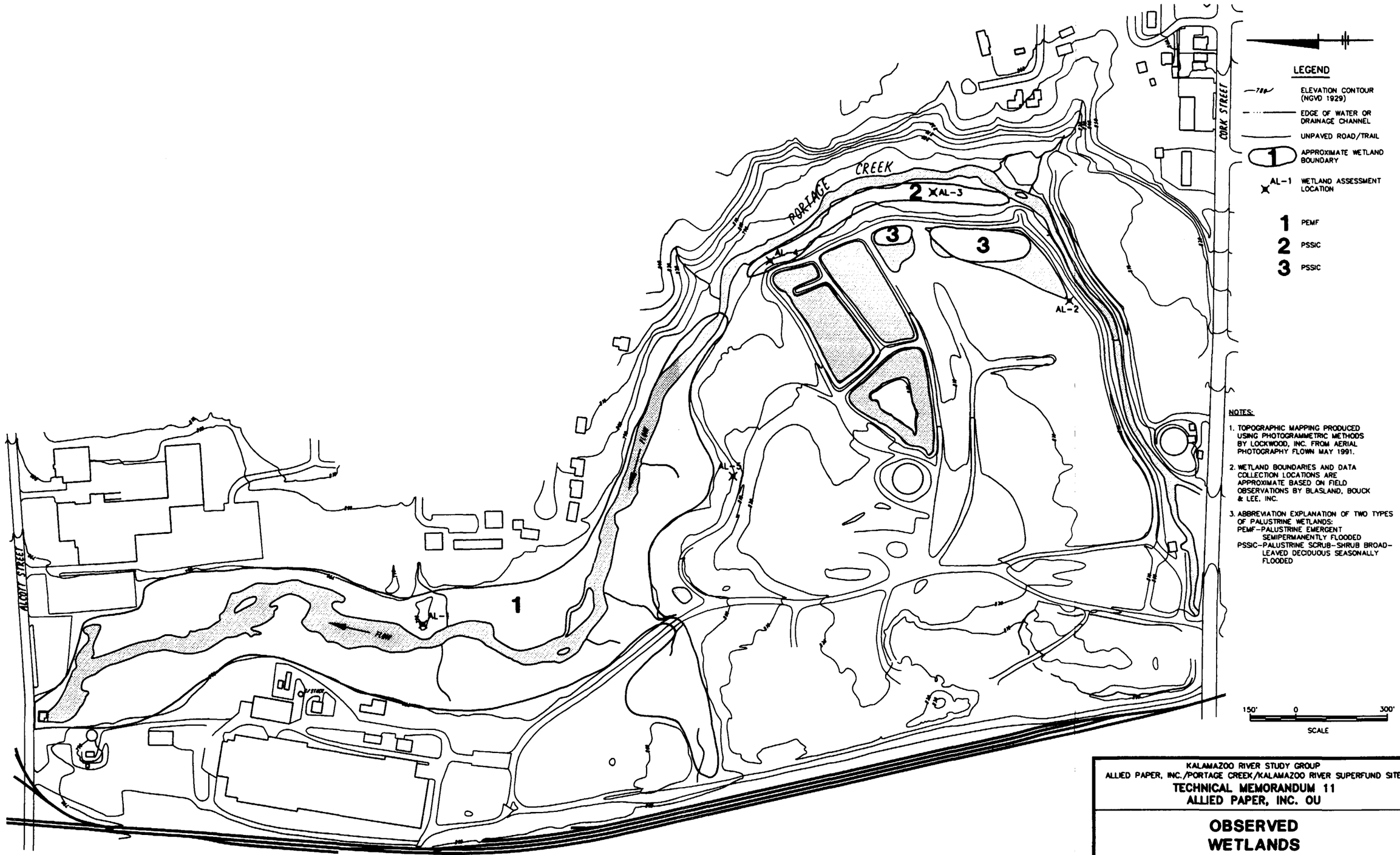
PORTAGE CREEK FLOW DURATION CURVES

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 3

05/00 SYR-D54-DJH LBR LAS
64551403/64551n04.cdr



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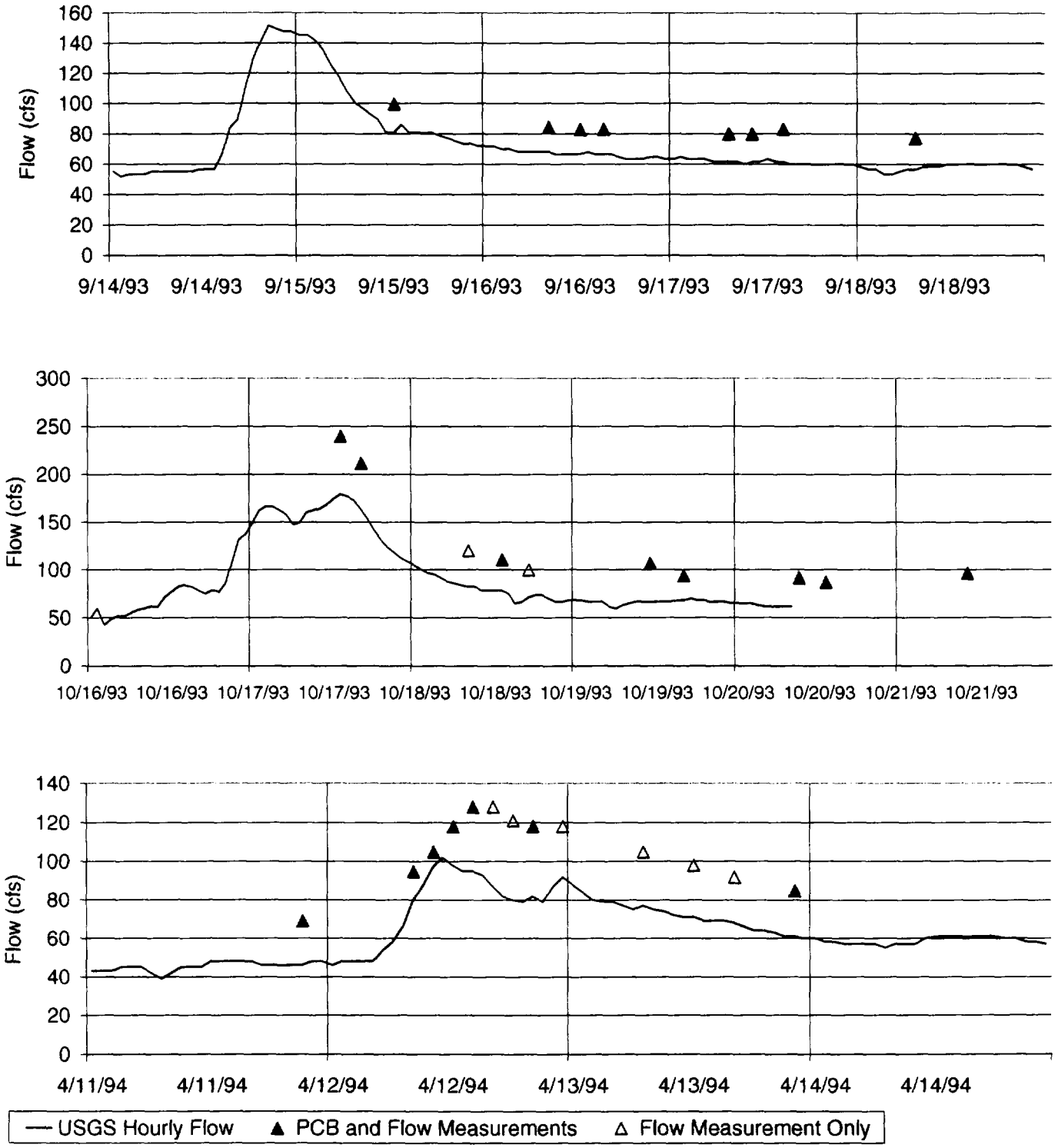
OBSERVED WETLANDS

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **4**

X: 64551X01.DWG
L: ON=*, OFF=*REF*
P: STD-PCP/BL
1/6/00 SYR-54-NES JMS GMS
64551403/64551G06.DWG



NOTES:
1. USGS gage data from Lovers Lane near Kalamazoo - USGS gage number 04106300.

2. December 1993 USGS gage data not available due to gage malfunction.

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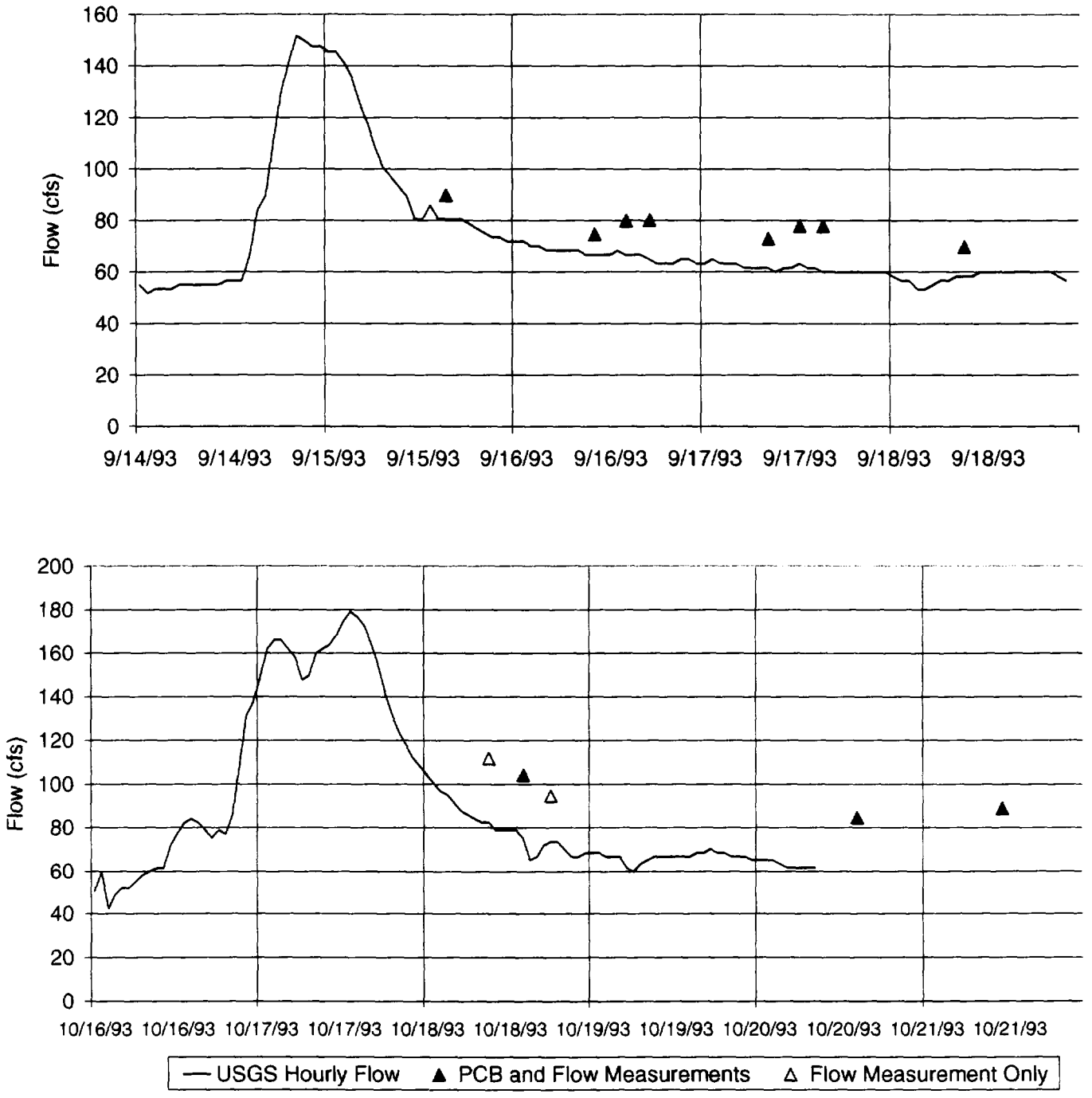
PORTAGE CREEK HYDROGRAPHS AT ALCOTT STREET

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE **5A**

mjs Qevents 5/23/00



NOTES:

1. USGS gage data from Lovers Lane near Kalamazoo - USGS gage number 04106300.

2. December 1993 USGS gage data not available due to gage malfunction.

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PORTAGE CREEK HYDROGRAPHS AT CORK STREET

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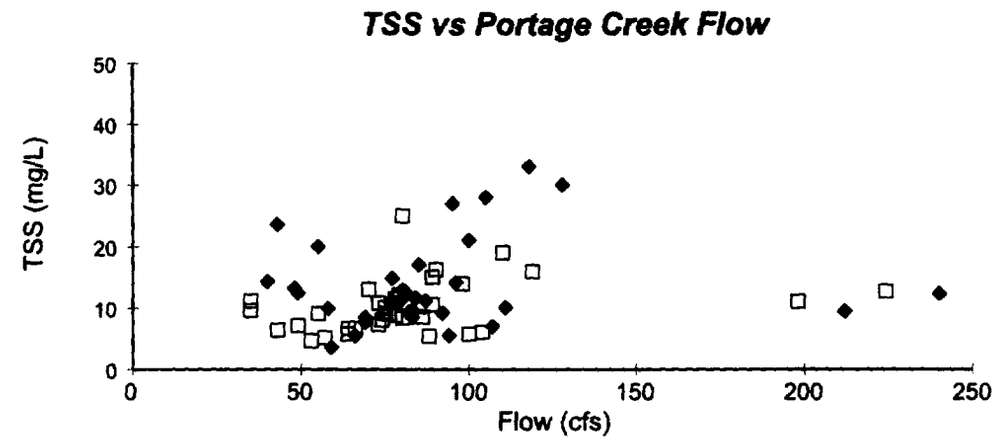
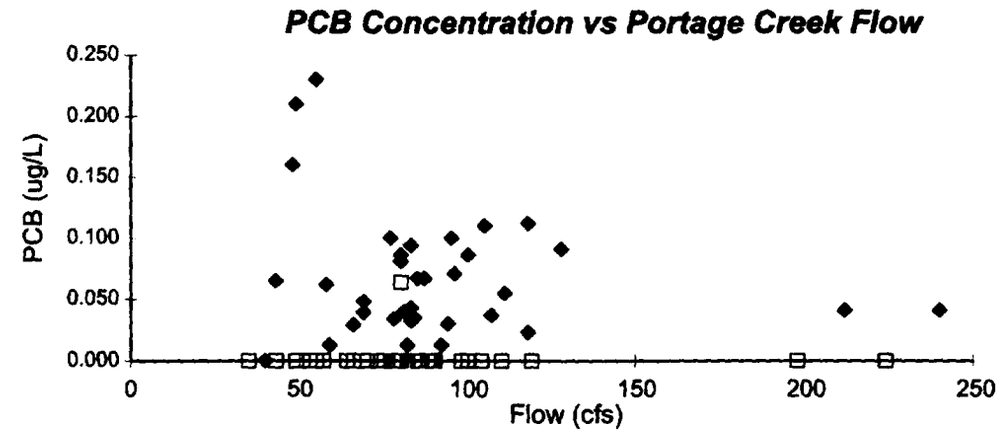
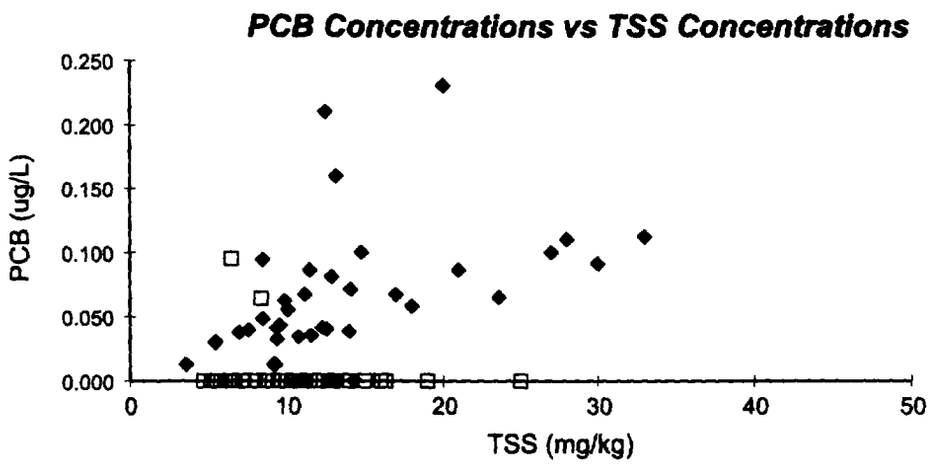
FIGURE 5B

mjs Qevents2 5/23/00







LEGEND:

◆ Alcott Street (Downstream)

□ Cork Street (Upstream)

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ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

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PCB, TSS AND FLOW DATA FROM PORTAGE CREEK

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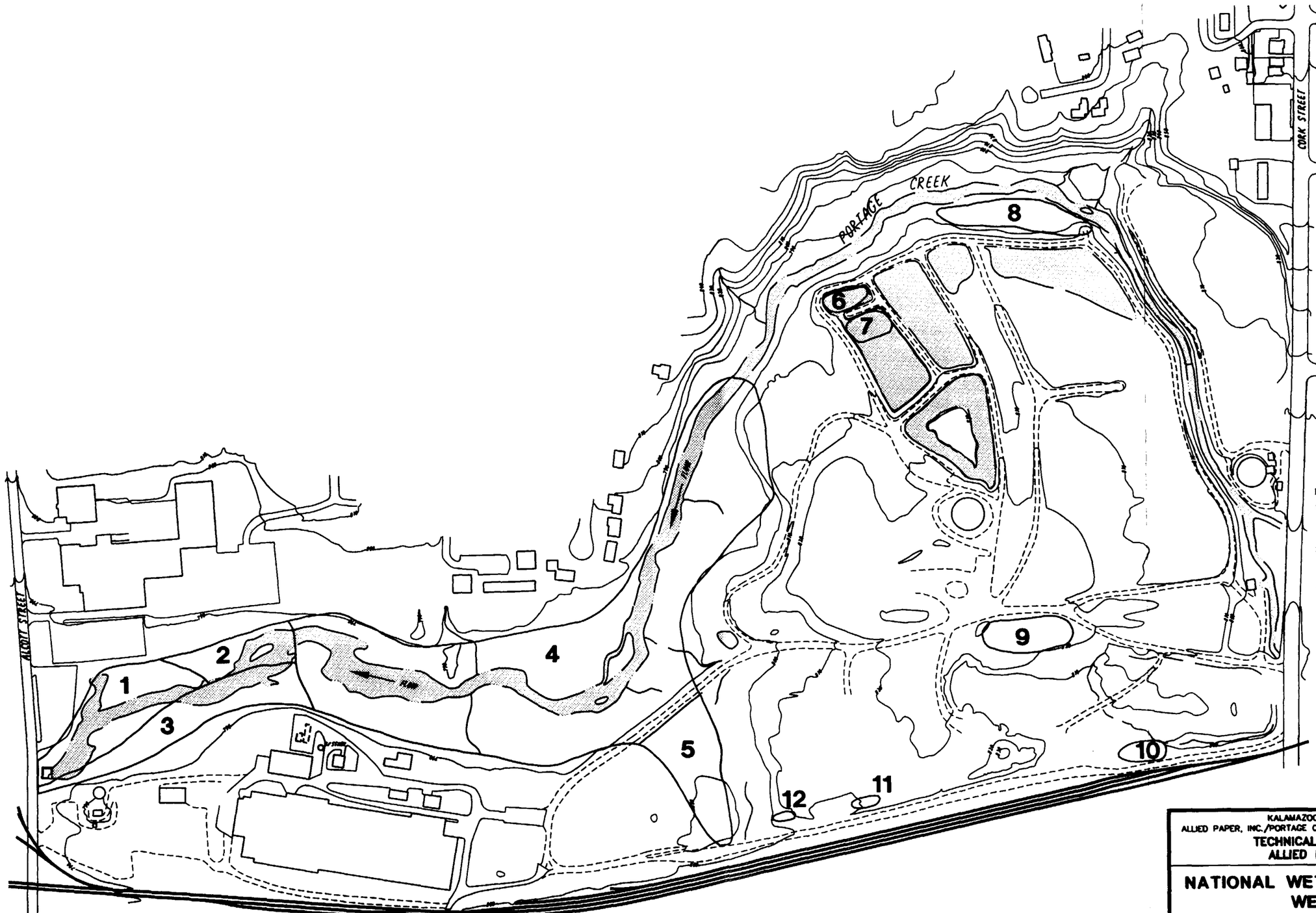
FIGURE 6

05/00 SYR-D54-DJH LBR LAS
64551403/64551n02.cdr



LEGEND

- ELEVATION CONTOUR (NGVD 1929)
- EDGE OF WATER OR DRAINAGE CHANNEL
- UNPAVED ROAD/TRAIL
- APPROXIMATE WETLAND BOUNDARY

1	PEMF
2	PSSIC
3	PSSIC
4	PEMF
5	PEMC
6	PUBF
7	PUBF
8	PEMC
9	PUBF
10	PEMC
11	PUBF
12	PUBF

NOTES:

1. TOPOGRAPHIC MAPPING PRODUCED USING PHOTOGRAMMETRIC METHODS BY LOCKWOOD, INC. FROM AERIAL PHOTOGRAPHY FLOWN MAY 1991.
2. WETLAND BOUNDARIES ARE APPROXIMATE BASED ON DRAFT NATIONAL WETLANDS INVENTORY MAP, KALAMAZOO, MICHIGAN QUADRANGLE, 1991.
3. ABBREVIATION EXPLANATION OF FOUR TYPES OF PALUSTRINE WETLANDS:
   - PEMF-PALUSTRINE EMERGENT SEMIPERMANENTLY FLOODED
   - PSSIC-PALUSTRINE SCRUB-SHRUB BROAD-LEAVED DECIDUOUS SEASONALLY FLOODED
   - PEMC-PALUSTRINE EMERGENT SEASONALLY FLOODED
   - PUBF-PALUSTRINE UNCONSOLIDATED BOTTOM SEMI-PERMANENTLY FLOODED AND SUBJECT TO EXCAVATION

150' 0 300'
SCALE

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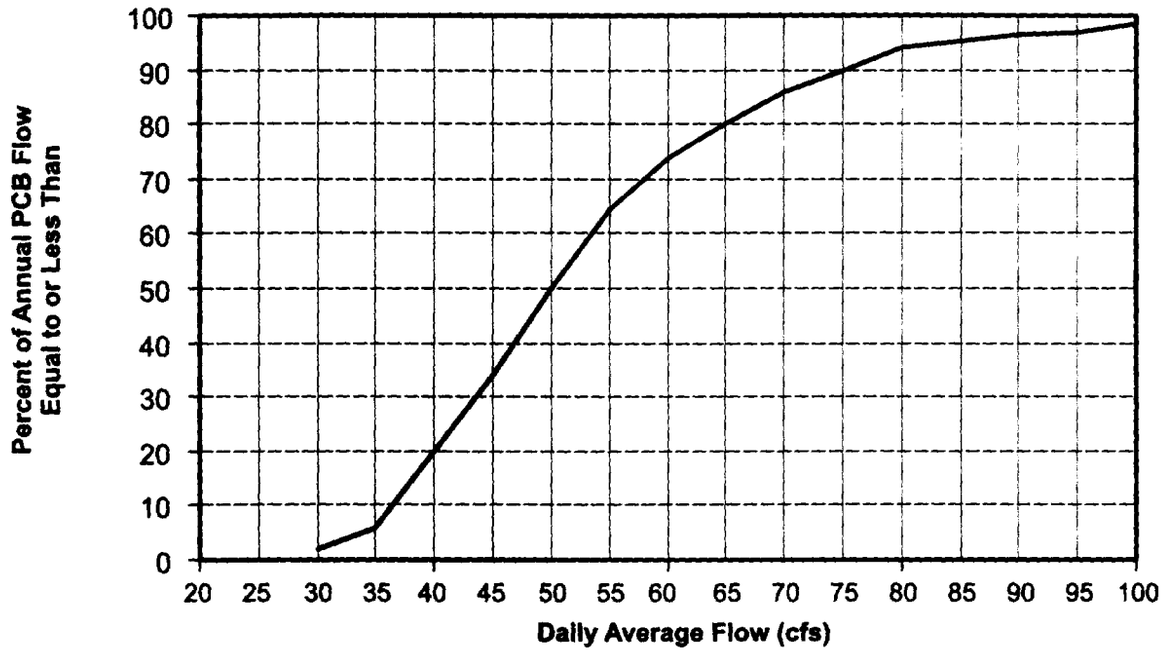
NATIONAL WETLANDS INVENTORY WETLANDS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

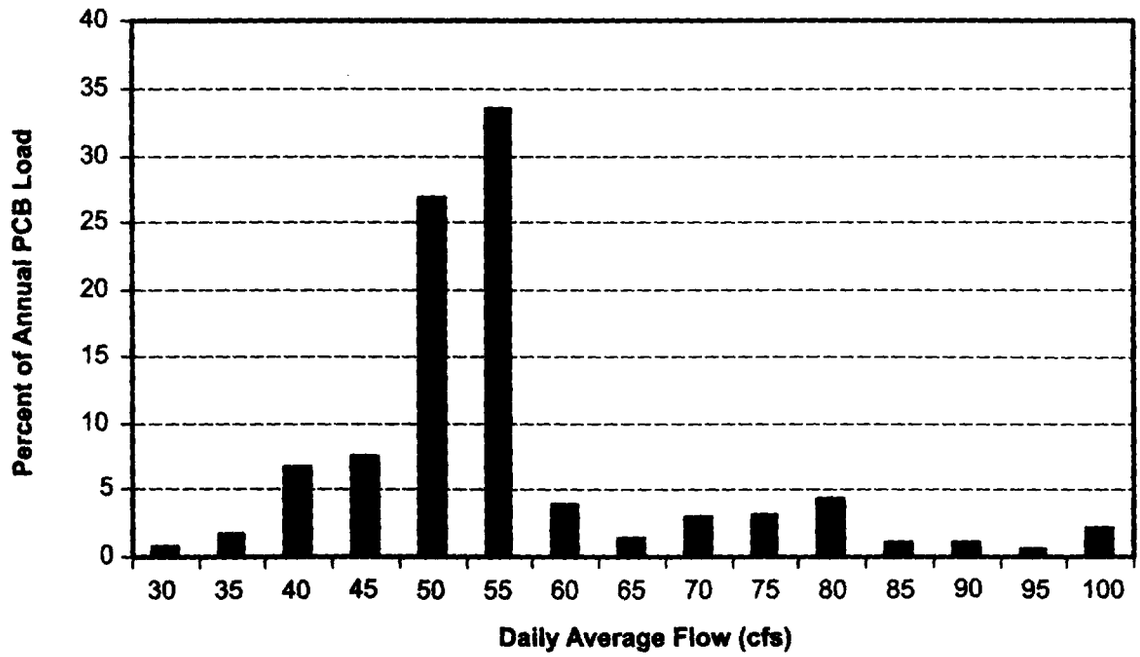
FIGURE 7

X: 64551X01.DWG
L: ON=*, OFF=*REF*
P: STD-PCP/BL
1/6/00 SYR-54-NES JMS GMS
64551403/64551G01.DWG

a) Cumulative Flow Frequency



b) Percent of Annual PCB Load by Flow Increment



NOTE:
Based on USGS flow data from Portage Creek at Reed Street (USGS Gage No. 04106500), 1975-1986.

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PCB LOAD AND FLOW AT ALCOTT STREET

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FIGURE 8

05/00 SYR-D54-DJH LBR LAS
64551403/64551n05.cdr