EPA Region 5 Records Ctr.
293483

Summary of Final Revised Baseline Ecological Risk Assessment (BERA) – April 2003

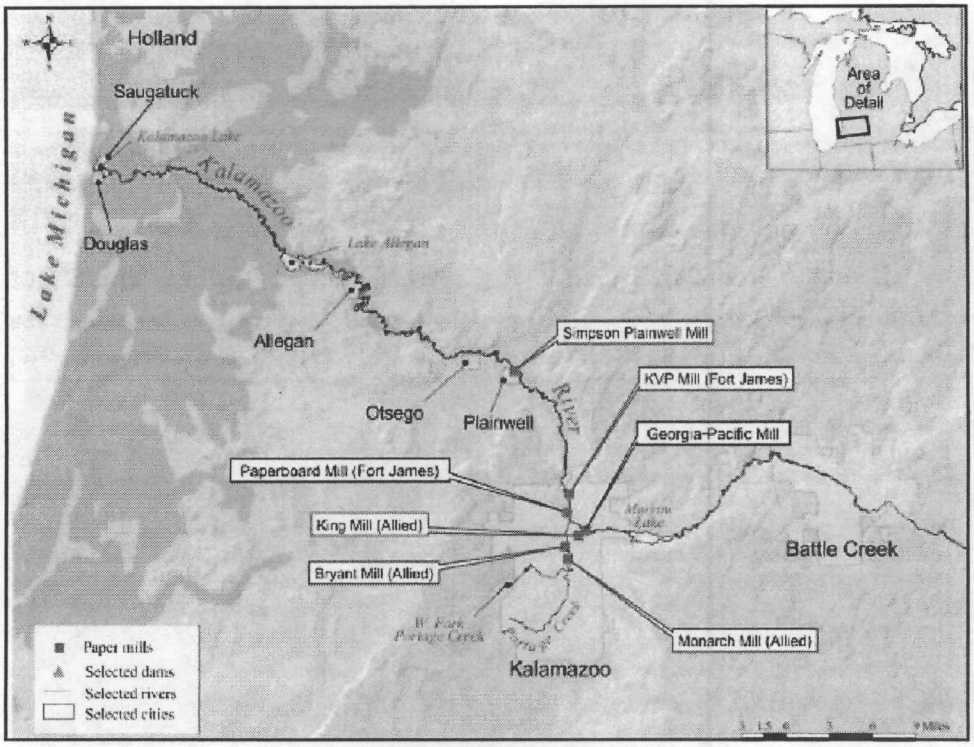
Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

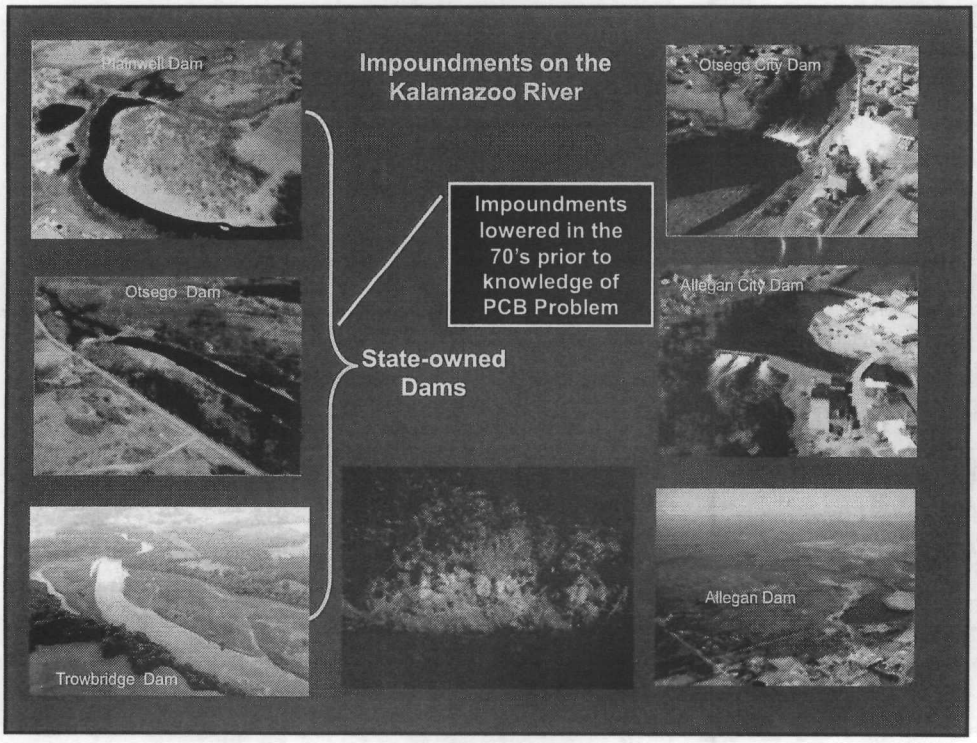
Michigan Department of Environmental Quality
Environmental Response Division
Lansing, MI

May 13, 2008

Overview

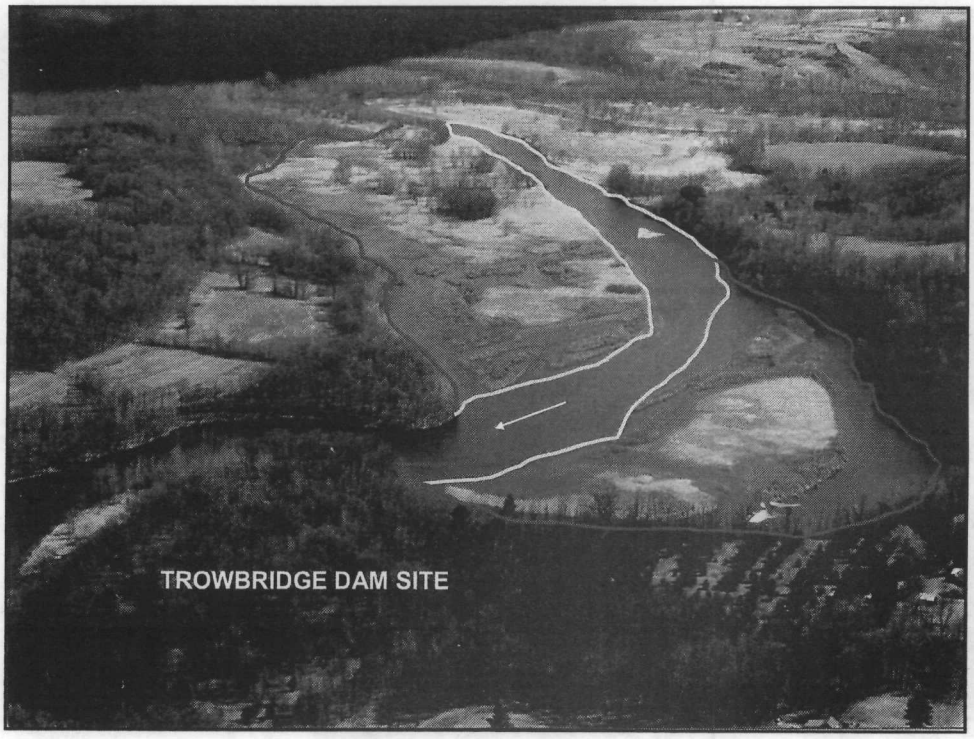
- Site Description
- BERA Development
- Conclusions

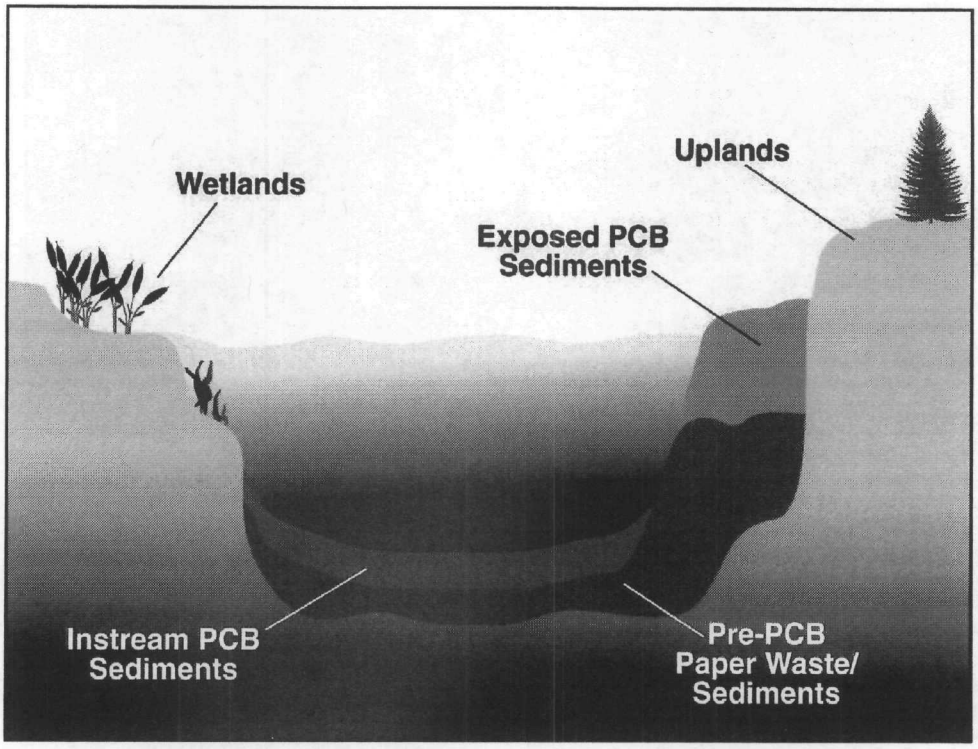

Holland
Saugatuck
Douglas
Lake Michigan
Kalamazoo
Allegan
Otsego
Plainwell
Simpson Plainwell Mill
KVP Mill (Fort James)
Georgia-Pacific Mill
Paperboard Mill (Fort James)
King Mill (Allied)
Bryant Mill (Allied)
Monarch Mill (Allied)
Battle Creek
Kalamazoo
Area of Detail
Paper mills
Selected dams
Selected rivers
Selected cities

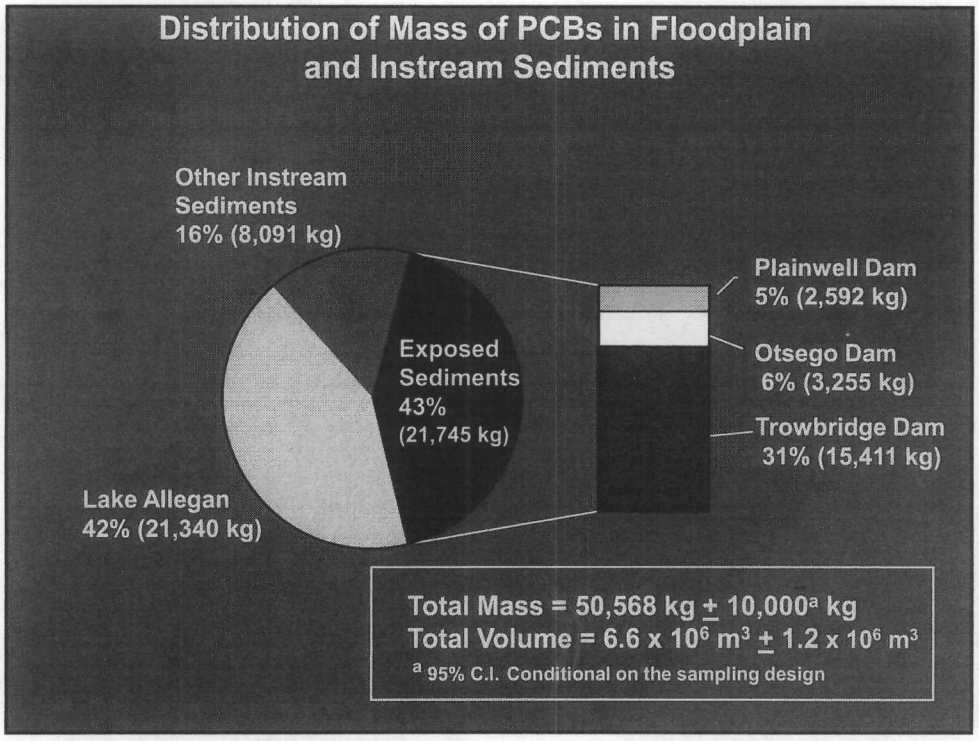

Impoundments on the Kalamazoo River
Plainwell Dam
Otsego City Dam
Impoundments lowered in the 70's prior to knowledge of PCB Problem
Otsego Dam
Allegan City Dam
State-owned Dams
Trowbridge Dam
Allegan Dam

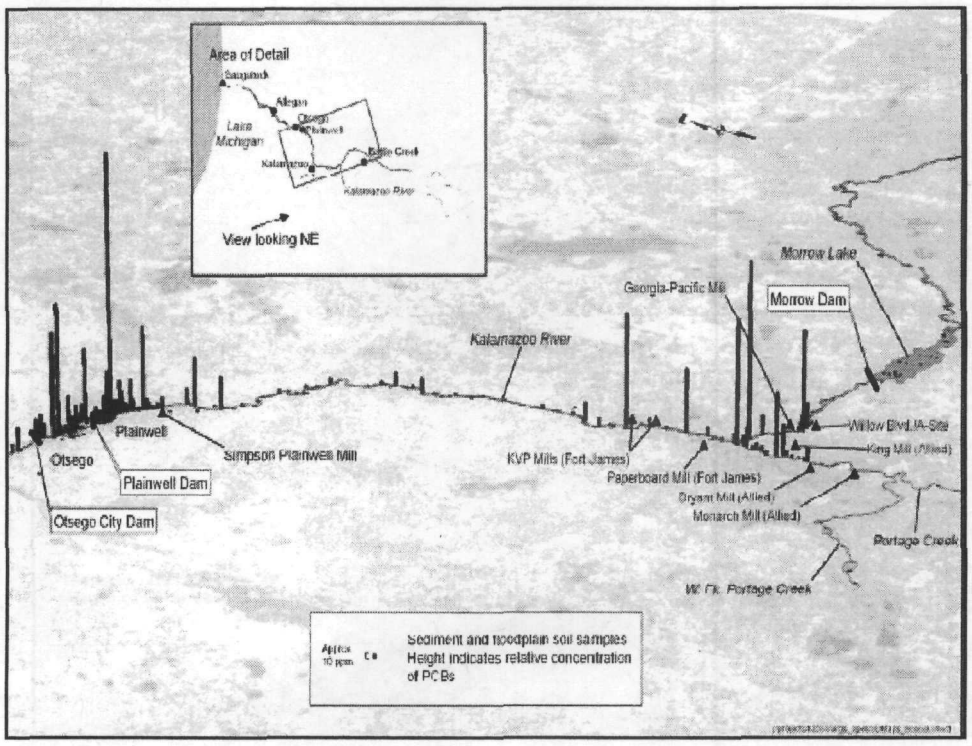
Background

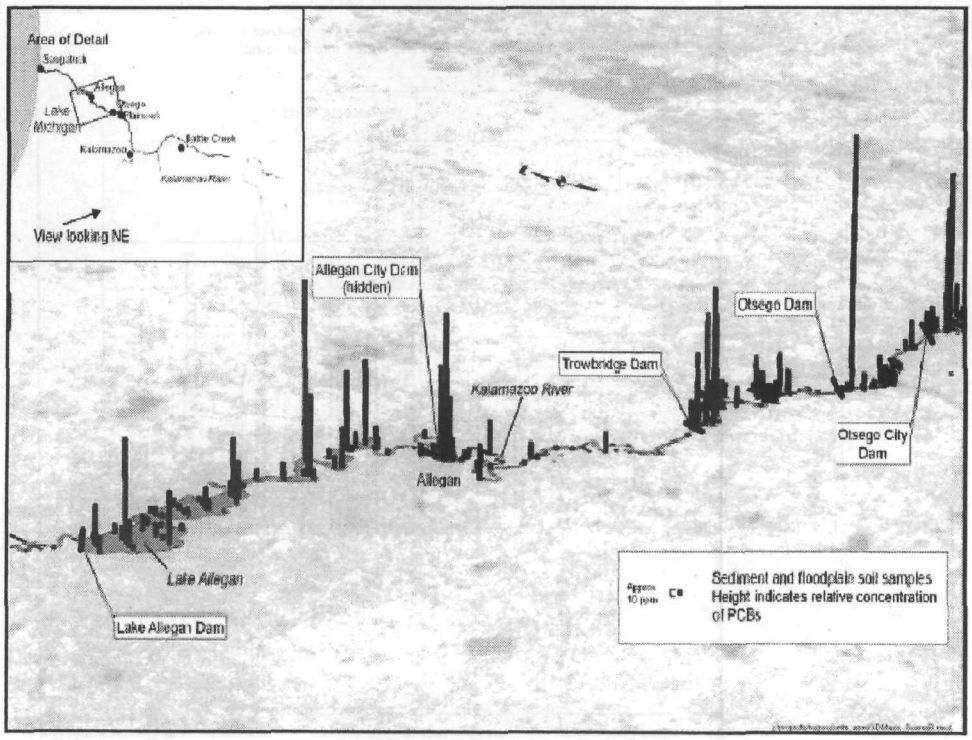
- Kalamazoo Area was known for paper production since the 1800's
- PCBs were used in No Carbon Required Paper from 1955-1972
- De-inking waste of recycled paper discharged directly to river and tributary
- Fish consumption advisory for PCBs in effect since 1977
- Site placed on Superfund list in late 1990
- PCBs found in surface water, sediment, floodplain soils (including wetlands) and terrestrial surface soils
- Ecological and Human Health Risk Assessment prepared by the Michigan Department of Environmental Quality
- Risk assessments reviewed and approved by USEPA in 2003.

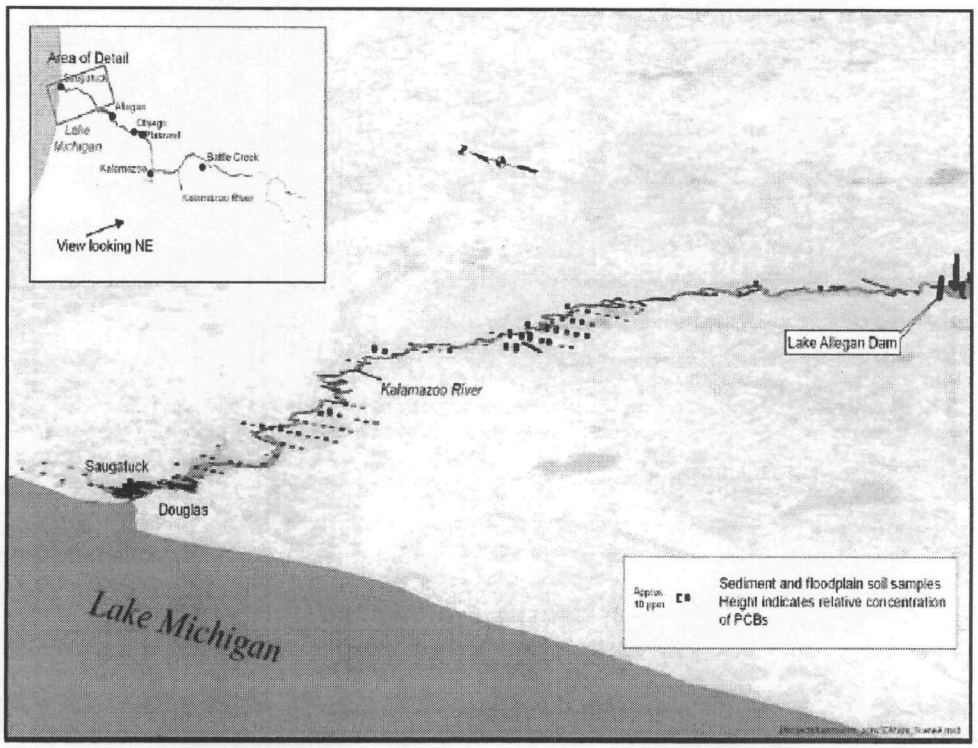



Wetlands
Uplands
Exposed PCB Sediments
Instream PCB Sediments
Pre-PCB Paper Waste/ Sediments


Distribution of Mass of PCBs in Floodplain and Instream Sediments
Other Instream Sediments 16% (8,091 kg)
Exposed Sediments 43% (21,745 kg)
Lake Allegan 42% (21,340 kg)
Plainwell Dam 5% (2,592 kg)
Otsego Dam 6% (3,255 kg)
Trowbridge Dam 31% (15,411 kg)
Total Mass = 50,568 kg ± 10,000[a] kg
Total Volume = 6.6 x 10^6 m^3 ± 1.2 x 10^6 m^3
[a] 95% C.I. Conditional on the sampling design


Area of Detail
Saugatuck
Allegan
Otsego
Plainwell
Lake Michigan
Battle Creek
Kalamazoo
Kalamazoo River
View looking NE
Morrow Lake
Georgia-Pacific Mill
Morrow Dam
Kalamazoo River
Willow Blvd./A-Site
King Mill (Allied)
Plainwell
Otsego
Simpson Plainwell Mill
KVP Mills (Fort James)
Paperboard Mill (Fort James)
Plainwell Dam
Dryam Mill (Allied)
Monarch Mill (Allied)
Otsego City Dam
Portage Creek
Wt. Ck. Portage Creek
Approx 10 ppm
Sediment and floodplain soil samples
Height indicates relative concentration of PCBs


Area of Detail
Saugatuck
Allegan
Otsego
Plainwell
Lake Michigan
Battle Creek
Kalamazoo
Kalamazoo River
View looking NE
Allegan City Dam (hidden)
Otsego Dam
Trowbridge Dam
Kalamazoo River
Otsego City Dam
Allegan
Lake Allegan
Lake Allegan Dam
Approx 10 ppm
Sediment and floodplain soil samples
Height indicates relative concentration of PCBs


Area of Detail
Saugatuck
Allegan
Otsego
Plainwell
Lake Michigan
Battle Creek
Kalamazoo
Kalamazoo River
View looking NE
Lake Allegan Dam
Kalamazoo River
Saugatuck
Douglas
Lake Michigan
Approx. 10 ppm
Sediment and floodplain soil samples
Height indicates relative concentration of PCBs

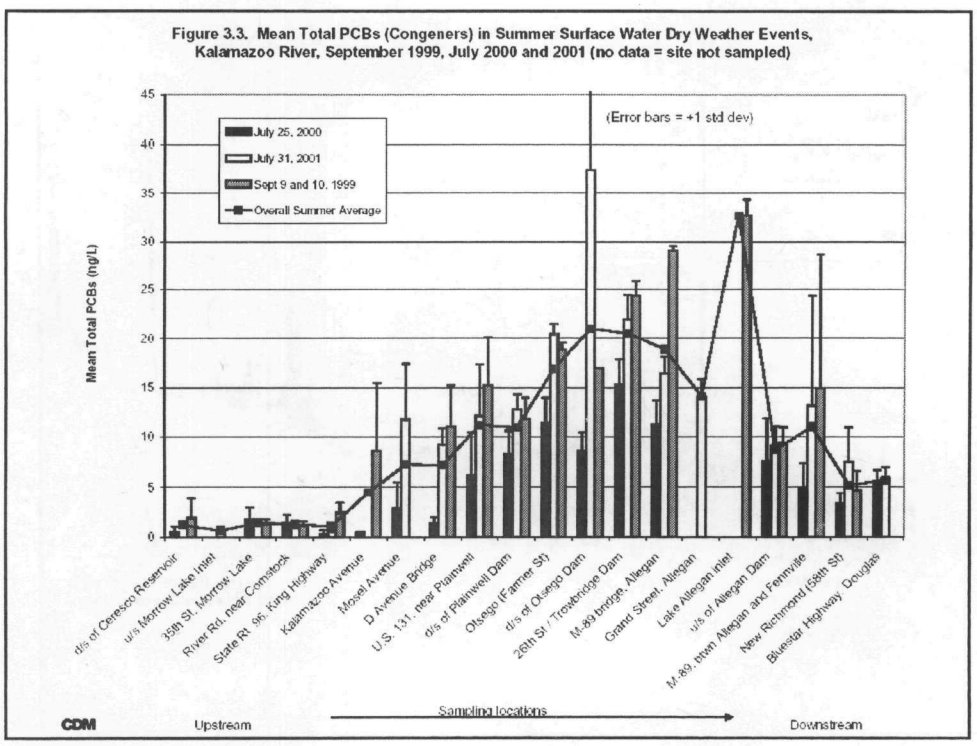
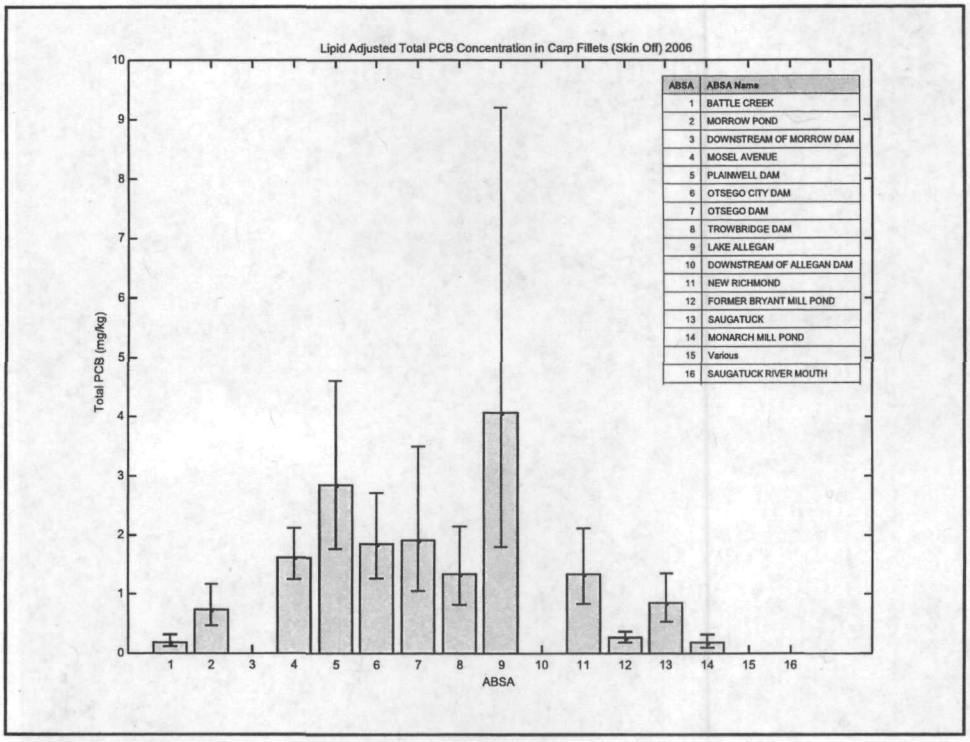
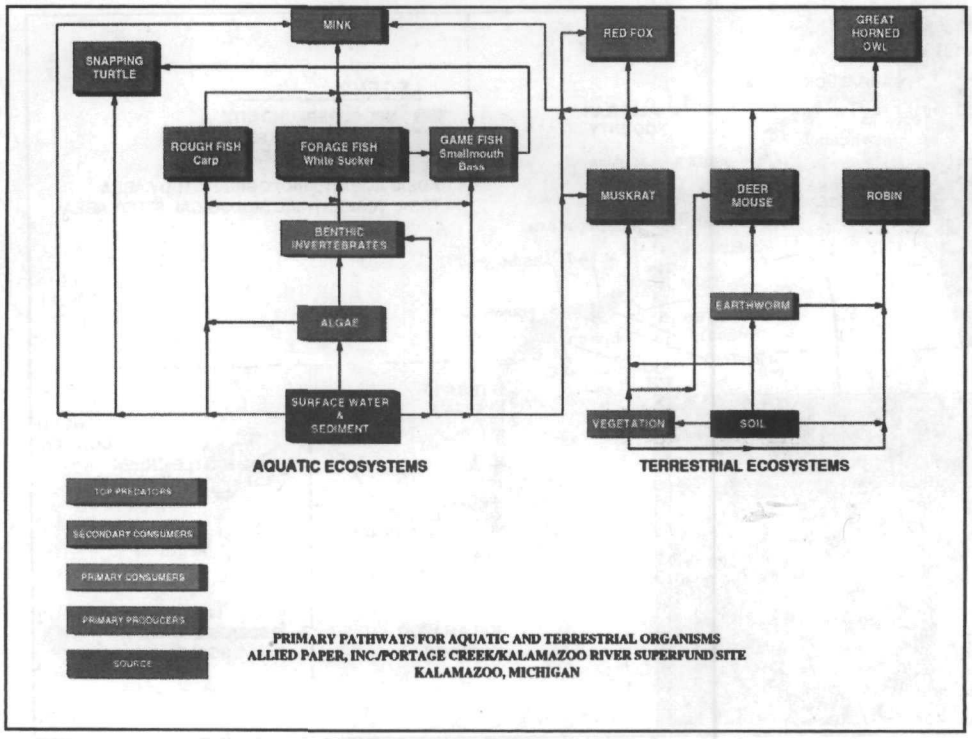


Figure 3.3. Mean Total PCBs (Congeners) in Summer Surface Water Dry Weather Events, Kalamazoo River, September 1999, July 2000 and 2001 (no data = site not sampled)
(Error bars = +1 std dev)
July 25, 2000
July 31, 2001
Sept 9 and 10, 1999
Overall Summer Average
Mean Total PCBs (ng/L)
0
5
10
15
20
25
30
35
40
45
d/s of Ceresco Reservoir
u/s Morrow Lake Inlet
35th St, Morrow Lake
River Rd, near Comstock
State Rt. 96, Kung Highway
Kalamazoo Avenue
Mosel Avenue
D Avenue Bridge
U.S. 131, near Plainwell
d/s of Plainwell Dam
Otsego (Farmer St)
d/s of Otsego Dam
26th St / Trowbridge Dam
M-89 bridge, Allegan
Grand Street, Allegan
Lake Allegan inlet
u/s of Allegan Dam
M-89, btwn Allegan and Fennville
New Richmond (68th St)
Bluestar Highway, Douglas
CDM
Upstream
Sampling locations
Downstream

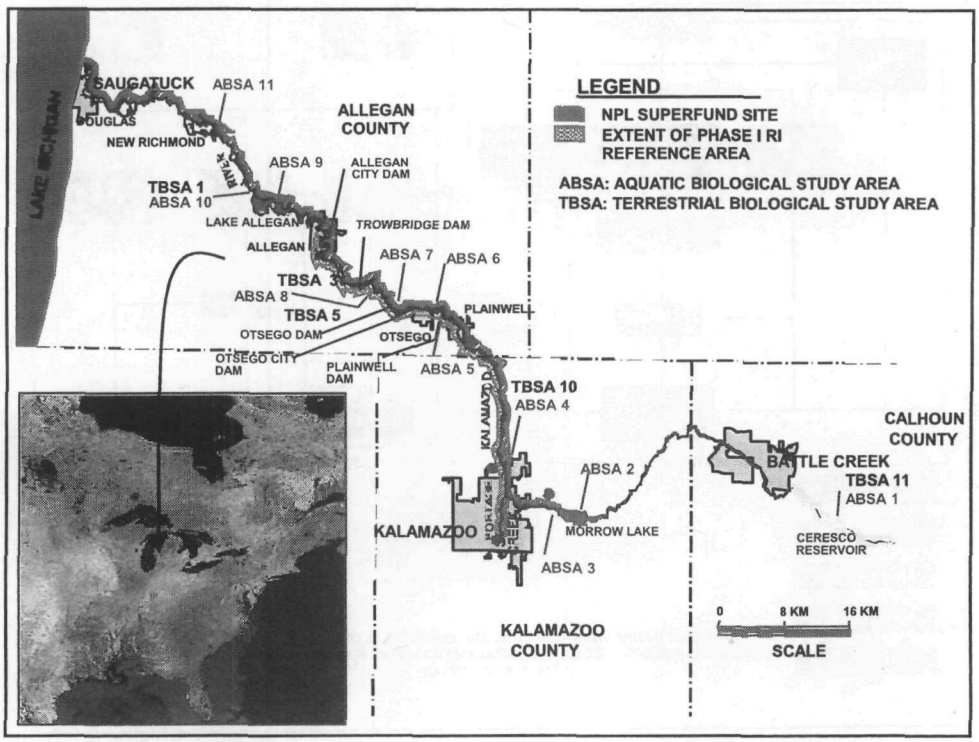




PRIMARY PATHWAYS FOR AQUATIC AND TERRESTRIAL ORGANISMS
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
KALAMAZOO, MICHIGAN

Extensive Biological and Chemical Sampling

- Biotic
  - Fish
  - Mink
  - Muskrat
  - Bird Eggs
  - Deer mice
  - Earthworms
  - Vegetation
- Abiotic
  - Sediments
  - Surface water
  - Surficial soils
  - Floodplain sediments/soils



BERA Overview

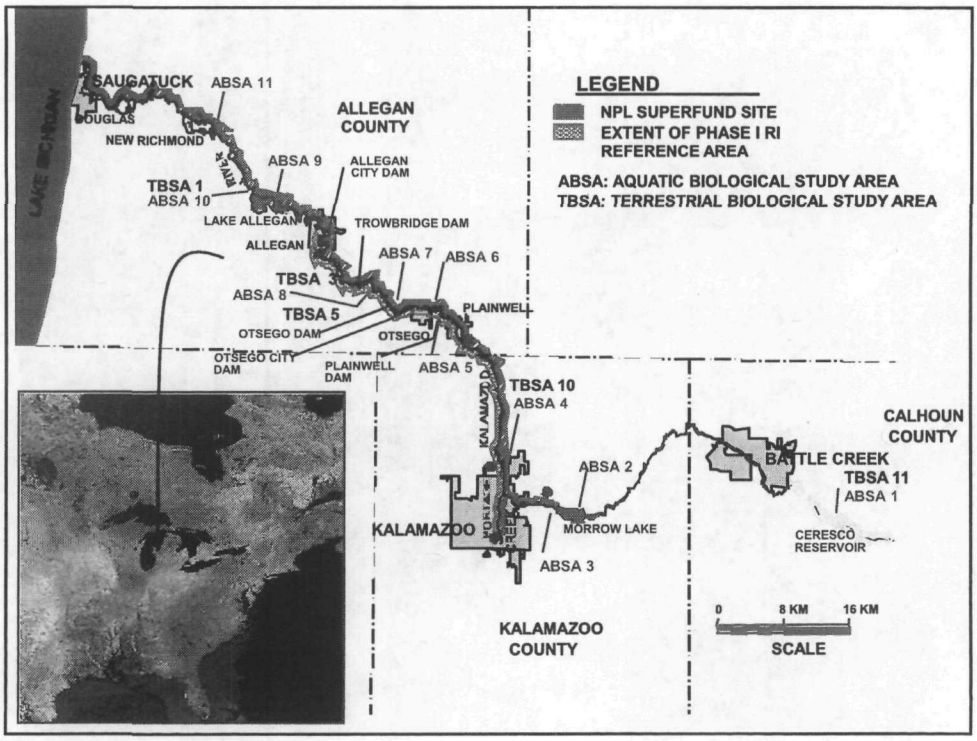
- Focus on total PCBs
- Abiotic Media
  - SW – Surface water
  - SED – Instream sediment
  - SS – Formerly impounded sediments from TBSAs
  - FP SED – Sediments/soils from 100 year floodplain
    - FP SED linked to Aquatic + Terrestrial Receptors

BERA Overview

- Representative Receptors
  - Aquatic/Terrestrial Plants, BMI, Sucker, Carp, Earthworm, Deer Mouse, Muskrat, Mink, Red Fox, Great Horned Owl, Bald Eagle, Bird Eggs
    - (Sampled Data)
  - Sampling and Risk Estimates
  - by ABSA (1-12)
  - by TBSA (1, 3, 5, 10, 11)
    - TBSA selection based on soil sampling and habitat

TBSAs

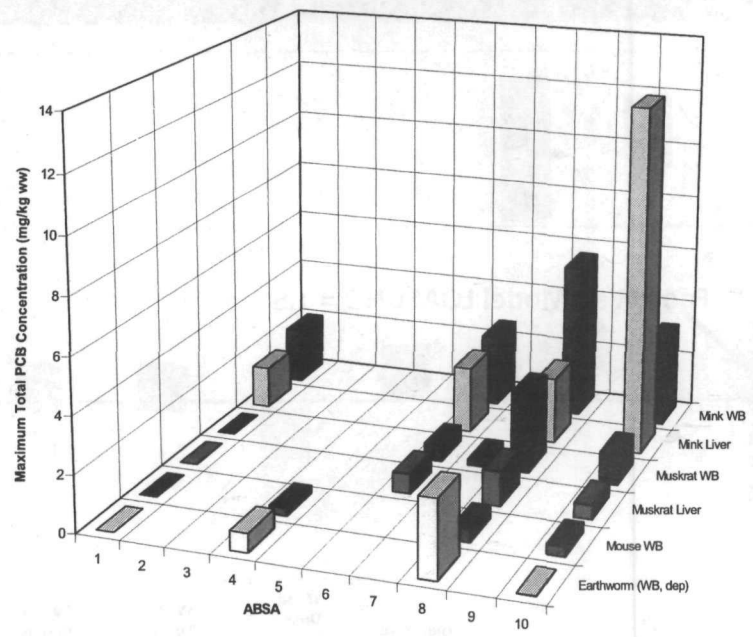
- TBSA 1
  - Ds of Allegan Dam, US of Swan Creek Marsh
- TBSA 3
  - Us of Trowbridge Dam, at Schnable Brook
- TBSA 5
  - Us of Trowbridge Dam, Us of TBSA 3
- TBSA 10
  - Us of Plainwell Dam, east of Hwy 131
- TBSA 11
  - Reference, Ds of Ceresco, us of Battle Creek



TBSA Data (biota and abiotic)
(total PCBs, mg/kg)

	1 Allegan	3 US Trowbridge	5 US Trowbridge	10 US Plainwell	11 (ref)
Worm (WB max)	NA	3.2	2.2	0.66	ND
Mouse (WB max)	0.35	0.45	0.38	0.28	ND
Muskrat (liver max)	0.5	1.2	1.2	NA	ND
Mink (liver max)	12.5	2.4	2.4	NA	1.5
SS mean	0.17	24.5	25.1	6.5	0.21

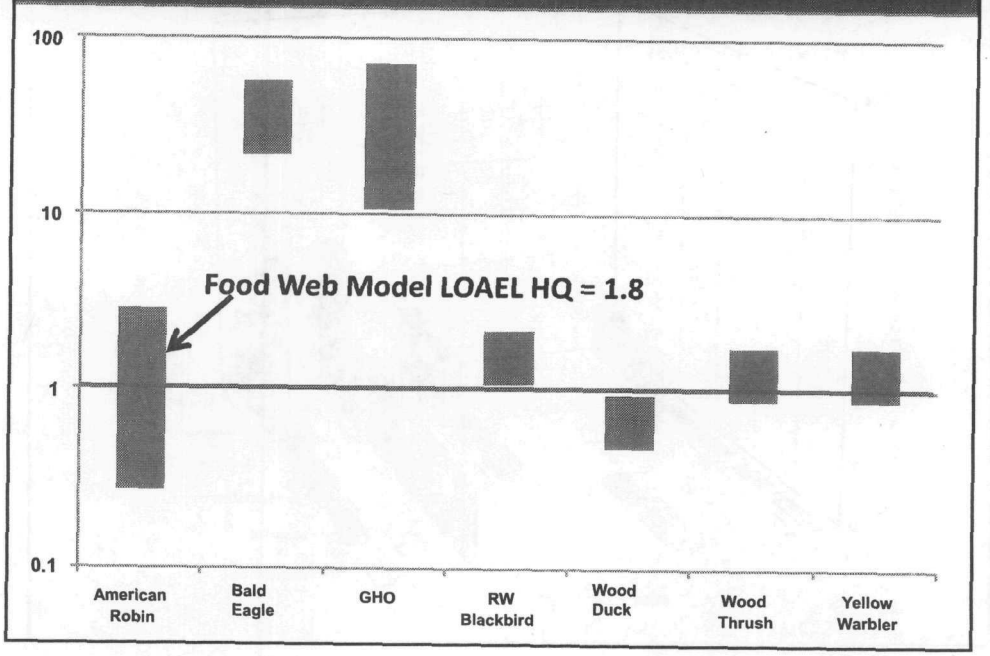
Figure 5-5 Maximum Total PCB Concentrations in Terrestrial Biota



Bird Egg Data (USFWS, Mehne) (total PCBs, mg/kg)

	ABSA 11 Ottawa Marsh	ABSA 7 Otsego Dam	ABSA 4 / TBSA 10 Plainwell Dam	ABSA 10 High Banks Refuge	ABSA 9 /Caulkin's Dam	ABSA 8 / TBSA 3/5 Trowbridge Dam	ABSA 10 / TBSA 1 Koopman's Marsh
RW Blackbird	0.009	1.1 - 1.8				1.6	
American Robin			0.4 - 3.8				
GH Owl				15.9	22.5		91
Wood Duck	0.27 - 0.45	0.7					
GB Heron	1.5 - 44						
Wood Thrush			1.9				
Yellow Warbler		1.3					
RT Hawk	27						
Bald Eagle	102 - 123			53			ASGA 32

Bird Egg HQs – Min to Max (mg/kg ww)



Selected TRVs
(NOAEL to LOAEL)

- Bird
  - dose Robin = 0.4 – 0.5 mg/kg-d (chicken studies, Appendix D)
  - dose GHO = 0.41 – 1.2 mg/kg-d (McLane & Hughes 1980)
  - egg (A) = 1.1 - 5.8 to 6.4 - 20.6 (est. from closely related species)
  - egg (B) = egg (B) = 1.0 – 1.5 mg/kg ww (chicken studies, Appendix D)
- Mink
  - diet = 0.5 – 0.6 mg/kg ww (multiple studies, Appendix D)
- Fox
  - dose = 1 -5 mg/kg-d (Earle et al. 1974)
- Mouse
  - dose = 0.45 – 1.35 mg/kg-d (Linzey 1987-88)

Terrestrial SS/ FP SED HQs
(Low Effect to No Effect)

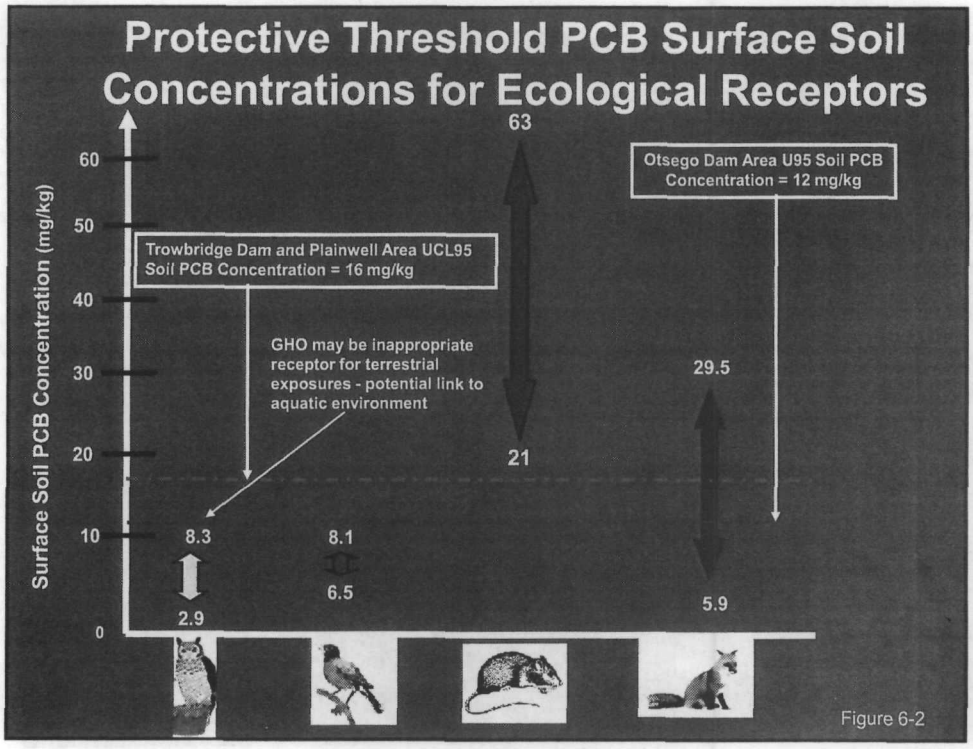
- Food Web Modeling HQs
  - GHO – 4.3 to 5.4
    - Terrestrial diet only
  - Robin – 1.8 to 2.3
  - Fox – 0.5 to 2.5
  - Mouse – 0.2 to 0.7

Terrestrial SS/ FP SED HQs (cont.)
(Low Effect to No Effect)

- Bird Egg HQs (Method A – species specific TRVs)
  - GHO – 6.7 to 33
  - RT Hawk – 1.8 to 8.7
  - Wood Thrush – 0.3 to 1.8
  - Yellow Warbler – 0.2 to 1.2
  - American Robin – 0.3 to 0.8
- Bird Egg HQs (Method B – chicken Appendix D TRVs)
  - GHO – 29 to 43
  - RT Hawk – 7.3 to 11
  - Wood Thrush – 1.3 to 1.9
  - Yellow Warbler – 0.9 to 1.3
  - American Robin – 1.4 to 2.1

Terrestrial SS PRGs

- Representative terrestrial receptors
  - Omnivorous songbirds (robin)
  - Raptors (GHO)
    - May be linked to aquatic prey
  - Mammalian predators (red fox)
  - Small omnivorous mammals (mouse)
- Robin most sensitive terrestrial receptor
- Lowest Terrestrial PRGs based on robin diet (earthworms and vegetation)
  - PRGs apply to terrestrial areas that do not support aquatic biota and dry floodplain areas
  - PRG range from NOAEC to LOAEC
  - NOAEC and LOAEC from literature (Appendix D), based on reproductive effects in chickens



Conclusions (terrestrial linked)

- PCBs pose acceptable or low risks to plants, herbivores, small omnivores (e.g., mouse (FWM))
- PCBs pose low risks to top terrestrial carnivores (e.g., red fox, (FWM))
- PCBs pose moderate risks to terrestrial omnivores (e.g., robin, FWM))
- PCBs pose elevated risks to birds (egg HQs, Appendix D TRVs)
  - GHO – HQ 29 to 43 (consider diet)
  - RT Hawk – HQ 7.3 to 11
  - Wood Thrush – HQ 1.3 to 1.9 (consider omnivorous diet)
  - American Robin – HQ 1.4 to 2.1 (driven by earthworm diet)

Summary – Lines of Evidence (Terrestrial)

- **Unacceptable Risk**
  - FWM (mink, eagle, owl, robin, fox)
  - Bird Egg HQ (other TRV = eagle, owl, hawk, GBH, thrush, warbler, blackbird)
  - Bird Egg HQ (chicken TRV = eagle, owl, hawk, GBH, robin, thrush, warbler, blackbird)
  - Tissue – Relative to Reference (bass, carp, sucker, worm, bird eggs (multiple taxa), mouse, muskrat liver, mink liver)
  - Soil Quality – Relative to Reference
  - FP SED Quality – Relative to Reference
- **Acceptable Risk**
  - Muskrat, mouse (FWM)
  - Bird Egg (other TRV - robin, wood duck)
  - Bird Egg (chicken TRV – wood duck)