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FINAL RECORD OF DECISION

for the

Sangamo Weston/Twelvemile Creek/Lake Hartwell
PCB Contamination Superfund Site - Operable Unit Two
Pickens, Pickens County, South Carolina
June 1994

Record of Decision Declaration

SITE NAME AND LOCATION

Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination
Superfund Site - Operable Unit Two
Pickens, Pickens County, South Carolina

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site - Operable Unit Two ("Sangamo OU2") in Pickens County, South Carolina, which was chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the Administrative Record for the Site.

The State of South Carolina concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This Operable Unit is the final action of two Operable Units for the Site. Operable Unit One addressed the land-based source areas which included the Sangamo Weston Plant and six satellite disposal areas. This action, Operable Unit Two, addresses the sediment, surface water, and biological migration pathways downstream from the source areas. This action addresses the primary PCB human exposure pathway by mitigating the consumption of PCB contaminated fish harvested from Lake Hartwell.

The major components of the selected remedy include:

- Continuation of the existing fish consumption advisory on Lake Hartwell;
- Public education program designed to increase awareness of advisory and methods to prepare/cook fish to reduce quantity of contaminants consumed;
- Continued monitoring of aquatic biota and sediment to support continuance and/or justify modifications to existing fish advisory; and

- Regulation of Twelvemile Creek Impoundments that will facilitate burial of contaminated sediment while mitigating adverse impacts to Lake Hartwell water quality.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This remedy does not satisfy the preference for treatment as a principal element based upon the excessive costs associated with removal, treatment and disposal of approximately 4.7 million cubic yards of PCB contaminated sediment spread out over approximately 730 acres.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted no less often than every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Patrick M Tobin for — 6-28-94

John H. Hankinson, Jr. — Date
Regional Administrator
EPA - Region IV

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1.0 SITE NAME, LOCATION, AND DESCRIPTION

The Sangamo Weston/Twelvemile Creek/Lake Hartwell Polychlorinated Biphenyl (PCB) Contamination Site - Operable Unit Two (hereinafter referred to as "the Sangamo OU2 Site") is located in Pickens County, South Carolina. The Sangamo OU2 Site comprises the sediment, surface water, and biological migration routes downstream from the Sangamo Weston Plant and satellite disposal areas that have site related PCB-contamination. The Sangamo Weston Plant and satellite disposal areas constitute Operable Unit One of the Site.

Lake Hartwell was constructed by the Savannah District U.S. Army Corps of Engineers (COE) between 1955 and 1963 by damming the Savannah, Seneca, and Tugaloo Rivers. Figure 1-1 provides an illustration of the 56,000 acre Hartwell Reservoir located on the Georgia-South Carolina border. The OU2 study area includes approximately 40 stream miles of Twelvemile Creek and its tributaries, the Twelvemile Creek Arm of Lake Hartwell, and portions of the Keowee and Seneca River Arms of Lake Hartwell down to the Route 37 (Rt. 37) bridge just south of Clemson, South Carolina. Figure 1-2 provides an illustration of the Sangamo OU2 study area. The primary focus of OU2 is centered on this area; however, samples were collected throughout Lake Hartwell during the OU2 investigations including that portion of the reservoir between Rt. 37 and Hartwell Dam.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Sangamo Weston, Inc., owned and operated a capacitor manufacturing plant in Pickens, South Carolina from 1955 to 1978, near the headwaters of Lake Hartwell. The plant manufactured several varieties of capacitors, including electrolytic, mica, and power factor capacitors as well as potentiometers. Schlumberger Industries, Inc. (SII) is the current owner of the plant site, as a result of a merger with Sangamo Weston in 1989.

The plant used several varieties of dielectric fluids in its manufacturing processes, including PCB-containing dielectric fluids. PCBs reportedly enhanced the performance and durability of the fluids. The PCBs used for this application were primarily Aroclors 1242, 1254, and 1016. Waste disposal practices from the Sangamo Plant included land-burial of off-specification capacitors and wastewater treatment sludges on the plant site and at the six satellite disposal areas. PCBs were also discharged with effluent directly into Town Creek, which is a tributary of Twelvemile Creek. Twelvemile Creek is a major tributary of Lake Hartwell. The use of PCBs was terminated by Sangamo Weston in 1977 prior to an EPA ban on PCB use in January 1978.

Estimates of the type and quantities of PCBs received, used, and discharged by Sangamo Weston were derived by reviewing Monsanto Corporation shipping records, Sangamo Weston records, interviews with Sangamo Weston employees, engineering and analytical reports completed by firms under contract to Sangamo Weston, and EPA documents. Figures 2-1 and 2-2 provide a graphical illustration of the PCBs received at the Sangamo Plant and an estimate of PCBs discharged to Town Creek, respectively.

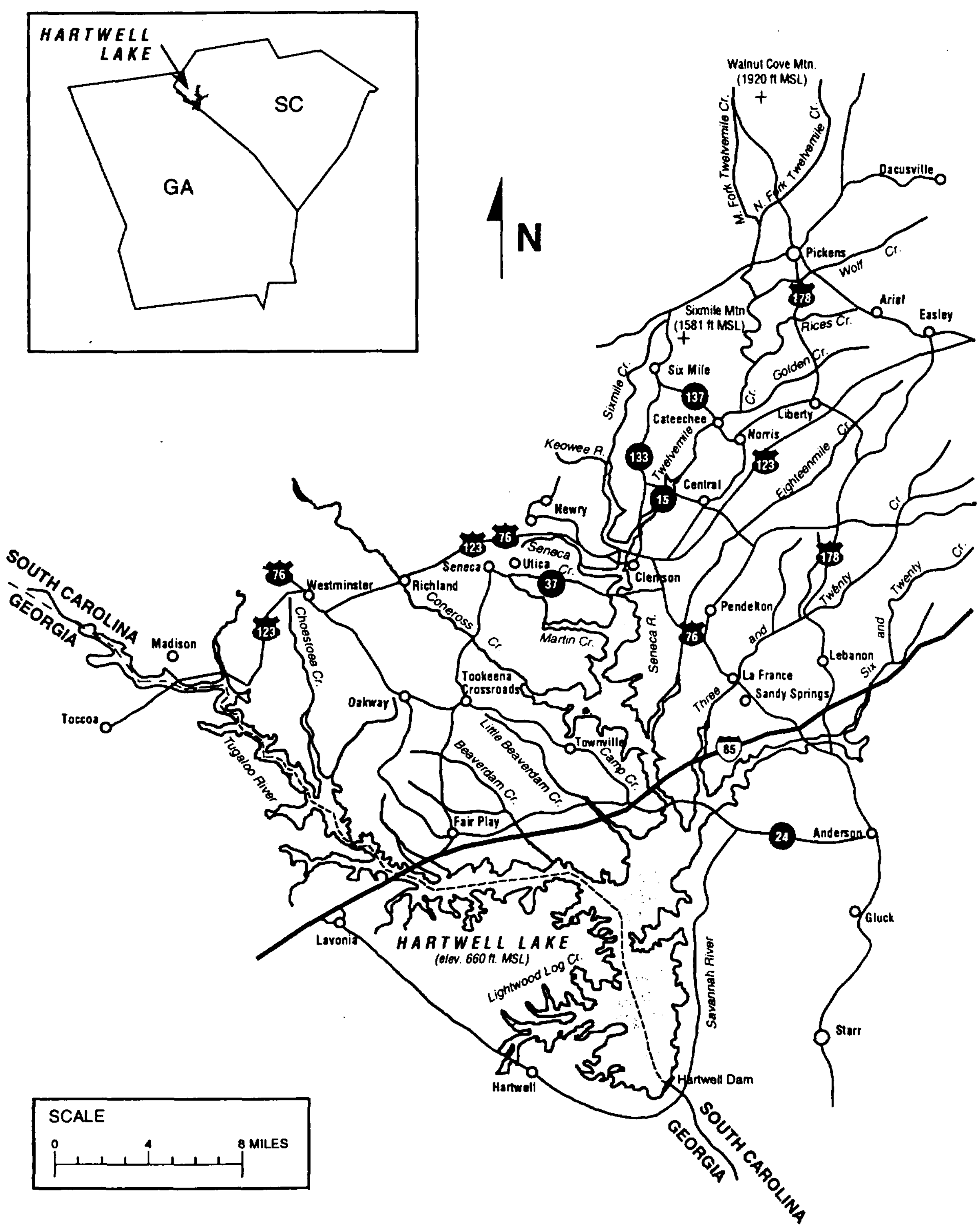

Figure 1-1
Hartwell Lake and Watershed
Sangamo OU-2 RI

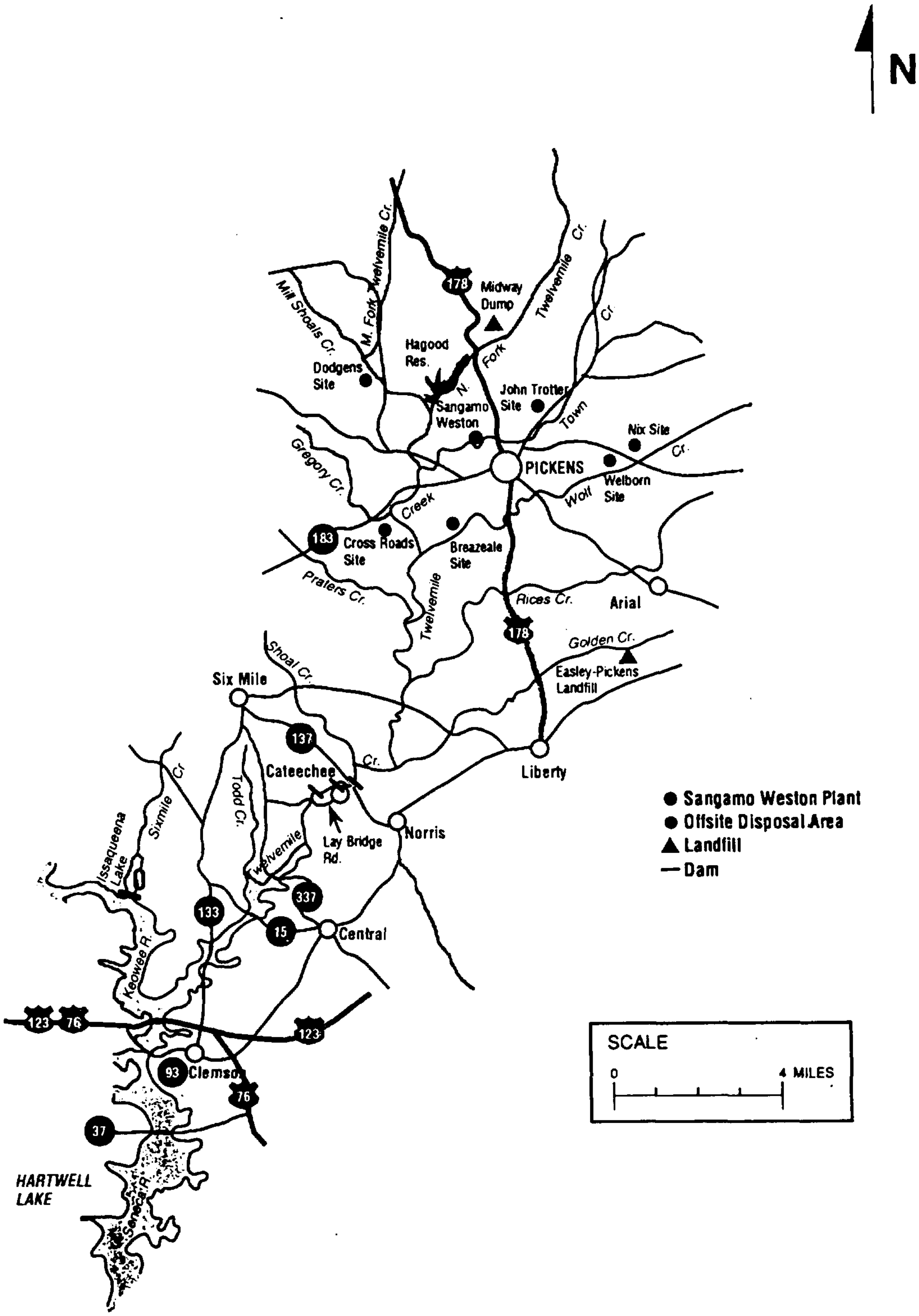

Figure 1-2
Study Area
Sangamo OU-2 RI

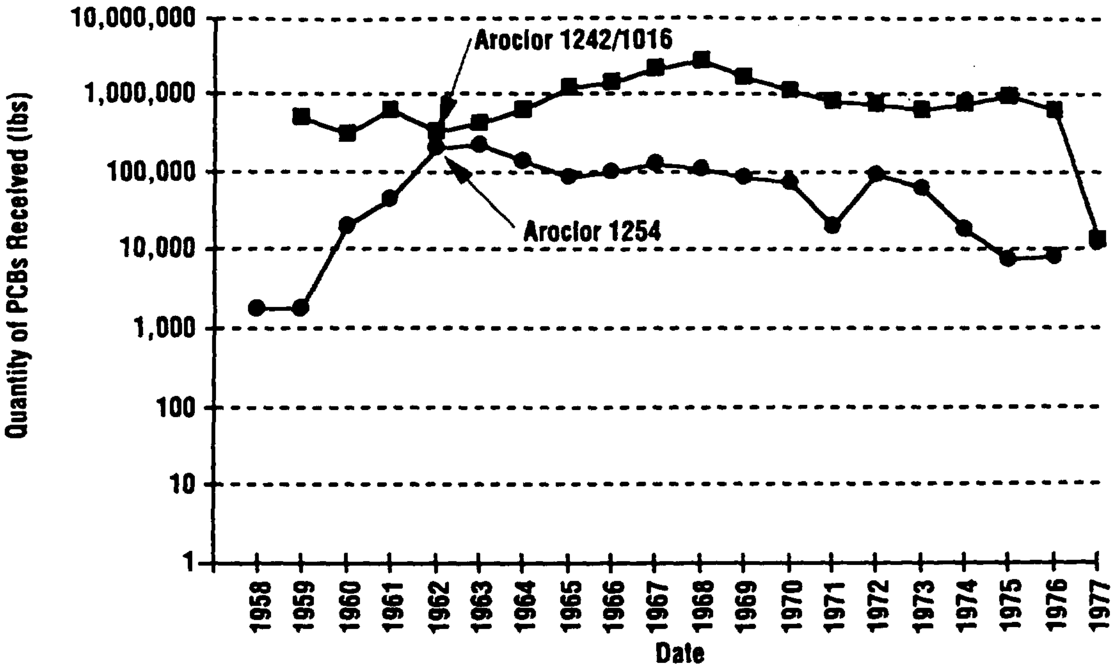

Figure 2-1
Estimate of PCBs Received at the Sangamo Weston Plant

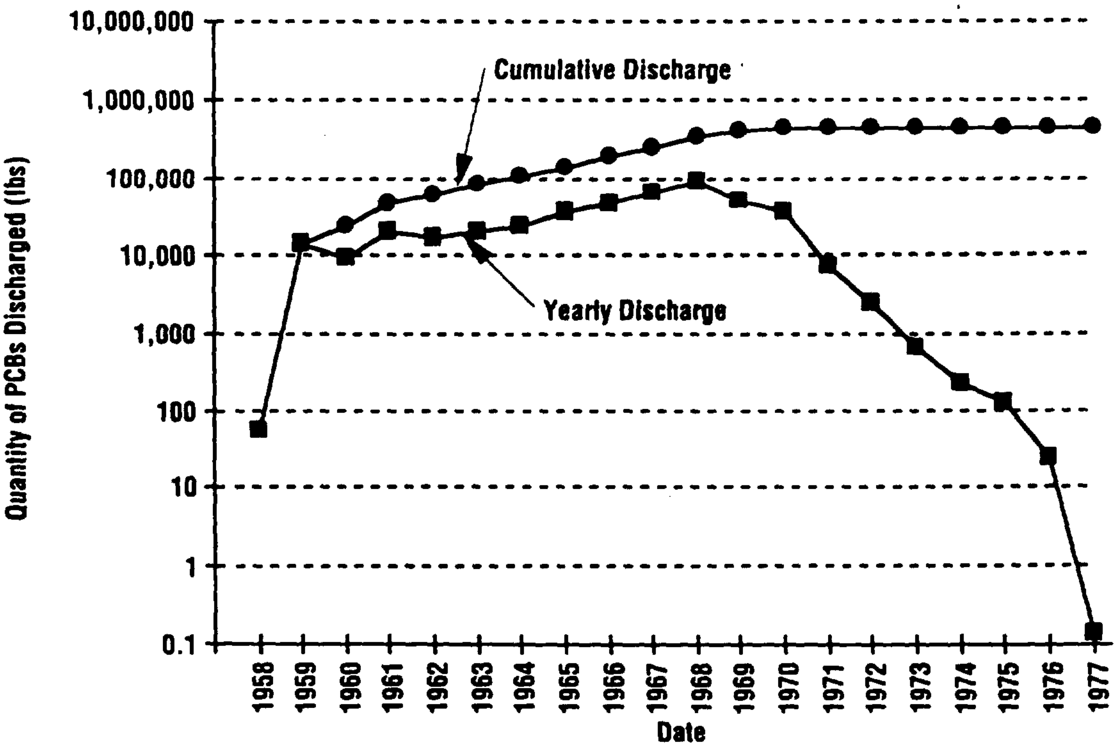

Figure 2-2
Estimate of PCBs Discharged Into Town Creek

The average quantity of PCBs used by Sangamo Weston ranged from 700,000 to 2,000,000 lbs/yr from 1958 to 1977. Data indicate that an estimated 3 percent of the quantities received and used were discharged to Town Creek. This approach leads to an estimated cumulative discharge of PCBs into Town Creek of over 400,000 lbs through 1977.

Historical surficial and core sediment studies of the Twelvemile Creek watershed and Lake Hartwell were conducted by several entities including the South Carolina Department of Health and Environmental Control (SCDHEC), COE, EPA, RMT (for Schlumberger), and several Clemson graduate students. These studies were initiated in 1976 by SCDHEC and occurred intermittently through the mid to late 1980s. PCB concentrations in surficial sediments were highest from samples collected near the plant's discharge point on Town Creek and generally decreased with increasing distance downstream from the Sangamo Weston Plant Site. PCB concentrations in sediment core samples were highest in samples collected from the Twelvemile Creek Arm of Lake Hartwell. PCB concentrations generally increased to maximum at a depth of 10-30 cm.

In the mid-1970s, SCDHEC and EPA discovered that fish from certain areas of Lake Hartwell were contaminated with PCBs at levels above the U.S. Food and Drug Administration (FDA) safe tolerance limit of 5 ppm (5 mg/kg). SCDHEC originally issued a health advisory in 1976 that warned the public against eating fish from the Seneca River Arm of Lake Hartwell north of State Highway 24 (Hwy 24) and Twelvemile Creek (Figure 1-1). FDA lowered the PCB tolerance level to 2 ppm (2 mg/kg) in 1984. As a result, SCDHEC modified the original health advisory in 1985 to state the following:

1) All fish taken from the Seneca River Arm of Lake Hartwell north of SC Hwy 24 and Twelvemile Creek should be released and not eaten;

2) All fish larger than three (3) lbs. taken from the remainder of Lake Hartwell should be released and not eaten; and

3) Fishing is not prohibited but SCDHEC advises that these fish not be eaten due to the presence of elevated levels of PCBs. Swimming, boating, and other related activities are not restricted by this advisory.

This advisory remains in effect, and signs warning against eating fish have been posted at the majority of the public boat launch and recreation areas in South Carolina since 1987.

SCDHEC has conducted studies in Lake Hartwell since 1976 to evaluate the levels of PCB contamination in fish. Their results indicate that PCB concentrations in non-migratory fish (i.e largemouth bass, catfish) collected within the Twelvemile Creek embayment remain above the FDA 2 mg/kg tolerance level with no apparent decrease over time. PCB concentrations in these non-migratory species generally decreased with increasing distance from the source area. However, migratory species (i.e.

hybrid/striped bass) collected at all stations in the lake had elevated levels of PCBs which frequently exceeded the 2 mg/kg tolerance level. There was no apparent decrease in migratory fish tissue PCB concentrations over time.

In 1987, based upon the EPA Hazard Ranking System, SCDHEC monitoring programs, and accompanying concerns of citizens in the area, the Sangamo Site was proposed for inclusion on the National Priorities List (NPL). The Sangamo Site was finalized on the NPL in February 1990. As a result, EPA issued special notice to SII in April 1990 for performance of a Remedial Investigation and Feasibility Study (RI/FS). Since SII declined to conduct the RI/FS, EPA assumed the lead-role in performing the RI/FS at the Sangamo OU2 Site and formally initiated the process in September 1990. The RI/FS process for OU2 was divided into two separate studies, a Sediment Investigation and Biological Investigation, which were conducted concurrently. The Sediment Investigation was conducted by the Oak Ridge, TN office of Bechtel Environmental under the funding and direction of EPA. The Biological Investigation was conducted by the Savannah District of the U.S. Army COE, under funding and direction provided by EPA.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

EPA held an OU2 RI Kick-Off Public Meeting at the Liberty (South Carolina) Senior High School Cafeteria on May 9, 1991 to present the approach for the Phase I Sediment RI and overall Biological Investigation strategy. On March 3, 1992, a public meeting was held at the Ramada Inn in Clemson, SC to discuss the Phase I Sediment Investigation results, planned approach for the focused Phase II Sediment Investigation, and provide an update on the Biological Investigations. The Final Remedial Investigation Reports (Sediment and Biological components) and a summary fact sheet were released to the public in May 1993. A public meeting was held on June 3, 1993 at the Ramada Inn in Clemson to present the findings from the completed investigations and the Baseline Risk Assessment.

The Draft Feasibility Study Report and a summary fact sheet were released to the public in February 1994 in an effort to facilitate greater public involvement in the remedy selection process at the Sangamo OU2 Site. On March 28, 1994, a public forum was held at the Strom Thurmond Institute on the Clemson University Campus to discuss the various remedial alternatives under consideration in the Draft FS Report.

The Final FS Report, Proposed Plan Fact Sheet, and all other site-specific documents EPA relied upon to develop the Proposed Plan were arranged in an Administrative Record and released to the public in April 1994. The Administrative Record was maintained and available for public review at the EPA Records Center in Region IV, and the following five information repositories: The Village Library in Pickens, SC; Pickens County Public Library in Easley, SC; R.M. Cooper Library at Clemson University, SC; Hart County Library in Hartwell, GA; and the

Corps of Engineers Lake Hartwell Natural Resources Management Center near the Dam in Hartwell, GA.

Concurrent with the public release of the Proposed Plan, a notice of availability of the Administrative Record was published in the *Greenville News* and *Anderson Independent* on April 11, 1994; the *Athens Daily*, *Easley Progress*, *Hartwell Sun*, and *Pickens Sentinel* on April 13, 1994; and the *Clemson Messenger-Journal Tribune* on April 16, 1994. A public comment period was held from April 11 through May 11, 1994. A Proposed Plan Public Meeting was held on April 19, 1994 at the Ramada Inn in Clemson, SC. At this meeting, representatives from EPA, the Savannah District COE, and SCDHEC discussed the site conditions, the remedial alternatives under consideration and presented the rationale behind the preferred alternative. During this meeting, a request for an extension to the public comment period was made. As a result, the public comment period was extended until June 10, 1994. The notice of this extended public comment period was published in the *Greenville News* on May 2, 1994.

A response to comments received during this 60-day public comment period is included in the Responsiveness Summary, which is attached to this Record of Decision (ROD) as Appendix B. This decision document presents the selected remedial action for the Sangamo OU2 Site in Pickens County, South Carolina, chosen in accordance with CERCLA, as amended by SARA, and in accordance with the National Contingency Plan. The decision for this Site is based on materials in the Administrative Record and comments received during the public comment period.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

Due to the size and complexity of the Sangamo Site, and in order to simplify the investigation and response activities, EPA divided the Site into two discrete study areas known as Operable Units (OUs). Operable Unit One (OU1) consists of the land-based source areas, including the Sangamo Weston Plant Site and six satellite disposal areas in Pickens County used for the disposal of solid wastes containing PCBs (Figure 1-2). The six satellite disposal areas are located in rural areas within a 3-mile radius of Pickens and have the following designations: Breazeale, Cross Roads, Dodgens, John Trotter, Nix and Welborn. EPA selected the remedy for OU1 in a ROD signed on December 19, 1990. Under a Consent Decree negotiated with EPA, Schlumberger initiated remedial action at OU1 in November 1993. This included the excavation of waste and PCB contaminated soils from the six satellite disposal areas and transportation of the excavated materials to temporary storage facilities at the former Sangamo Plant Site. A treatment system will be built and tested at the plant at which time the contaminated material will be treated by means of low temperature thermal desorption. In addition, groundwater recovery and treatment systems will be installed at the plant site and at applicable satellite areas.

Operable Unit Two (OU2), the subject of this ROD, addresses the PCB-contamination in the sediments and aquatic biota of the study area (Figure 1-2). The exposures associated with ingestion of fish contaminated with PCBs from all fish sampling stations in Lake Hartwell exceeded EPA's acceptable human health risk range. OU2 represents the final response action EPA expects to implement as part of its overall strategy in remediating the Sangamo Site. This response action addresses the principal threat posed at the Site which is ingestion of PCB-contaminated fish.

5.0 SUMMARY OF SITE CHARACTERISTICS

Due to the atypical size and complexity of the Sangamo OU2 Site, the Sediment and Biological Investigations generated an immense and extensive data base . In the interest of brevity, this information will not be reiterated in this ROD. This section presents a brief, comprehensive overview of the Sangamo OU2 Site characteristics as assessed during the Remedial Investigation. The reader is referred to the Final Remedial Investigation Report (May 1993), Volumes I and II and/or the Final Biological Investigation Report (February 1994) for a more detailed account of this subject matter.

5.1 SUMMARY OF PHYSICAL CHARACTERISTICS

This section presents information concerning the physical characteristics of the study area including its surface features, surface water hydrology, meteorology, and demographics.

5.1.1 Surface Features

The Sangamo OU2 study area generally consists of sloping to moderately steep uplands that are dissected by a well-developed drainage system. There are a number of small towns in the area in addition to the city of Clemson. Outside of the towns and the residential developments along the Hartwell lakeshore, the countryside is predominantly rural. Much of the undeveloped area is forested, but significant agricultural tracts can also be found.

The northern portion of the Twelvemile Creek watershed is in the foothills of the Blue Ridge Mountains, an area characterized by steep, heavily forested slopes and ridges. Twelvemile Creek originates near 1,920-ft-high Walnut Cove Mountain, in an isolated area approximately 7 miles north-northeast of Pickens, which includes first- and second-order streams with abundant riffles (Figure 5-1).

The relief is somewhat lower in the vicinity of Pickens and the OU1 source areas. In this portion of the watershed, Twelvemile Creek occurs as a meandering, relatively slow-moving, fourth-order stream with abundant pools, sand and gravel bars, and broad floodplains that in some reaches exceed 1,000 ft. However, approximately 1 mile south of Pickens, the stream valley narrows and the creek has a large number of sharp bends. In this area, Twelvemile Creek resembles a mountain stream with exposed rocks, swift-moving water, and abundant riffles that in some locations may be considered rapids. Floodplains are generally absent as the creek valley narrows to widths of only 100 to 200

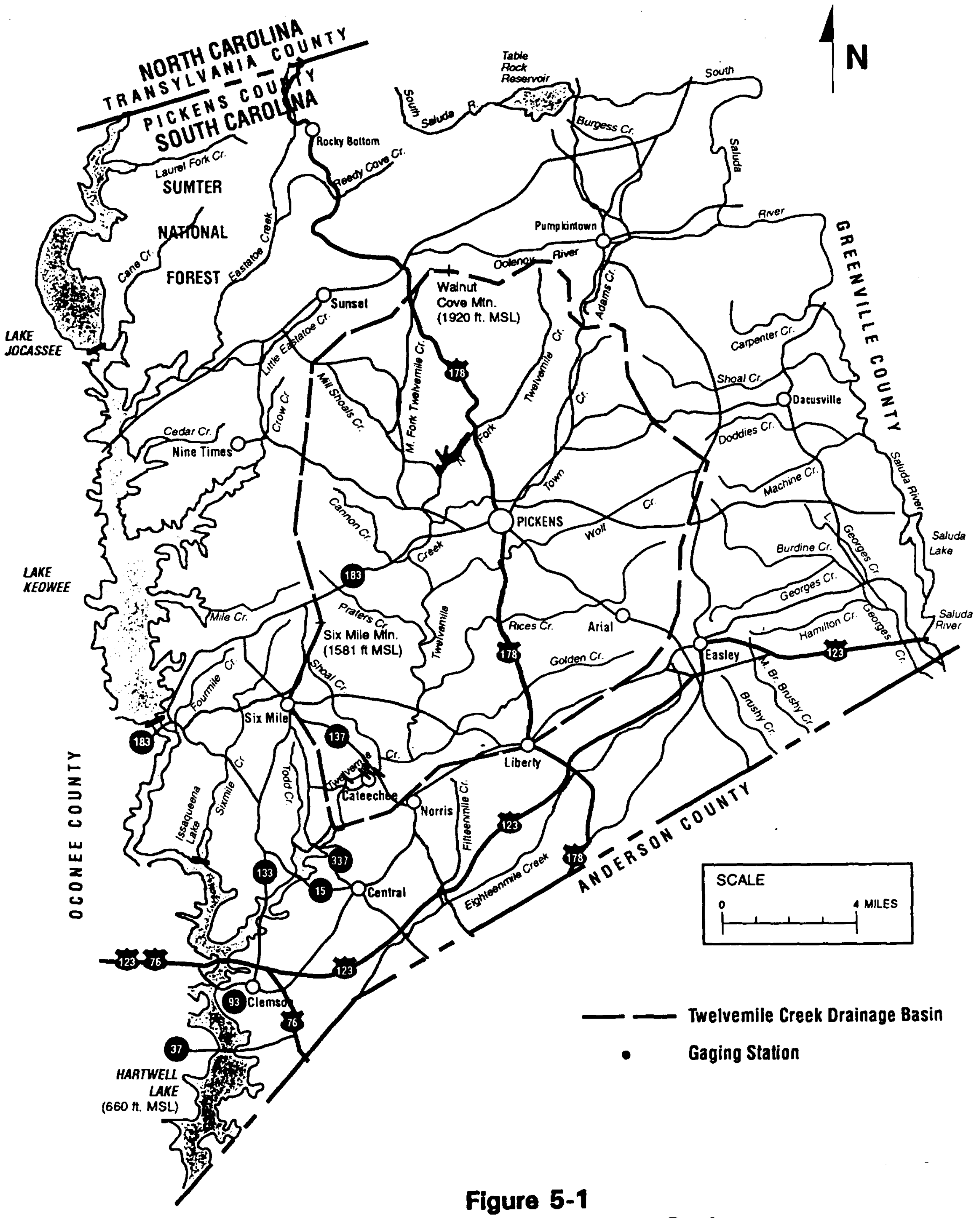

Figure 5-1
Twelvemile Creek Drainage Basin

ft., bounded by moderate to steep slopes that are generally covered with trees and other vegetation. Access to the creek is difficult and generally limited to the few bridges in the area. These conditions continue downstream (south) to the headwaters of Hartwell Lake, just upstream of the Maw Bridge (Hwy 337 Bridge).

The Twelvemile Creek Arm of Lake Hartwell is characterized by a narrow channel with steep, heavily vegetated shoreline with only limited access. The waters in the upper portion of this arm have been impounded and thus water velocities are greatly reduced. There is a sharp bend in the lake near the Madden Bridge, but otherwise the channel has a linear, northeast-southwest trend. The lake becomes progressively wider downstream, reflecting the widening of the former Twelvemile Creek floodplain, and the number and size of inlet coves increases. The lakeshore along the Twelvemile Creek Arm is generally undeveloped due to the relief and development restrictions imposed by the COE, which has classified much of the western shoreline and the major inlet coves on the eastern shoreline as a Protected Lakeshore Area. This designation does not necessarily prohibit all development, but has served to greatly limit the type and extent of development within this portion of the lake.

In the downstream direction, past the Keowee River confluence, into the Seneca River Arm and finally into Lake Hartwell proper, the shoreline typically becomes more gradually sloped and is more developed with less vegetative cover than the shoreline of the Twelvemile Creek Arm. Relief around the main portion of the lake is much lower, primarily due to the pool elevation, which becomes progressively closer to the hilltops toward the south.

Lake Hartwell was formed by the construction of Hartwell Dam across the Savannah River approximately 7 miles below the point where the Tugaloo and Seneca rivers converge to form the Savannah River. Construction of the dam began in 1955 and was completed in 1963. The dam is a concrete and earth structure that spans 18,000 ft across the Savannah River and rises 204 ft above the riverbed at its highest point. At normal pool level, Hartwell Lake extends for 49 miles up the Tugaloo River and 45 miles up the Seneca River and its tributaries (i.e., Twelvemile Creek and the Keowee River).

At a normal pool elevation of 660 ft. mean sea level (MSL), the lake has an area of 56,000 acres and large expanses of open water, particularly below the point where Twenty-six Mile Creek meets the Seneca River. Because of the relief and large number of coves, the lake has a shoreline of 962 miles. There are a number of large arms in the main portion of the lake. The major ones include the Tugaloo Arm, Twenty-six Mile Creek Arm, Coneross Creek Arm, and Eighteen Mile Creek arm.

5.1.2 Surface Water Hydrology

The Sangamo OU2 study area is defined by hydrologic features; therefore, the surface water hydrology is one of the most important physical characteristics of the study area. This section presents an overview of the hydrologic characteristics of the Twelvemile Creek watershed and Lake Hartwell, which are the principal hydrologic units in the study area.

5.1.2.1 Surface Water Hydrology of Twelvemile Creek Watershed

The Twelvemile Creek watershed has an area of 140-mi^2 and includes first-, second-, third- and fourth-order streams. The tributaries to Twelvemile Creek are predominantly first- and second-order streams. The major tributaries, Town Creek, Wolf Creek, Rices Creek, and Golden Creek, are third-order streams. Twelvemile Creek is a third order stream above the mouth of Town Creek; below this point, Twelvemile Creek is a fourth-order stream. Twelvemile Creek is the longest stream segment in the watershed, which flows southward for approximately 24 miles until reaching the headwaters of Hartwell Lake. Within this 24-mile reach, approximately 80 tributaries flow into Twelvemile Creek.

The gradient of the Twelvemile Creek basin is represented by the longitudinal profile shown in Figure 5-2. The profile extends from the confluence of the Middle and North forks into Hartwell Lake as far as the Rt. 37 Bridge (the downstream limit of the study area in Hartwell Lake). From this figure, it can be seen that the total elevation drop from the confluence of the North and Middle forks to the headwaters of the lake is approximately 200 ft, which over a distance of 17 miles amounts to an average slope of 11.8 ft per mile.

The bulk of the stream flow is derived from runoff. Flow data for Twelvemile Creek indicate an average daily flow of 198 cubic feet per second (cfs), with historical daily flow ranging from 30 to 5360 cfs. Sediment in the creek is composed primarily of sand and has a generally low total organic carbon content (TOC), ranging from 0.1 to 3.6 percent. NPDES permit data indicate that Twelvemile Creek receives discharges from sewage treatment plants and a small number of industrial facilities. These discharges average 1 to 2 million gallons per day. During low flow periods, the permitted discharges may comprise 10-13 percent of the flow in the creek; during normal flows, the discharges comprise less than 2 percent of the flow and become negligible during high flow periods.

The three impoundments on the lower section of Twelvemile Creek are all of masonry construction. The lowermost impoundment (Woodside II) is the largest of the three, with an upper pool elevation of 722 ft MSL and a lower pool elevation of 684 ft MSL (difference of 38 ft). This impoundment was built in 1905. The middle impoundment (Woodside I) is located in the community of Cateechee and was rebuilt in 1937 after it failed in 1934. The middle impoundment has an upper pool elevation of 760 ft MSL and a lower pool elevation of 736 ft MSL (difference of 24 ft). Both the lower and middle impoundments were constructed by Norris Mills and are currently owned and operated by Consolidated Hydro of Greenville, South Carolina. These two impoundments were renovated in 1983-1985 and currently produce a combined 2.5 million kWh/yr. In 1984, up to 20 ft of sediments were

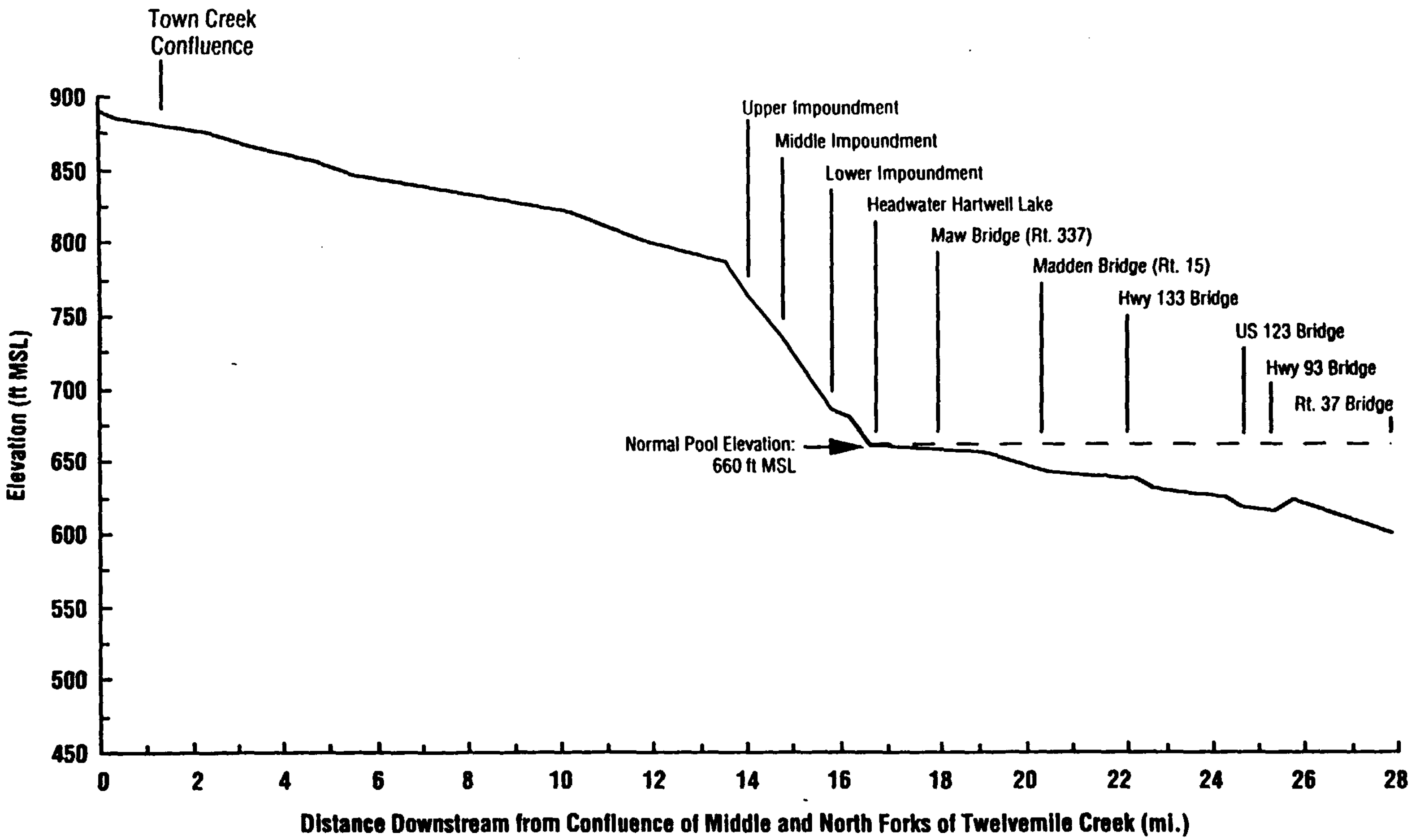

Figure 5-2
Twelvemile Creek Profile

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flushed from the pools behind the lower and middle impoundments. In September 1993, an estimated 43,000 cubic yards of sediment were flushed from behind the lowermost impoundment. Currently, sediments are flushed from these pools approximately biannually.

The third, or uppermost, impoundment was built in 1926 and is the smallest of the three impoundments, with an upper pool elevation of 783 ft MSL and a lower pool elevation of 763 ft MSL (difference of 20 ft). This upper impoundment was formerly used for generation of hydroelectric power. The impoundment was purchased by the Easley-Central Water District in 1962 and is currently used as the intake point for the Easley-Central Water Plant. Sediments are flushed from behind the upper impoundment quarterly. Approximately 6 ft of sediments are flushed from behind the impoundment during each flushing event.

Surface water in the Twelvemile Creek basin is currently utilized for drinking water supply, fishing, and industrial uses. Twelvemile Creek is classified as a Class B stream according to South Carolina Regulations (*Regulation 61-68, Water Classifications and Standards*). Under the regulations, Class B waters are defined as being suitable for secondary-contact recreation (fishing, boating, wading) and drinking water supply (assuming conventional treatment methods are used) as well as both agricultural and industrial uses.

5.1.2.2 Surface Water Hydrology of Lake Hartwell

The surface water hydrology of the Hartwell Lake reservoir is different from that described for the Twelvemile Creek basin because it is an impoundment with a drainage basin 2,088 mi^2. Hartwell Lake is managed by the COE for flood control and electric power generation, both of which are affected by the storage capacity of the reservoir, which is 2,550,000 acre-feet of water (equivalent to 830 billion gallons). Since its construction, the reservoir has become one of the major recreational lakes in the Southeast. Current management practices therefore consider recreational benefits as well as flood control and power generation.

The COE maintains a pool elevation of 660 ft MSL during the recreation season (summer); in mid-October through mid-December the lake level is dropped 4 ft to a level of 656 ft MSL. The lake is drawn down in the fall in anticipation of the increased rainfall that the area usually receives during the winter and spring. The annual fluctuations in the lake commonly exceed 4 ft; peak elevations commonly occur in April or May. The lowest recorded monthly average lake level of 643.3 ft MSL occurred in December 1981.

Water flows in the Lake Hartwell system were characterized by the inflow and outflow data provided by the COE. These data consist of 30 years of daily inflow and outflow data collected between 1962 and 1992. The average monthly inflow to the lake for the period 1962-1992 ranged from a low of 2,693 cfs in September to a high of 6,222 cfs in March. Average monthly outflow from Hartwell Dam in the same period ranged from a low of

3,034 cfs in September to a high of 5,190 cfs in April. On a yearly basis, the average monthly inflow to Hartwell Lake has been 4,090 cfs; outflow has been 3,997 cfs. Given the reported storage capacity of the reservoir (2,550,000 acre-feet or 830 billion gallons), the estimated hydraulic residence time in the lake is 25 days.

Lake Hartwell is Class A surface water (South Carolina regulations) suitable for primary contact recreation (swimming, waterskiing), secondary contact recreation (fishing, boating, wading), drinking water supply, and agricultural/industrial uses. The lake currently receives a significant level of point and non-point source discharges. NPDES-permitted discharges include industrial facilities, electric power generating stations, and various sewage treatment plants. The permitted industrial discharges include heavy metals, volatile organic compounds, cyanide, phenol, oil and grease, and textile dyes. Permitted discharges comprise only 18 million gallons per day (approximately 200 cfs). Since the reservoir continues to be a source of potable water for a number of communities, these discharges apparently have not had an appreciable impact on water quality in the lake.

5.1.3 Meteorology

Pickens County has a temperate climate characterized by mild winters and relatively abundant rainfall. The National Weather Service has two precipitation and temperature gauging stations in the Twelvemile Creek area, one at Pickens and the other at Clemson. Table 5-1 summarizes the monthly mean temperature and precipitation for these two locations.

Generally the mean monthly temperature is higher in the summer and winter months in Clemson while in the spring and fall it is higher in Pickens. The average monthly precipitation for the Pickens and Clemson stations ranges between 3.5 in. and 6.1 in. Annual precipitation in both Clemson and Pickens is more or less evenly distributed throughout the year. The average annual precipitation for Pickens from 1951-1992 was 56.04 in. The maximum and minimum annual rainfall events occurred 1964 and 1981, respectively, when 78.46 in. and 33.40 in. were recorded. In Clemson, the average annual precipitation from 1911-1992 was 53.23 in. The maximum and minimum annual rainfall events occurred in 1936 and 1925, respectively, when 73.36 and 34.31 in. of precipitation were recorded.

Free water surface evaporation data was obtained for the study area from the *Evaporation Atlas for the Contiguous 48 United States* (NOAA 1982). These data indicate that annual evaporation from Hartwell Lake should be in the range of 40 to 41 in. With annual precipitation in the area greater than 53 in., Hartwell Lake receives 12 to 13 in. of net precipitation per year.

TABLE 5-1
Monthly Mean Temperature and Precipitation for Clemson and Pickens, South Carolina[1]

Month	Clemson, SC[2]		Pickens, SC[3]	
	Temp. (°F)	Precipitation (inches)	Temp. (°F)	Precipitation (inches)
January	42.8	5.01	42.0	5.14
February	45.4	5.01	45.3	5.12
March	51.9	5.65	52.5	6.07
April	60.6	4.31	61.2	4.53
May	68.4	4.12	68.3	4.60
June	75.7	3.95	74.7	4.53
July	78.4	4.86	77.8	4.76
August	77.6	4.57	77.1	4.40
September	72.7	3.54	71.8	3.64
October	61.8	3.68	62.0	4.05
November	51.6	3.49	52.4	4.02
December	44.2	4.98	44.2	4.91

1 Data Source: National Climatic Data Center
2 Reporting Period 1911-1992
3 Reporting Period 1951-1992

5.1.4 Demographics

Demographics and land use in the Hartwell Lake area are variable, with small towns and rural residential development in the Twelvemile Creek watershed giving way to larger towns and more concentrated development in the areas surrounding Hartwell Lake. According to 1990 census data, approximately 356,000 people live in the six counties that border Hartwell Lake: Anderson, Pickens, and Oconee counties in South Carolina; and Hart, Franklin, and Stephens counties in Georgia. Of this total, an estimated 297,000 people live in the South Carolina counties; 93,894 live in Pickens County alone.

The major community in the upper portion of the Twelvemile Creek watershed is Pickens, which had an estimated population of 3,042 in 1990. Two communities are located along Twelvemile Creek: Cateechee (estimated 1990 population of 158) and Norris (estimated 1990 population of 884). The town of Clemson, with an estimated 1990 population of 11,096, is the only large community directly on the shoreline of the lake. Outside of the small towns and communities, the majority of the Twelvemile Creek watershed (and Pickens County in general) is undeveloped. Most of the acreage bordering Twelvemile Creek and its tributaries is either forested or cleared for agricultural purposes.

The entire Hartwell project, both land and water usage, is managed by the COE Savannah District. Hartwell Dam was constructed by the COE as part of a flood control and hydroelectric power project. In addition to these primary uses, Hartwell Lake has developed into one of the largest and most popular recreational lakes in the southeastern U.S. According to a 1989 COE survey, more than 15 million people visited the lake, making it one of the three most visited COE lakes in the nation. Data from a recreational area on Twelvemile Creek indicates that, out of a total of 301,000 visitors, 125,787 visits were made for fishing, 76,892 for boating, 30,310 for water skiing, and 28,139 for swimming.

Development along the shoreline of Lake Hartwell is at least partially controlled through the COE Lakeshore Management Plan (COE 1989). The COE controls 23,566 acres above the normal pool elevation of 660 ft MSL. The COE acreage in effect establishes a buffer zone of variable width around the entire shoreline. This buffer zone enables the COE to restrict access, development, and the types of activities permitted. These restrictions are effected through a system of permits and land use allocations as established in the Shoreline Management Plan. In order to administer the permit program, the shoreline of Hartwell Lake was allocated into four categories: Limited Development Areas, Public Recreation Areas, Protected Shoreline Areas, and Prohibited Access Areas.

Surface water supplies the bulk of potable water utilized by the residents of Pickens County and surrounding areas. Currently there are two active water intakes on Twelvemile Creek; these intakes provide potable water supply to the Pickens Water Plant and Easley-Central Water Plant. The Pickens Water Plant intake point is located near the confluence of the Middle and north Forks of Twelvemile Creek. Withdrawals from this intake enable the Pickens Plant to supply 2 to 2.5 mgd of potable water to approximately 4,000 residents in the Pickens area. The intake for the Easley-Central Water Plant is located in the uppermost of the three impoundments on Twelvemile Creek. According to the Easley-Central Water Plant, withdrawals from this intake supply an average of 1.2 mgd of potable water to approximately 1,100 residents in the plant's service area.

5.2 SEDIMENT INVESTIGATION SUMMARY

Field investigation activities for the sediment component of the Sangamo OU2 RI were conducted in two seasonal sampling events. The initial, Phase I event was conducted during July and August 1991. The objectives of Phase I were to verify extent-of-contamination data from previous investigations and further characterize the magnitude and distribution of PCB contamination in the Twelvemile Creek watershed and Hartwell Lake. Results of Phase I sampling were used to define a focused sampling program for the second, Phase II sampling event. Phase II was conducted during April and May 1992. The objective of Phase II was to address specific data gaps regarding the extent of PCB contamination in sediments of the upper Hartwell Lake reservoir (i.e., Seneca River, Keowee River, and Twelvemile Creek Arms) and the Twelvemile Creek watershed.

5.2.1 Phase I Investigation

Phase I field sampling encompassed an area extending some 50 miles, from the Sangamo Weston Plant site and the satellite disposal areas to the Hartwell Dam. A total of 480 samples, exclusive of quality assurance/quality control (QA/QC) samples, were collected during Phase I from Twelvemile Creek, its tributaries, and Hartwell Lake. Phase I samples included 88 surface water, 341 sediment core, and 51 sediment grab samples, at 50 locations throughout Lake Hartwell. An onsite field screening method, the Modified Spittler Method (See Section 5.2.3), and offsite Contract Laboratory Program (CLP) laboratories were used to analyze the samples.

A stainless steel ponar grab sampler was used for collecting the surface sediment sample. The depth of sample collected by the grab sampler was approximately 10 to 15 cm. A representative sample from this surface zone was important to adequately characterize the horizontal contamination in the biologically active zone and to determine the quality of sediment that was recently deposited. All 51 grab samples were analyzed by CLP laboratories. Four of these samples were selected for full-screen Target Compound List (TCL)/Target Analyte List (TCL) analyses. Offsite analyses were also conducted for grain size, TOC, and cation exchange capacity, all which are factors that affect the mobility of PCBs and other contaminants.

Sediment core samples were recovered to a maximum depth of 50 cm to characterize the vertical distribution of PCBs in the sediment. In shallow water areas, core samples were collected by driving a stainless steel core tube into the sediment by hand. In deep-water areas, a gravity corer with a stainless steel liner and core catcher was used to collect the subsurface sample. In both cases, sediment was extruded from the top of the core tube at 5-cm intervals and placed in jars marked according to the depth interval. All core samples were analyzed for total PCBs. Split samples were collected from 19 percent of the sediment cores analyzed onsite and sent for offsite PCB analyses at a CLP laboratory. This was done to determine the correlation between field and laboratory analytical results.

Surface water samples were collected at all 50 locations. A near-surface water sample was collected at all stations by dipping the mouth of the sample container just beneath the surface of the water. Where water depths exceeded 4 to 6 ft, a near-bottom sample was collected approximately 1 ft above the sediment interface using a peristaltic pump and teflon tubing. All 88 water samples were analyzed for PCBs and TOC at offsite CLP laboratories. Samples from 4 stations received full scan TCL/TAL analyses. Selected surface water samples were also analyzed for the following water quality parameters: total dissolved solids (TDS), total suspended solids (TSS), chloride, flouride, sulfate, and nitrate-nitrite.

Given the large number of samples collected on the open water of Hartwell Lake, the technical impracticality of conducting an accurate location survey utilizing traditional survey methods, and the importance of precise sample locations in determining the nature and extent of contamination in OU2, sample location coordinates (latitude/longitude) were determined utilizing a hand-held Magellan Global Positioning System (GPS). GPS is a network of 24 satellites orbiting the earth at an altitude of 10,900 miles. The satellites and the hand-held receivers both generate a continuous code which allows the receiver to calculate how long it takes the signal to travel from the satellite, and then to extrapolate the satellites's distance. Once the hand-held receiver gets position information from three satellites, position coordinates are determined by triangulation.

5.2.2 Phase II Investigation

During the Phase II study, a more extensive sampling program was conducted in areas determined during the Phase I study to have the highest PCB concentrations. The Phase II field sampling effort focused on the Keowee River, Seneca River and Twelvemile Creek Arms of Hartwell Lake as well as Twelvemile Creek itself. Not including QA/QC samples, 744 samples consisting of 185 surface sediment, 550 sediment core, and 9 storm-event surface water samples were collected and analyzed by field screening and CLP analytical methods. Sample collection and location techniques were as described under Section 5.2.1.

Twenty transects with a maximum of five sediment coring stations per transect were established across the lake and creek bed. The sediment core stations along each transect were selected following a review of the bottom depth profile collected with a bathymetric profiler. Sediment grab samples were then collected between each transect location. Sediment was sampled from a total of 374 locations during the Phase II study. Composite surface water samples were collected from the following bridges, which cross Twelvemile Creek and the upper reaches of the Hartwell Lake reservoir: the Maw Bridge (Rt. 337), Madden Bridge (Rt. 15), Hwy 133 Bridge, Hwy 93 Bridge, and Rt. 37 Bridge. Samples were collected from these stations following two significant storm events to evaluate the potential for resuspension of PCBs into the water column.

5.2.3 Field Screening - Modified Spittler Method

Both phases of the Sediment Investigation utilized the Modified Spittler Method, a field screening analytical technique, to significantly reduce cost and turnaround time on analyses. Reduced turnaround time (approximately 24 hours) enabled sampling teams to identify locations where additional sampling was warranted and to evaluate data quality on a real time basis.

The Modified Spittler Method is an EPA-approved field screening technique for quantifying total PCB concentrations in a sediment/soil matrix. The technique employs a gas chromatogram (GC) with an electron capture detector (ECD), and has demonstrated reliability in the quantification of PCB concentrations in excess of 1 ppm (mg/kg). The primary difference in time and cost between the CLP procedure and Spittler Method is incurred in the extraction procedure. Using commonly available laboratory equipment, one analyst can extract 10 to 20 samples in less than 2 hours. The cost of GC/ECD analysis using the Spittler Method is between $50 and $100, compared to approximately $300 for conventional CLP analysis.

A total of 122 samples were analyzed for PCBs by both the modified Spittler and CLP methods during Phase I and II. A statistical comparison of the 67 Phase II samples analyzed by both CLP and Spittler was performed by the EPA Environmental Monitoring Systems Laboratory (EMSL) in Las Vegas, Nevada. Twenty-eight of these samples were reported as "non-detect" by both analytical methods. Of the remaining 39 samples, PCB concentrations reported by Spittler were greater than those reported by CLP for 35 samples, 3 samples analyzed by Spittler were less than the concentration reported by CLP, and 1 sample was not detected by Spittler, but was detected by CLP (i.e. false negative).

In general, PCBs results obtained by field screening were conservative. Ninety percent of the results were higher than those obtained by the CLP method, and only one false negative was reported. Only one result was an order of magnitude greater than the CLP laboratory result. Although correlation coefficients were low, the data sets were generally in agreement when the factors affecting comparability are taken into consideration. The major reasons for poor statistical correlation in results were attributed to nonhomogeneity of the split samples and the differences in PCB quantitation.

Based upon this comparison, the Modified Spittler Method was found to detect PCBs as well as the CLP laboratory. It was concluded that the Spittler Method produces data of Data Quality Objective (DQO) Level II/III when compared to DQO Level IV for CLP analyses. However, the level of data quality generated by this field screening technique allowed EPA to cost effectively determine the nature and extent of PCB contamination in a study area that encompassed approximately 40 stream miles and over 1,000 acres of open water.

5.2.4 Nature and Extent of PCB Contaminated Sediment

Previous investigations and the Sangamo OU2 RI have delineated in detail the distribution and magnitude of PCB contamination in sediment within the study area. Most of the contaminated sediment lies within the upper portion of Hartwell Lake, specifically the Twelvemile Creek Arm and Seneca River Arm opposite the city of Clemson. Within the Twelvemile Creek watershed, minor levels of PCB contamination have persisted in Town Creek near the Sangamo Weston plant site and in the impoundments associated with the 3 small dams on Twelvemile Creek. Within Hartwell Lake, localized accumulations of contaminated sediment have been detected as far downstream as the dam, with concentrations generally decreasing with increasing distance downstream from the Twelvemile Creek Arm. Concentrations have been decreasing since the mid-1980's, reflecting a decline in PCB input to the lake as well as the burial and/or dilution of previously deposited sediment through mixing with clean sediment.

A summary of the significant findings regarding PCB contamination in sediment for eight subsections of the study area is presented below. The sediment investigation results are also graphically illustrated on Figures 5-3, 5-4, 5-5 at the end of this section. Bridges and landmarks used in the description of the study area subsections can be found on these figures or Figure 5-1 and 1-2.

Upper Twelvemile Creek Watershed - This section includes segments of the principal tributaries of Twelvemile Creek that collect drainage or other discharges from the Sangamo Weston Plant Site and the six satellite disposal areas. This section also includes Hagood Reservoir and tributary reaches associated with the Midway Dump and Easley-Pickens Landfill. Sampling conducted for the RI and previous investigations supports the following conclusions:

- Sediment contamination in Twelvemile Creek was limited to isolated occurrences between the mouth of Town Creek and the upper (Easley-Central) impoundment; PCB concentrations were typically <1 mg/kg.

- PCB-contaminated sediments remain in Town Creek downstream of the Sangamo Weston outfall; RI data show concentrations as high as 6.5 mg/kg.

- The OU1 satellite disposal areas represent insignificant sources of PCB contamination based on the results of sediment sampling from locations downstream of these areas.

- Town Creek was confirmed as the only tributary contributing PCBs to Twelvemile Creek, further substantiating earlier conclusions that the Sangamo Weston Plant Site has been the principal source of PCB contamination released into the Twelvemile Creek watershed and Twelvemile Creek Arm of Hartwell Lake.

Lower Twelvemile Creek Watershed - This section includes the three small impoundments and the lower reach of Twelvemile Creek to the Lay Bridge (just south of the lowermost impoundment). Sampling in the impounded waters and in close proximity downstream of the 3 small dams in the lower reaches of Twelvemile Creek indicate low levels of PCB contamination have persisted and/or continue to accumulate in this area. Specific conclusions include the following:

- The upper impoundment had the lowest levels of PCB contamination among the 3 impoundments; concentrations were typically below detection limits or <0.5 mg/kg.

- The middle (Woodside I) impoundment had only low levels of PCB contamination (<1 mg/kg), most of which was detected in core intervals below 10 cm.

- More highly contaminated sediment has accumulated in the lower (Woodside II) impoundment; most samples had <1 mg/kg but concentrations ranged up to 6 mg/kg in core samples.

- All 3 of the impoundments are flushed on a periodic basis to remove sediment and the slightly contaminated sediment detected in these impoundments will eventually be released into the Twelvemile Creek Arm of Lake Hartwell.

Upper Twelvemile Creek Arm - This section begins at the Lay Bridge and extends south, in a downstream direction, to Madden Bridge (Route 15 Bridge). Historical and RI data indicate that potentially significant quantities of PCB-contaminated sediment have accumulated in the upper portion of the Twelvemile Creek Arm of Hartwell Lake, particularly in the open water section immediately above the Madden Bridge. Specific conclusions include:

- The most significant accumulations of PCB-contaminated sediment coincided with depositional areas for fine-grained materials; in the upper arm, these areas typically occurred in proximity to the shoreline or in coves.

- The uppermost portion of the arm, in the vicinity of Maw Bridge, has only minor levels of contamination (1-2 mg/kg) due to the higher water velocities and limited sedimentation.

- The open water area upstream of the Madden Bridge represents the principal site for deposition of contaminated sediment in the Twelvemile Creek arm; concentrations have ranged as high as 153 mg/kg in historical samples and to a maximum of 61 mg/kg in the RI samples.

- The magnitude of PCB contamination in the upper arm has declined significantly since the mid-1980's, reflecting the decreased input of PCBs to the lake and, in the open water area, burial of the more highly contaminated sediment through deposition of several feet of sediment with much lower levels of contamination. This burial is consistent with results from the HEC-6 sediment transport modeling discussed in Section 5.4.

- The vertical extent of contamination in the open water area was not defined. Given that the source of PCB contamination predated the impoundment of the creek and that releases continued for many years thereafter, contaminated sediment probably extends down to the original elevation of the land surface (and former channel).

Middle Twelvemile Creek Arm - This section begins at Madden Bridge and extends south to the Hwy 133 Bridge. A variable distribution of low to moderate levels of contamination was identified, with higher concentrations generally limited to depositional areas having finer-grained sediment. Specific conclusions include:

- Sediment PCB concentrations in the middle portion of the arm have varied over time, but since 1985 have consistently been greater than 1 mg/kg and in most cases greater than 3 mg/kg.
- RI data show surface sediments contaminated with 1-3 mg/kg of PCBs and slightly higher concentrations in deeper sediment from core samples.
- The more highly contaminated sediment was encountered in samples from depositional areas such as Moore Bend and the open water area upstream of the Highway 133 Bridge.
- PCB concentrations in samples collected from depositional areas show a downward trend since 1988, indicating decreased input of PCBs into the lake and that more highly contaminated sediments have either been buried, resuspended and transported away, or diluted through mixing with cleaner sediments.
- Alternating sequences of vertically increasing or decreasing contamination observed in the majority of sediment cores from the Twelvemile Creek arm complicate the interpretation of the vertical extent of contamination. This vertical extent was not defined in the middle segment of the arm.

Lower Twelvemile Creek Arm - This section begins at the Hwy 133 Bridge and extends south to the U.S. Hwy 123 Bridge adjacent to Clemson. The lower portion of the Twelvemile Creek arm has also been a depositional area for contaminated sediment, as evidenced by the widespread PCB contamination in this area. A summary of the major findings include:

- RI data show PCB concentrations in surface sediments generally in the range of 1-2 mg/kg; higher concentrations were detected in core samples, with maximums in the 18-21 mg/kg range. Concentrations generally decreased with increasing distance downstream but localized accumulations of more highly contaminated material were identified.
- The vertical limits of contamination generally occurred in the upper 30-40 cm of sediment in most of the historical and RI sediment cores.
- The more highly contaminated sediment in the lower arm was usually detected in samples collected from within or in close proximity to the former submerged channel of Twelvemile Creek.
- A decline in sediment PCB concentrations was observed at the mouth of Twelvemile Creek, reflecting the influence of the

Keowee River arm, which has a much higher average flow than Twelvemile Creek.

- PCB concentrations in the shallow sediment (0-15 cm) of the lower arm have declined significantly, reflecting the decreased input of PCBs and/or that the more highly contaminated sediment detected in previous investigations is getting buried by or diluted through mixing with cleaner sediment.

- The persistence of relatively high levels in deeper sediment (down to 40 cm) supports conclusions based on the HEC-6 modeling that only limited amounts of sedimentation occur in the lower portion of the Twelvemile Creek arm.

Keowee Arm - The Keowee Arm is a branch of Lake Hartwell that meets the Twelvemile Creek Arm just north of Clemson. Historical data and the Phase I/Phase II sampling results from the Keowee River Arm indicate the following:

- RI data have shown generally low levels of contamination (<2 mg/kg) in the lower part of the Keowee arm, most likely related to hydrodynamic interactions with the Twelvemile Creek or Seneca River arms.

- Historical data included higher levels of contamination (6-7 mg/kg) in core samples collected from locations farther upstream in the Keowee arm, possibly indicating an additional PCB source in the upstream portion of the Keowee arm. This contamination is probably not related to the Twelvemile Creek source because of its occurrence several miles upstream in the Keowee arm and because flow in the Keowee is several times greater than flow in Twelvemile Creek. Data were insufficient to characterize the magnitude or determine the location of this source.

Seneca River Arm/Upper Section of Hartwell Lake - This section begins at the Hwy 123 Bridge and extends south to the Route (Rt) 37 Bridge. PCBs were detected throughout this area as concluded below:

- Surficial sediments had contamination in the range of 1-2 mg/kg everywhere except the excavated channel opposite the Clemson University diversion structures.

- Deeper contamination was encountered in the former Seneca River channel and the open water area just upstream from the Highway 37/Southern Railroad embankment. Deposition of more highly contaminated sediment near the Highway 37 embankment was attributed to the hydrodynamic influences associated with the constriction of the channel at this location.

- Residual PCB contamination likely exists in the former Seneca River channel located on the western edge of the Clemson University campus, behind the diversion structures.

- The vertical extent of contamination was defined and generally limited to depths of 20-40 cm. A good correlation between the depth of contamination in cores collected in 1988 and for the RI (in 1991-1992) indicate that only limited sedimentation has occurred in this portion of the lake during this 3 to 4-year period.

- Maximum PCB concentrations in sediment core samples declined from levels of 16 to 18 mg/kg in 1988 to concentrations of 5 to 11 mg/kg in 1991/1992; explanations for the decline, if predicted low sedimentation rates are accurate, include spatial variability in the distribution of contamination and continued mixing of the vertical sediment profile.

Lake Hartwell Proper - This section includes the remainder of Lake Hartwell, beginning at the Rt 37 Bridge and extending south to the Hartwell dam. Historical sampling in this area indicate that PCB contamination has migrated as far downstream as the Hartwell dam. This was not confirmed during the RI. The occurrence and magnitude of PCB contamination in Lake Hartwell declined significantly downstream of the confluence of the Seneca River Arm and Twenty-six Mile Creek, reflecting the input of significant quantities of uncontaminated sediment from Twenty-six Mile Creek and the various other tributaries. The majority of widespread contamination in the lower part of the lake was limited to concentrations below 1 mg/kg.

5.2.5 Other Contaminants in Sediment

A limited number of sediment grab and core samples were collected for full-screen TCL/TAL analyses. No significant contaminants other than PCBs were detected in these analyses. Specific conclusions include:

- No volatile organic contaminants were detected in any of the samples other than an estimated concentration of acetone (2200J μg/kg) in one duplicate sample.

- A number of semivolatile organic compounds were detected in one of the samples, mostly in low, estimate concentrations that were not indicative of significant contamination.

- Several unidentified semivolatile organic compounds were reported in sediments at 4 sampling stations, ranging in concentration from 2 mg/kg to 200 mg/kg. These compounds were most likely petroleum hydrocarbons related to urban run-off or boating discharges of fuel and oil.

- Several pesticide compounds (DDE, DDD, and DDT) were also detected, in low, estimated concentrations of 0.0024 to 0.053 mg/kg.

- Metals analyses did not identify any sediment with elevated concentrations of heavy metals; the following metals were not detected: antimony, arsenic, cadmium, mercury, selenium, and thorium.

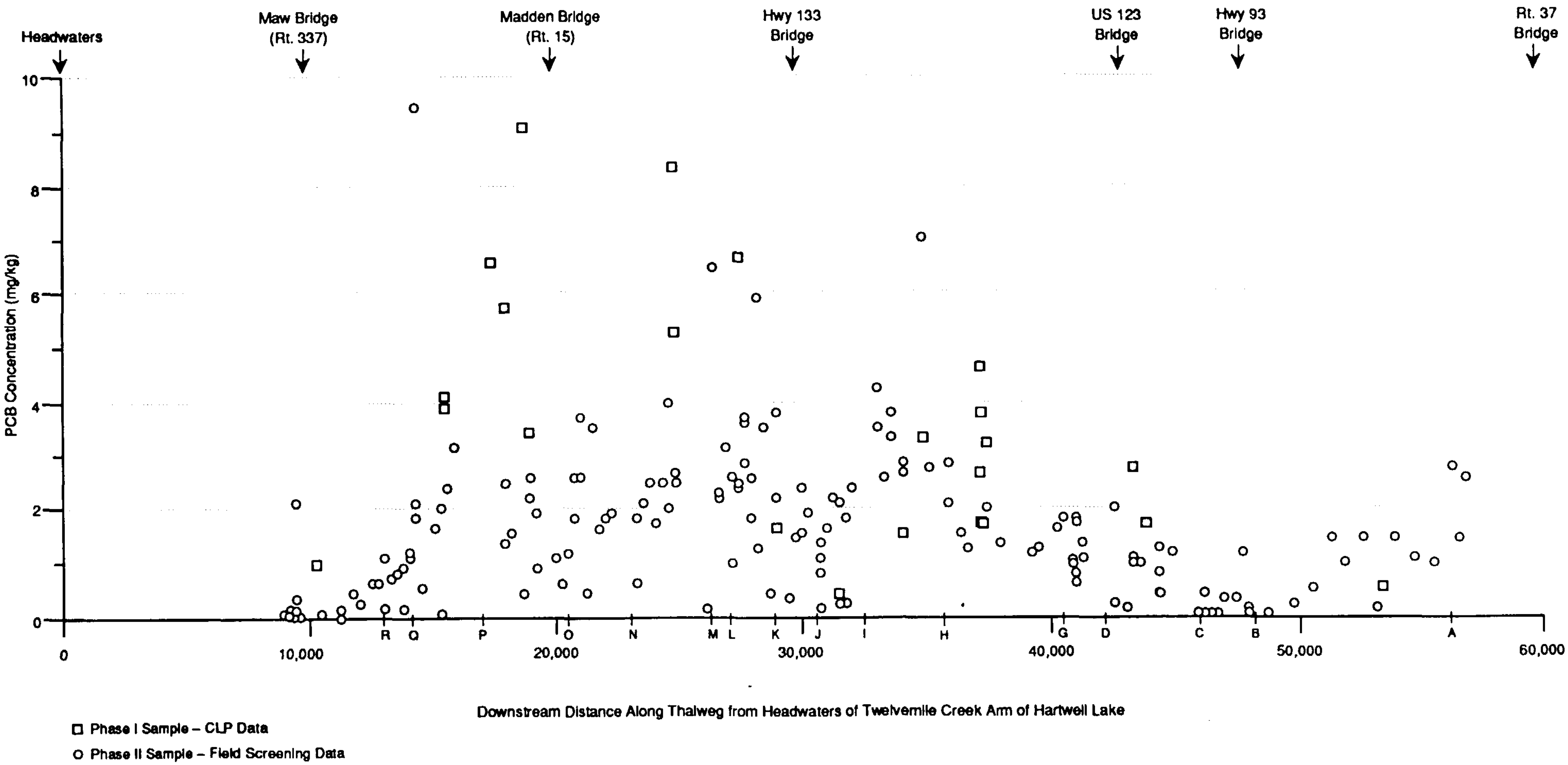
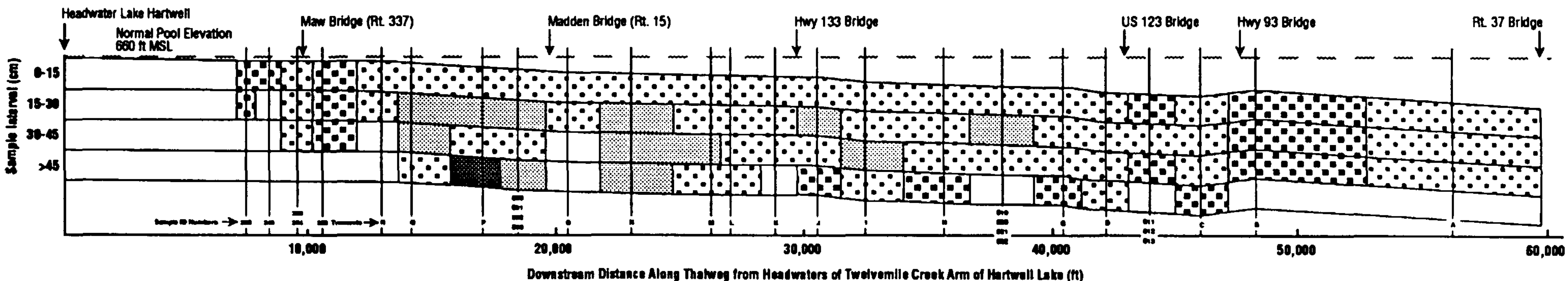


Figure 5-3
PCB Distribution for Grab Samples

59 0033

Mean PCB Concentration per Transect Interval



NOTE: Mean PCB concentrations were determined by averaging all results for a given sample depth interval for all coring stations along a given transect.

Figure 5-4
Vertical Distribution of Mean PCB Concentration per Transect Interval

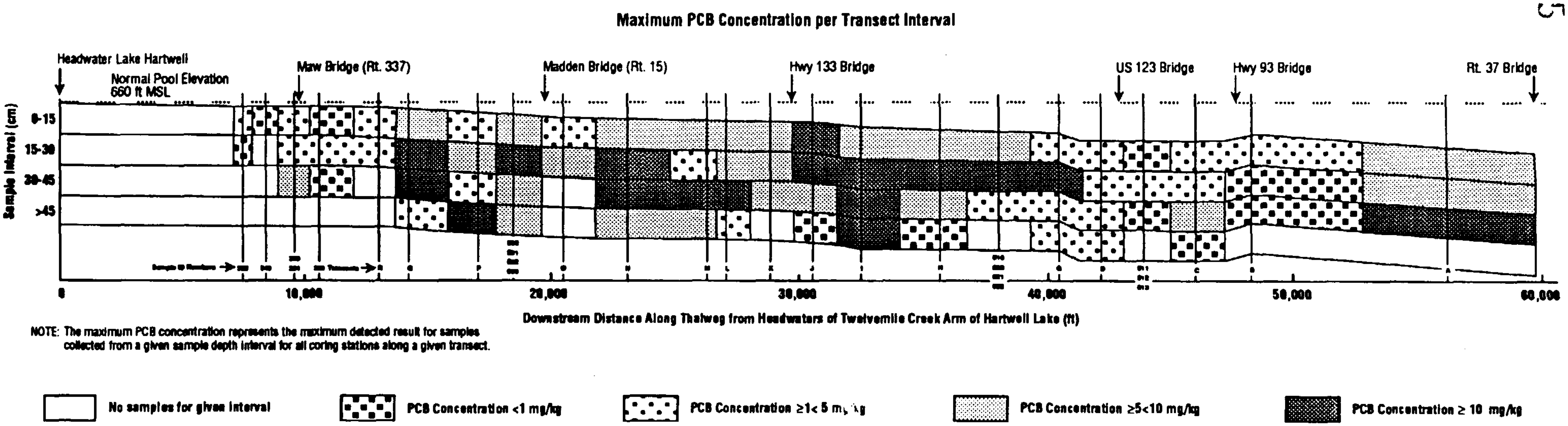


Figure 5-5
Vertical Distribution of Maximum PCB Concentration per Transect Interval

5.2.6 Summary of Surface Water Investigations

Surface water quality investigations have focused on the presence of PCBs in waters downstream of the Sangamo Weston Plant Site, the OU1 offsite disposal areas, and/or the Midway dump and Easley-Pickens landfill. Relevant conclusions from these historical investigations and the RI studies include:

- The most frequent and highest levels of PCB contamination (1.7-20.3 μg/l) were detected in surface water samples collected from locations downstream of the Sangamo Weston outfall on Town Creek.

- PCBs were either not detected or present in concentrations <1 μg/l in surface water samples collected from drainage ditches and tributaries associated with the OU1 offsite disposal areas (Breazeale, Cross Roads, Dodgens, Trotter, and Welborn disposal areas). These areas are apparently not releasing appreciable levels of contamination to Twelvemile Creek or its tributaries.

- Based upon NPDES data, PCB concentrations in discharge from the Sangamo Weston wastewater treatment plant outfall on Town Creek during the mid-1970's averaged 13 μg/l and ranged as high as 235 μg/l; NPDES monitoring data from this outfall for 1992 reported PCB concentrations in the range 0.4 to 40.3 μg/l. This continued release of PCBs to Town Creek and the downstream portions of OU2 are expected to terminate once the OU1 remedial action at the Sangamo Weston plant site has been completed.

- PCBs were not detected in any of the surface water samples collected for Phase I of the RI; detection limits for these unfiltered samples ranged from 1.2 to 1.3 μg/l.

- A limited number of these RI samples were also analyzed for full TCL analyses; no volatile organics, extractable organic compounds, pesticides or cyanide were detected, and inorganic (metals) concentrations were not indicative of contamination.

- PCBs were not detected in any of the storm event samples collected for Phase II of the RI; detection limits for these unfiltered samples ranged from 1.2 to 1.3 μg/l.

5.3 BIOLOGICAL INVESTIGATION SUMMARY

Field activities for the Biological Investigations were conducted by the COE in the Spring 1991, 1992, and 1993. The field activities were divided into two individual study areas; the Twelvemile Creek watershed and Lake Hartwell. The specific methods employed and results from these two investigations are summarized in the following sections.

The information gathered from the Biological Investigations conducted in the Twelvemile Creek watershed further support the conclusions made in the sediment component of the RI that: 1) the Sangamo Plant Site is the primary source of PCB contamination in Twelvemile Creek; and 2) the contribution of PCB contamination in the Twelvemile Creek watershed from the six satellite disposal areas is negligible. The aquatic biota in Twelvemile Creek appear to have suffered from the influence of man's activities. Although PCBs have likely contributed to these perturbations producing cumulative effects, other factors have no doubt had an additional impact on these animals at the population and community levels.

Fish in Lake Hartwell continue to be contaminated with PCBs often at levels that exceed the FDA safe tolerance limit of 2 mg/kg. PCBs appear to be the only pollutant of concern in Lake Hartwell fish. The highest concentrations of PCBs in fish are located in the Twelvemile Creek Arm. PCB concentrations in fish species that are generally non-migratory decrease both downstream and farther from the Twelvemile Creek Arm. Migratory fish species have PCB concentrations that are similar throughout the reservoir and are high enough to be a concern.

PCBs were detected at all levels of the food chain in both the Twelvemile Creek watershed and Lake Hartwell. Pathways for PCB uptake in aquatic biota of Lake Hartwell include ingestion through the food chain and contact, most likely through the gills. Exposure results from PCBs being adsorbed to sediments and transported down Twelvemile Creek into Lake Hartwell.

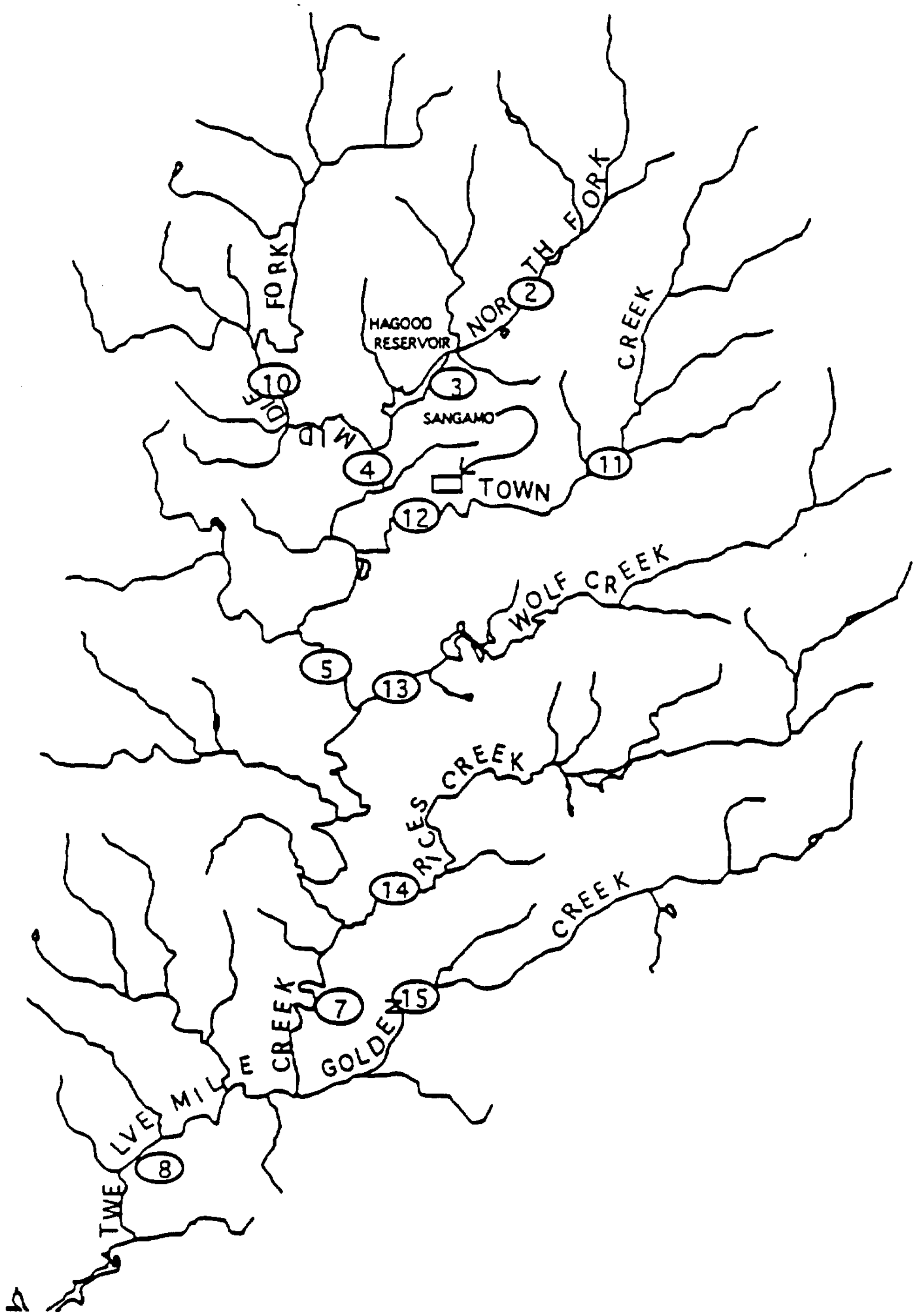
The health of fish in Lake Hartwell does not appear to be affected at the population level for fish that have PCB concentrations at the current levels (around 5 mg/kg). However, there is evidence that as concentrations increase to greater than 20 mg/kg fish health can be affected. Largemouth bass was the target species used during these investigations. The sensitivity or tolerance of other fish species to PCB contamination is not known.

5.3.1 Twelvemile Creek Watershed Investigations

Field investigations in the Twelvemile Creek watershed were conducted during Spring 1992 to: 1) determine the concentration of PCBs in one primary sport fish species and one bottom feeding species; 2) assess the condition of the fish community by determining the Index of Biotic Integrity (IBI); 3) assess the condition of the macroinvertebrate community by using Benthic Rapid Bioassessment techniques; 4) assess fish health of redbreast sunfish by using bioindicators and the Health Assessment Index (HAI); 5) assess composition and fate of harvest to determine public utilization by using a creel survey; and 6) determine on-going PCB contamination due to transport of drifting organic matter and bioaccumulation by a sediment dwelling, filter feeding organism, the freshwater clam (Corbicula fluminea).

Twelve sampling stations were established in Twelvemile Creek and three uncontaminated tributaries. These sample stations are shown in Figure 5-6. The length of each station was

Figure 5-6
Twelvemile Creek Drainage Sampling Stations



from 0.3 to 0.5 miles to encompass gross habitat types and ensure adequate sample size. Stations were permanently marked with "Carsonite" markers located in the creek bank at the upper and lower boundaries. All 12 stations were not involved in each sub-element of the overall investigation (i.e. PCB tissue analysis, IBI, HAI).

Twenty fish were collected for PCB contaminant analysis from each of the stations in the Twelvemile Creek watershed and one tributary reference site. Redbreast sunfish (Lepomis auritus) were used as a sport fish species for assessment of human health and environmental risk. Redbreast sunfish were chosen based on abundance and likelihood of use by anglers. Ten redbreast were collected per site. Ten northern hogsuckers (Hypentelium nigricans) were collected per site to determine PCB concentrations in a bottom feeding species to assess environmental risk. Northern hogsuckers were selected based on abundance and tropic level. Largemouth bass and bluegill were substituted for redbreast sunfish at three stations.

Concentrations of PCBs in fish collected in the Twelvemile Creek watershed were highest in Town Creek and Twelve Mile Creek. Four of the 12 stations sampled had PCB values exceeding 2.0 mg/kg. Three of these stations (5, 8, and 12) were downstream from the Sangamo Plant Site. Station 4, the other station having high PCB values, was located just upstream from the confluence of Town Creek and Twelvemile Creek and was probably affected by fish migrating from both creeks. Stations upstream from station 4 could not be affected by migration due to a low head dam located at the upper boundary of station 4. Mean PCB concentrations ranged from a high of 12.5 mg/kg for northern hogsuckers in Town Creek to a low of 0.88 mg/kg in redbreast sunfish in Twelvemile Creek for stations downstream from the Sangamo Plant Site. The remaining stations located in tributary streams or upstream from the Sangamo Plant Site had lower PCB concentrations in fish than those located downgradient from the plant site.

Several non-diagnostic studies which employed a metric/index system were conducted to assess the health or condition of individuals, populations and/or communities in the Twelvemile Creek watershed. The benthic macroinvertebrate community of Twelvemile Creek watershed was evaluated using EPA's rapid bioassessment protocols. Samples were collected at a reference site and the remaining sites shown on Figure 5-6. Eight of the nine stations sampled in the Twelvemile Creek drainage were classified as moderately impaired. Station 11, located upstream of the Sangamo Plant site on Town Creek, was classified as non-impaired and had high values for taxa richness and exhibited an abundance of intolerant taxa. Sites immediately downstream of the Sangamo facility exhibited evidence of greater impairment than did upstream or tributary sites.

The Index of Biotic Integrity (IBI) was used to assess the general health of the fish community in the Twelvemile Creek watershed. The IBI index is based on a set of metrics determined from species composition and abundance for a fish community. These metrics focus on basic ecological characteristics of the fish fauna and have been used effectively in stream monitoring programs for the past decade. Nine stations in the Twelvemile Creek watershed and three reference sites were sampled. The IBI was effective for ranking the reference sites as expected based on no identifiable impacts at station 1 (IBI 40), known impacts of agricultural runoff at station 2 (IBI 30), and a known point source discharge at station 3 (IBI 12). Therefore, it appeared appropriate to use the IBI to assess the relative health of fish populations in the Twelvemile Creek watershed with confidence.

The IBI scores indicated that all stations sampled have been impaired to some degree. Most stations throughout the watershed were classified as either "fair" or "good" indicating moderate negative effects on the fish communities that could have resulted from habitat degradation from man's activities. Only the two reference stations 2 and 3 that were identified as having known impacts and station 5, located in Twelve Mile Creek downstream from Town Creek, were classified as "poor" or "very poor." The IBI classification at station 5 ("poor") and a comparison of relative health between sample stations and reference stations indicated that station 5 has been severely impacted. Both habitat degradation and water quality impacts including PCB contamination likely contributed to this adverse impact.

Both the macroinvertebrate and fish communities have been impaired throughout the Twelvemile Creek watershed. Assumably, these impairments have resulted from PCB discharges, habitat degradation, particularly siltation due to erosion from development, siviculture and agriculture, and poor water quality from both point and non-point discharges throughout the watershed.

The Health Assessment Index (HAI) was employed to assess the health of redbreast sunfish at selected stations in the Twelvemile Creek drainage and a reference site. HAI is an autopsy based index that uses divergence from the normal of various organs, tissues and blood parameters to evaluate fish health. The HAI scores for redbreast sunfish were variable throughout the watershed ranging from 39.3 to 62.7. Station 12 located in Town Creek immediately downstream from the Sangamo site had the lowest HAI score, 39.3, indicating healthy fish at this site.

It is not evident from evaluating the HAI scores that the health of redbreast sunfish has been effected by PCB contamination. HAI scores were variable throughout the drainage. However, scores in the range seen during this investigation were not considered high. It is likely that health problems that would manifest themselves to visual inspection through autopsy do not occur in fish contaminated at the lower PCB concentrations seen in redbreast sunfish in the Twelvemile Creek drainage.

Drift net samples were used to collect detritus (floating organic matter) in Town Creek downstream of the Sangamo site and in Twelvemile Creek at Lay Bridge. Additionally, cages of "clean" Corbicula fluminea (fresh water clams) were placed at these sites for 28 days to determine rates of bioaccumulation of PCBs by analyzing the muscle tissue. Drift net samples of coarse particulate matter collected from Town Creek, immediately downstream of the Sangamo Plant Site had detectable PCB concentrations ranging from 0.066 to 0.51 mg/kg. PCB concentrations in corbicula collected at this station ranged from 0.75 to 0.88 mg/kg. Corbicula collected from the station immediately downstream of the Lay Bridge had PCB concentrations that ranged from 0.45 to 0.57 mg/kg. From these results, it can be concluded, that even though PCBs have not been detected in water samples collected from the study area, transport of PCBs down Town Creek and Twelvemile Creek is occurring.

5.3.2 Lake Hartwell Investigations

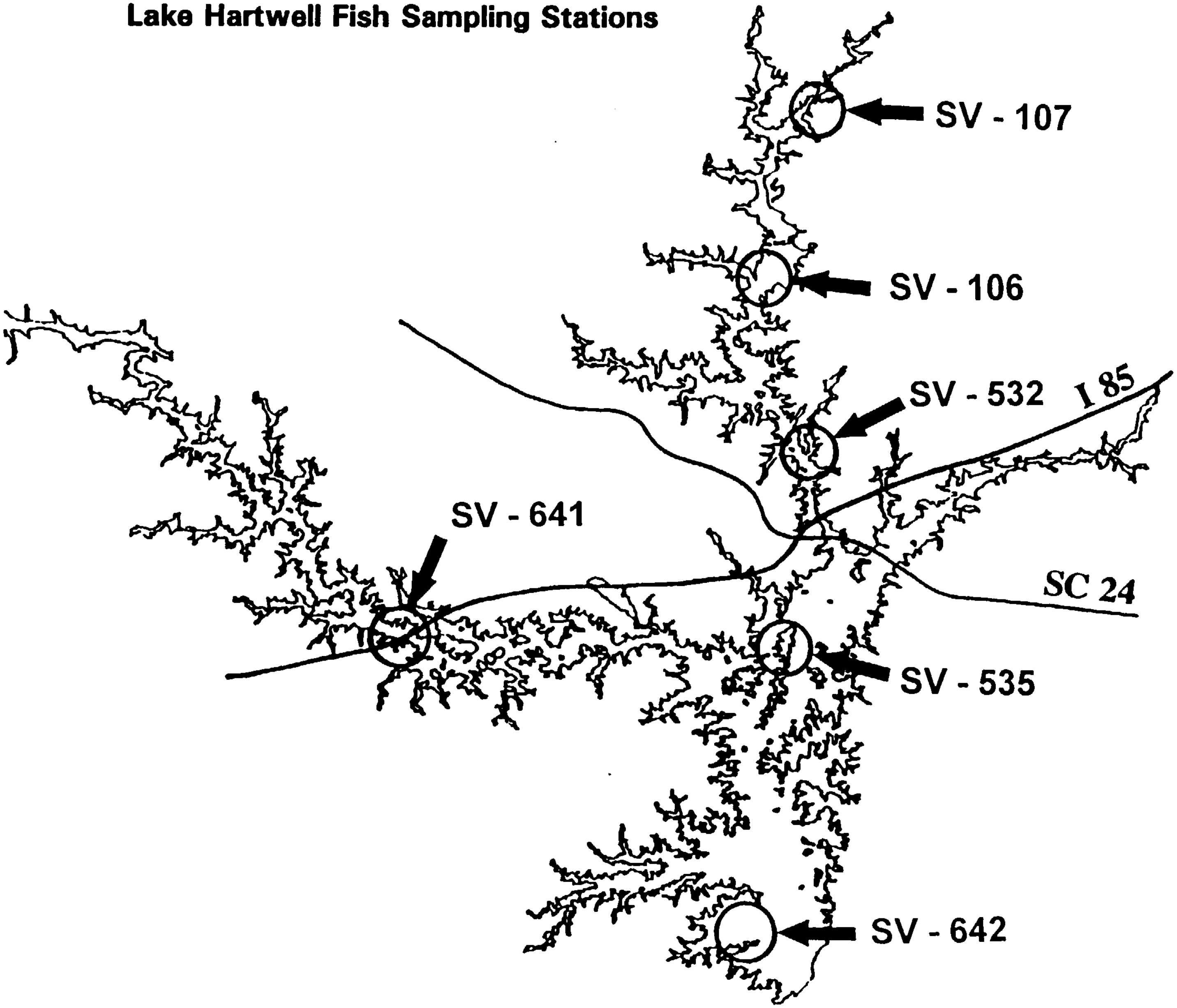
Studies in Lake Hartwell were conducted during Spring 1991, 1992, and 1993 to: 1) determine the concentration of PCBs in primary sport and forage fish species; 2) assess fish health of largemouth bass using bioindicators and HAI; 3) determine PCB concentrations in seston and macroinvertebrates; and 4) assess composition and fate of harvest to determine public utilization using a creel survey.

Fish species selected for Lake Hartwell contaminant analysis included: 1) sport and/or commercial species, 2) fishes that seasonally occupy different habitats or exhibit seasonal migrations, and 3) primary forage species. Species selected for collection and analysis were: largemouth bass, hybrid bass, channel catfish, threadfin shad (Dorosoma petenense), gizzard shad (Dorosoma cepedianum), blueback herring (Alosa aestivalis), and bluegill (Lepomis macrochirus).

A total of 134, 144, and 144 fish were collected from six locations throughout Lake Hartwell during spring 1991, 1992, and 1993, respectively. These six stations are illustrated on Figure 5-7 and were selected to represent a gradient of PCB contamination in fish ranging from the most impacted (SV-107 in the Twelvemile Creek embayment) to a background location (SV-641) in the Tugaloo Arm. These fish were analyzed for PCB concentrations in standard U.S. FDA fillets with skin on, de-scaled with rib cage (except for catfish where the skin was removed). Additionally, the 60 largemouth bass collected in 1991 were analyzed for priority pollutants. Composite samples of forage fish, including bluegill, threadfin shad, gizzard shad, and blueback herring, were collected from SV-107 (highly impacted), SV-532 (intermediate zone), and SV-641 (background).

PCB concentrations in fish have historically been highest in the Twelvemile Creek Arm of Lake Hartwell (SV-107) and decrease in a downstream direction. This is expected since PCBs enter Lake Hartwell bound to sediments that are transported down Twelvemile Creek, as discussed in Section 5.2 of this ROD. Results of PCB analyses collected from 1990-1993 for largemouth bass, channel catfish, and hybrid bass are graphically illustrated on Figures 5-8, 5-9, and 5-10, respectively. These years were comparable since analyses were completed in the same manner. Although 4 years of data may be insufficient to justify

Figure 5-7
Lake Hartwell Fish Sampling Stations



meaningful trend analysis, PCB levels decreased significantly in largemouth bass at SV-107 (Figure 5-8). This trend was not significant at other stations. As in past samples, PCB levels in largemouth bass decreased in a downstream direction. PCB concentrations in channel catfish have also decreased at stations farther from the source in Twelvemile Creek (Figure 5-9). However, there has been little change in the PCB concentrations in channel catfish over the past 4 years

The distribution of PCB concentrations in hybrid bass throughout the lake remains a concern. Hybrid bass collected farther from the source in Twelvemile Creek have higher PCB concentrations than other species, often exceeding the FDA tolerance level of 2 mg/kg (Figure 5-10). This is thought to be a result of their migratory behavior and is also seen in the samples of walleye, another migratory species having high concentrations of PCBs (mean 3.48 mg/kg) from SV-642 at Hartwell Dam.

Contaminants other than PCBs were not identified at concentrations of concern nor were they widely distributed. A comparison of the priority pollutants to the established USFDA action levels showed that no chemical exceeded any of the safe tolerance standards except PCBs. Priority pollutants having no standards were compared to SCDHEC's fish tissue trend data base. Out of 60 largemouth bass there were 17 different compounds (mostly petroleum and organic solvents) that occurred only once in a single fish and several others that occurred only twice. There was no pattern of contamination and PCBs are considered the only contaminant of concern.

Forage fish species had mean PCB concentrations ranging from 3.00 mg/kg in threadfin shad to 12.43 mg/kg in gizzard shad at SV-107. PCB concentrations in forage fish decreased at stations farther from the Twelvemile Creek Arm. This supports the hypothesis that migratory species bioaccumulate PCBs while located in the upper Seneca River rather than through the food chain as forage species migrate out of the more heavily contaminated area.

The effects of PCB contamination on fish health and reproductive competence in Lake Hartwell were examined utilizing the HAI, biological indicator analyses, and age and growth analysis. Largemouth bass were the target fish species sampled. Comparisons of fish health using the HAI as the indicator were made among all six stations sampled in Lake Hartwell in 1992 and 1993. Differences in the HAI were seen between stations. Station SV-107 consistently had the highest HAI score for each year sampled. Station SV-106, the closest downstream station, also had high HAI scores. During 1992, these two stations exceeded 80 while stations farther from Twelvemile Creek ranged from 42 to 65. Fish from Twelvemile Creek (SV-107) and Martins Creek (SV-106) had the highest occurrence of fatty liver conditions. Accumulation of fat in the liver can be associated with exposure of fish to PCBs. The remaining stations had a greater percentage of normal livers with little occurrence of fatty livers. Although HAI scores only indicate the relative

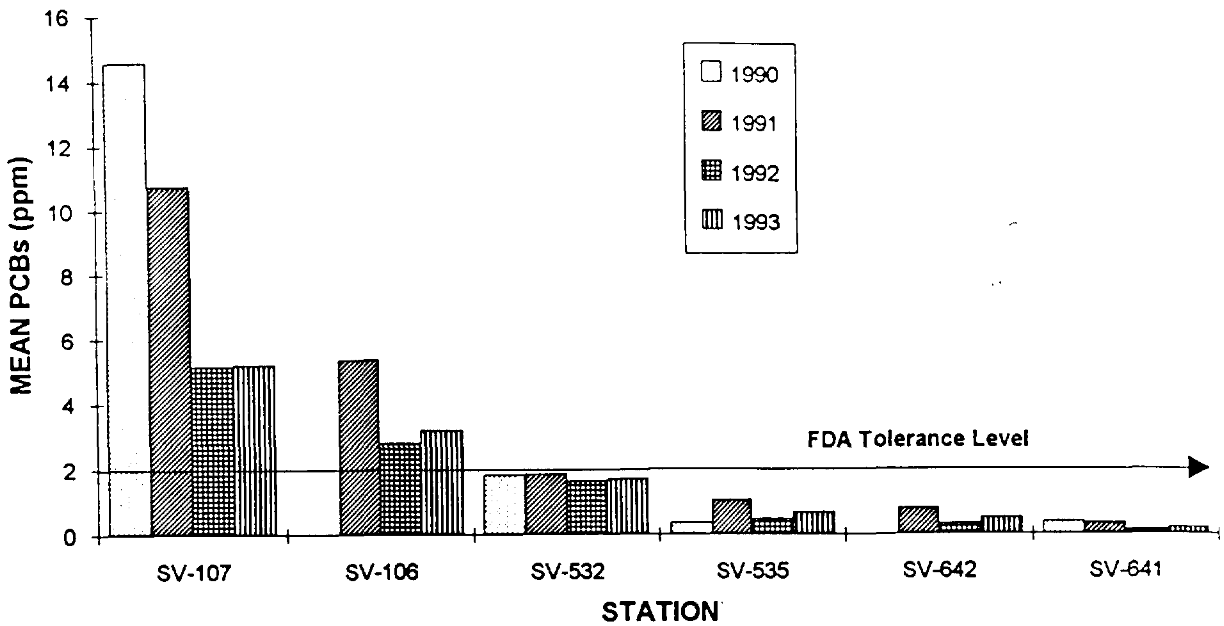


Figure 5-8
PCB Concentrations in Largemouth Bass Fillets (1990-1993)

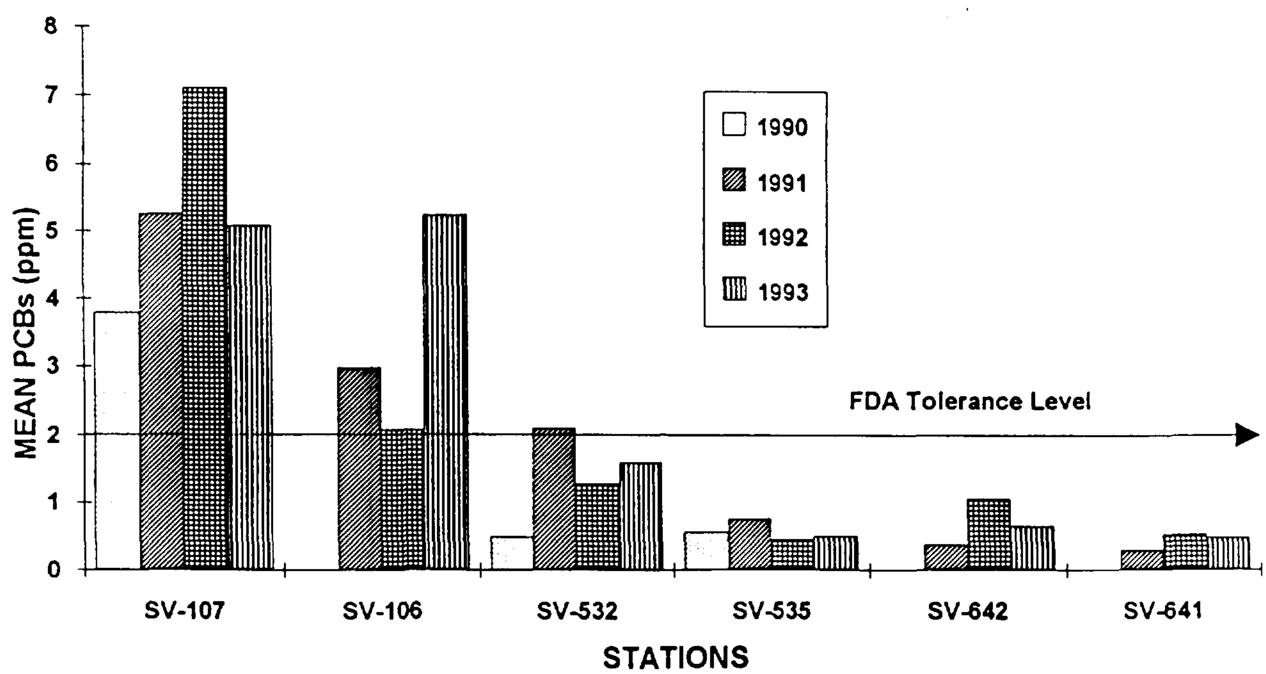


Figure 5-9
PCB Concentrations in Channel Catfish (1990-1993)

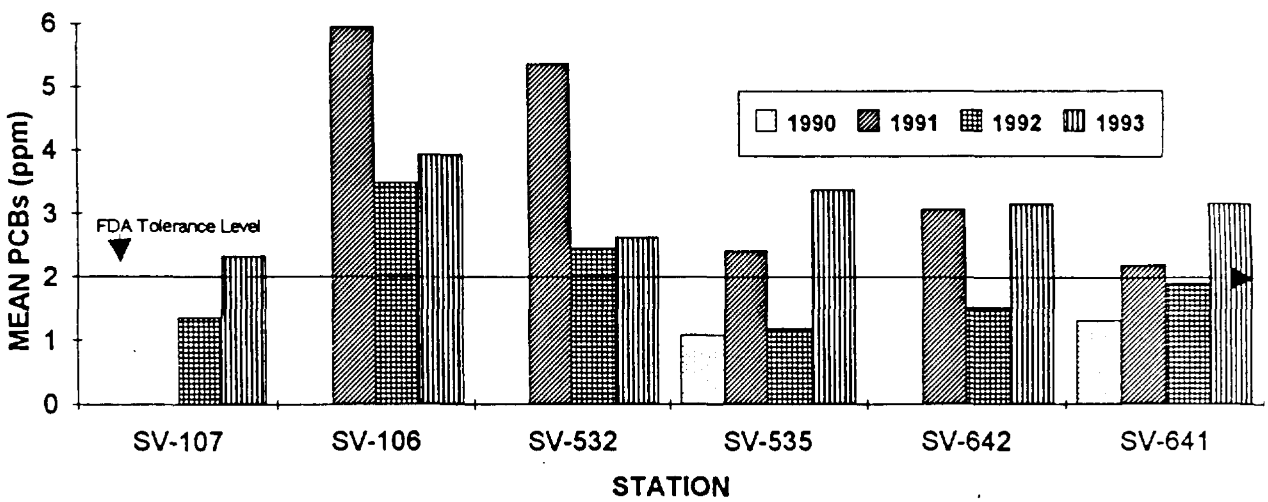


Figure 5-10
PCB Concentrations in Hybrid Bass Fillets (1990-1993)

health of fish without indicating cause, decreases in the HAI scores with distance from the source was consistent with declines in PCB concentrations in fish at these stations.

Biomonitoring using biological indicators of fish health and reproductive competence was conducted at both Twelvemile Creek and Lake Hartwell study sites. The selected suite of bioindicators measured in this investigation included, among others, organ dysfunction, nutritional status, gonadal analyses, detoxification enzymes, and concentrations of reproductive steriods. The redbreast sunfish was the target species in the Twelvemile Creek watershed, while largemouth bass was the target species in Lake Hartwell. Bioindicator analyses conducted in Twelvemile Creek indicated that PCB contamination probably contributes, but is not the sole cause of impacts on fish health. There was evidence of biochemical and physiological differences between Lake Hartwell stations with largemouth bass collected from SV-107 exhibiting abnormal responses to several bioindicators. The most obvious physiological difference in largemouth bass between stations related to the functions of the liver. Additionally, age and growth analysis indicated that largemouth bass from SV-107 had a slower growth rate and were less plump having lower weights per unit of length.

Cages of clean corbicula were deployed for 28 days at two locations in the Twelvemile Creek Arm of Lake Hartwell to evaluate the uptake of PCBs by this filter feeding organism. The two locations were established in the "goose-neck bend" area between the Maw (Hwy 337) and Madden (Hwy 15) Bridges and near the lower end of Twelvemile Creek Arm, just above the Keowee River confluence. PCBs were detected in corbicula muscle tissue at concentrations ranging from 0.48 mg/kg at the lower Twelvemile Creek Arm station to 0.56 mg/kg at the goose-neck bend station. Adult mayflies were also collected from the Twelvemile Creek Arm, just above the Hwy 133 Bridge and were found to have 2.6 mg/kg of PCBs.

5.3.3 Assessment of Resource Use

Public utilization of the fishery resources was assessed by creel surveys on Twelvemile Creek and Lake Hartwell. Twelvemile Creek was surveyed at major access points upstream to the confluence of the Middle Fork and North Fork. Lake Hartwell was divided into eight sampling areas that allowed analysis of angler use relative to PCB concentrations in fish within each area. Additionally, interviews provided data from which to evaluate the economic importance of the resource. The interviews also included questions to assess how fishermen used or consumed their harvest and fisherman awareness of the health advisory. These questions were the same for both the Lake Hartwell and the Twelvemile Creek creel survey.

Angler use of Twelvemile Creek appeared to be minimal. Only 21 interviews were obtained during this investigation. Some anglers were interviewed more than once indicating there may be a small localized group of anglers that frequent Twelvemile Creek. Most anglers interviewed were located at bridge crossings near the confluence of Twelvemile Creek and Lake Hartwell. They were encountered from March through August only. There was evidence of some fishing in more upstream areas from the presence of the types of trash that is customarily associated with bank fishermen. However, anglers were not encountered at these locations indicating low use.

Most anglers (66%) do consume fish caught in Twelvemile Creek. Channel catfish and sunfish made up most of the harvest. Consumption estimates for those anglers that indicated they ate fish were higher for Twelvemile Creek (37 g/day) than for Lake Hartwell (28 g/day). However, the total estimated harvest for Twelvemile Creek in 1992 was only 116.2 kg (256 lbs.).

Public utilization of the fishery resources in Lake Hartwell was also assessed by creel survey. A total of 415,839 fish were caught in 728,489 angler-hours of effort. A total of 239,726 (58%) were released, while 176,112 fish weighing 115,320 kg (253,703 lbs.) were harvested. The top five species sought included largemouth bass, anything, striped bass, hybrid bass, and crappie. Largemouth bass and crappie comprised the largest percentage by number of fish harvested, while largemouth bass and hybrid bass comprised the largest percentage by weight.

The number of fish harvested was greatest in areas which comprised the Twelvemile Creek, Keowee River, and Seneca River Arms which encompass the most heavily contaminated portion of Lake Hartwell and much of the area under the most extreme advisory. Additionally, the Seneca River Arm area had the highest harvest by weight. By weight, 29% of the largemouth bass, 48% of the hybrid bass, and 66% of the striped bass harvested from Lake Hartwell came from the Seneca River Arm. Despite the advisory concerning fish consumption, anglers continue to harvest the largest portion of fish from Lake Hartwell from the areas most affected by PCB contamination.

Eighty-five percent of all anglers responding were aware of the fish consumption advisory. Sixteen percent had stopped eating fish because of the advisory. Sixty-seven percent of anglers interviewed indicated they ate fish from Lake Hartwell. The mean monthly per capita consumption for Lake Hartwell anglers that eat fish was estimated to be 0.85 kg (1.86 lbs). The mean monthly per capita consumption estimate for the Twelvemile Creek Arm, the most contaminated area, was 0.9 kg (2 lbs) near the lake average.

The health advisory on fish consumption appeared to influence consumptive habits of less than one-fourth of the anglers interviewed. Most anglers cited other reasons why they had stopped eating fish caught from Lake Hartwell. Most anglers indicated that they practiced catch-and-release, presumably for sport reasons. Some anglers indicated that a stronger advisory, a ban on fishing, seeing people get sick from eating fish and/or documentation of increased contamination would affect their fish consumption habits.

5.4 CONTAMINANT FATE AND TRANSPORT SUMMARY

An integral component of the Sangamo OU2 RI was to develop predictions regarding the continued deposition, migration, and accumulation of PCB contaminants in the sediment, water, and aquatic biota of Lake Hartwell. These predictions were accomplished through the use of specialized numerical-based models that considered the environmental processes and contaminant characteristics that control PCB migration and accumulation as well as the intermedia transfer and degradation of PCBs.

This comprehensive modeling effort focused on changes to an approximate 10 mile reach of the Twelvemile Creek Arm of Lake Hartwell over a 30-year period and consisted of: 1) future sediment transport/deposition using the HEC-6 computer model, "*Scour and Deposition in Rivers and Reservoirs, Version 4.0*", which was developed by the Hydrologic Engineering Center of the COE; 2) future PCB fate and transport using the "*Water Quality Analysis Simulation Program (WASP-4), Version 4.0*" developed and supported by EPA; and 3) future aquatic bioaccumulation modeling using the "*Food and Gill Exchange of Toxic Substances (FGETS), Version 3.0*" developed by EPA. The results of these modeling efforts are summarized below.

5.4.1 Future Sedimentation

The objective of sediment transport simulation was to determine rates at which presently contaminated sediments would be buried by relatively clean sediments from tributary drainages over the next 30 years. This simulation assumes that the historic hydrologic flow regime and sediments loading to the system remains unchanged. An overview of sedimentation regimes within the Twelvemile Creek Arm and upper Seneca Arm is summarized below. Figure 5-11 provides a bed profile of the Twelvemile Creek Arm. Figure 5-12 provides an illustration of the average sediment burial rates as predicted by the HEC-6 model.

The model identified three distinct sediment transport regimes. The first regime extends from just below the Woodside II impoundment (Transect T19) to a point approximately 2,400 ft upstream of the Maw Bridge (Transect T16). This reach is upstream of the backwater influence of the Hartwell impoundment (normal pool elevation of 660 ft MSL) and, therefore, behaves as a river. Energy gradients, bottom shear stresses, and turbulence intensities are relatively large in this reach; sediment transport potential is therefore high and sediments of all sizes, sand included, are carried by the flow as suspended sediment. The HEC-6 results predict excess sediment transport potential, resulting in a small amount of scour along this reach.

The second regime extends from upstream of the Maw Bridge to just above the Hwy 133 bridge; this reach represents a zone of transition from a high energy fluid environment (river) to a low energy environment (lake). As the transition from river to lake occurs, energy gradients, bottom shear stresses, and turbulence

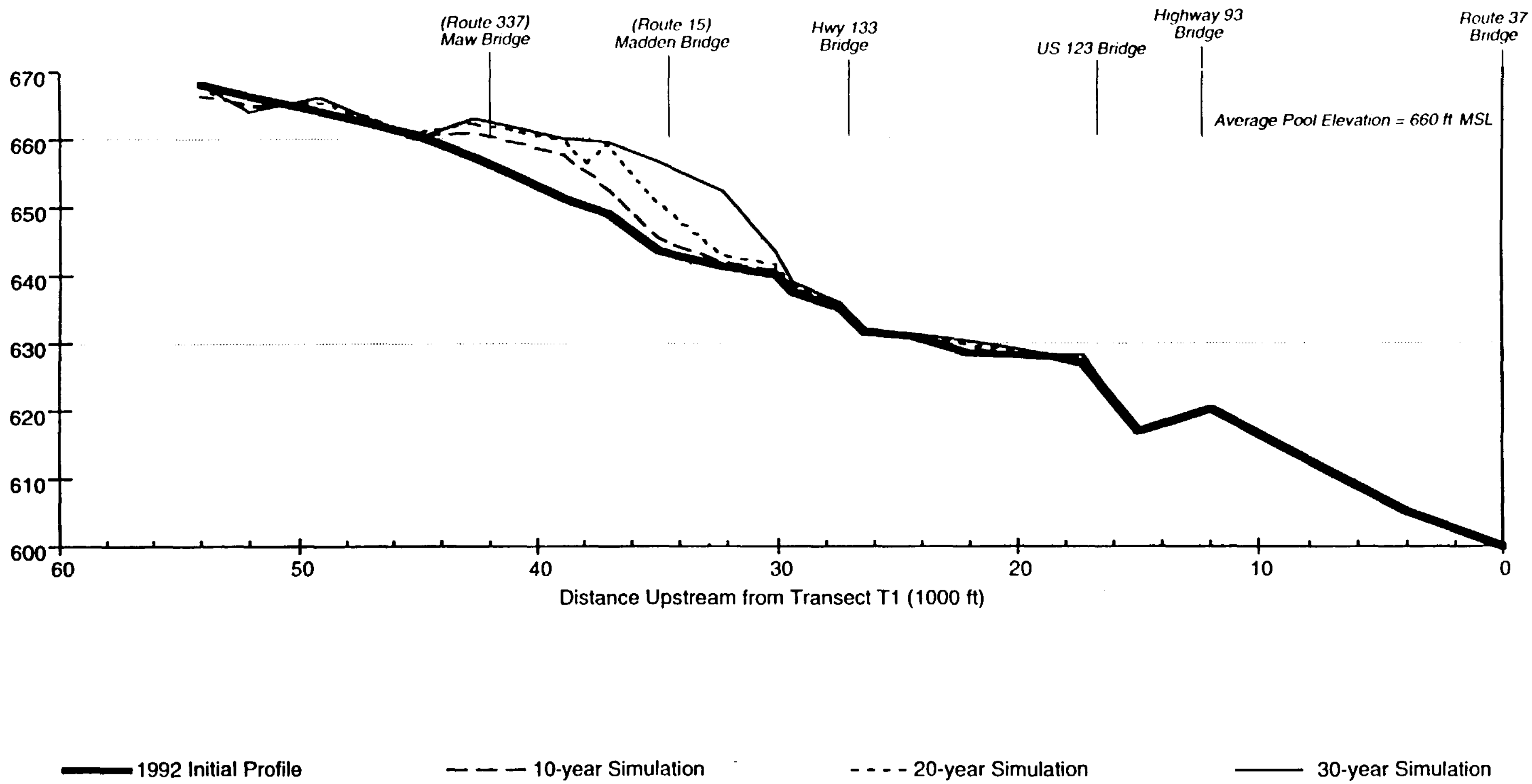


Figure 5-11
Simulated Bed Profile Twelvemile Creek Arm

59 0049

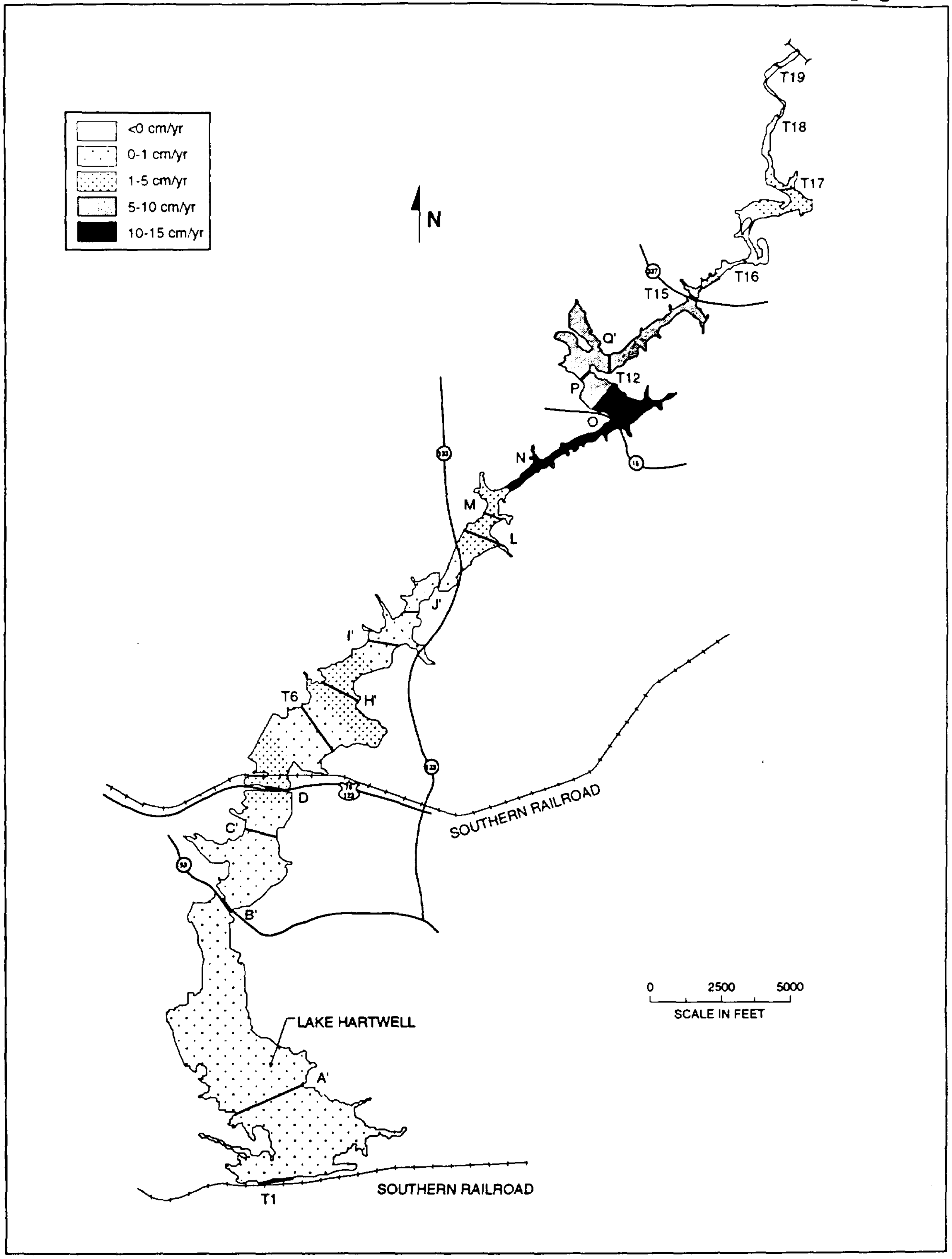


Figure 5-12
Predicted Average Sediment Burial Rates

levels all decrease, resulting in high rates of sediment deposition (1.43 to 13.12 cm/yr) as all of the sand and most of the silt coming into the reservoir are deposited (clays remain as suspended sediment and continue downstream). The model predicted a 30-year accumulation of nearly 10 ft of sediment in some areas. Sedimentation in this area results in the formation of a delta that advances into the impoundment over time, moving the headwater location further into the impoundment as well (See Figure 5-11). With a continuous supply of sediment from the watershed, this delta eventually will advance below Madden Bridge.

The third regime extends from upstream of the Hwy 133 bridge to the Hwy 37 bridge, which marks the downstream extent of the system modeled. Hydraulically, this portion of the system behaves as an impoundment with low-energy gradients and turbulence levels. This quiescent environment favors sediment deposition; however, only small deposition depths and burial rates are predicted because most of the sand and silt load is deposited upstream, and only slow-settling, clay-sized particles are available for deposition downstream. Most of the clay entering this reach is deposited, resulting in predicted deposition depths ranging from 0 to 54 cm and average burial rates of 0 to 1.8 cm/yr.

5.4.2 Future Sediment and Water Quality Trends

Future PCB fate and transport in the Twelvemile Creek/Hartwell Lake system was modeled using the WASP4 code developed by EPA. The modeling was conducted to predict the fate and transport of PCBs in the Twelvemile Creek/Hartwell Lake system over the next 30 years. This work was conducted to assist in the extrapolation of PCB data collected in the present investigation to future conditions. An overview and results of the water quality modeling study are summarized below. Figures 5-13, 5-14, 5-15, and 5-16 provide predicted PCB concentrations in surface sediment initially, at 10 years, 20 years, and 30 years, respectively.

Results from the WASP4 simulations reflect a relatively complex cycling of PCBs through the system. Initially, PCB concentrations are relatively high in upstream surface and bottom sediment segments. Over time, clean sediment from the upstream tributary is deposited over the contaminated sediments, which results in burial and dilution of the contaminated sediments. Because sediment resuspension and deposition can occur simultaneously, some contaminated sediments from upstream segments is resuspended in the water column, where advection and dispersion transport them further into the impoundment. These contaminated sediments are then redeposited. Because suspended sediment concentrations decrease with increasing distance into the impoundment, the rate at which redeposited sediments are buried is much smaller than at points upstream where they originated.

The net result of these transport processes is (1) a significant reduction in PCB concentrations in the surface and

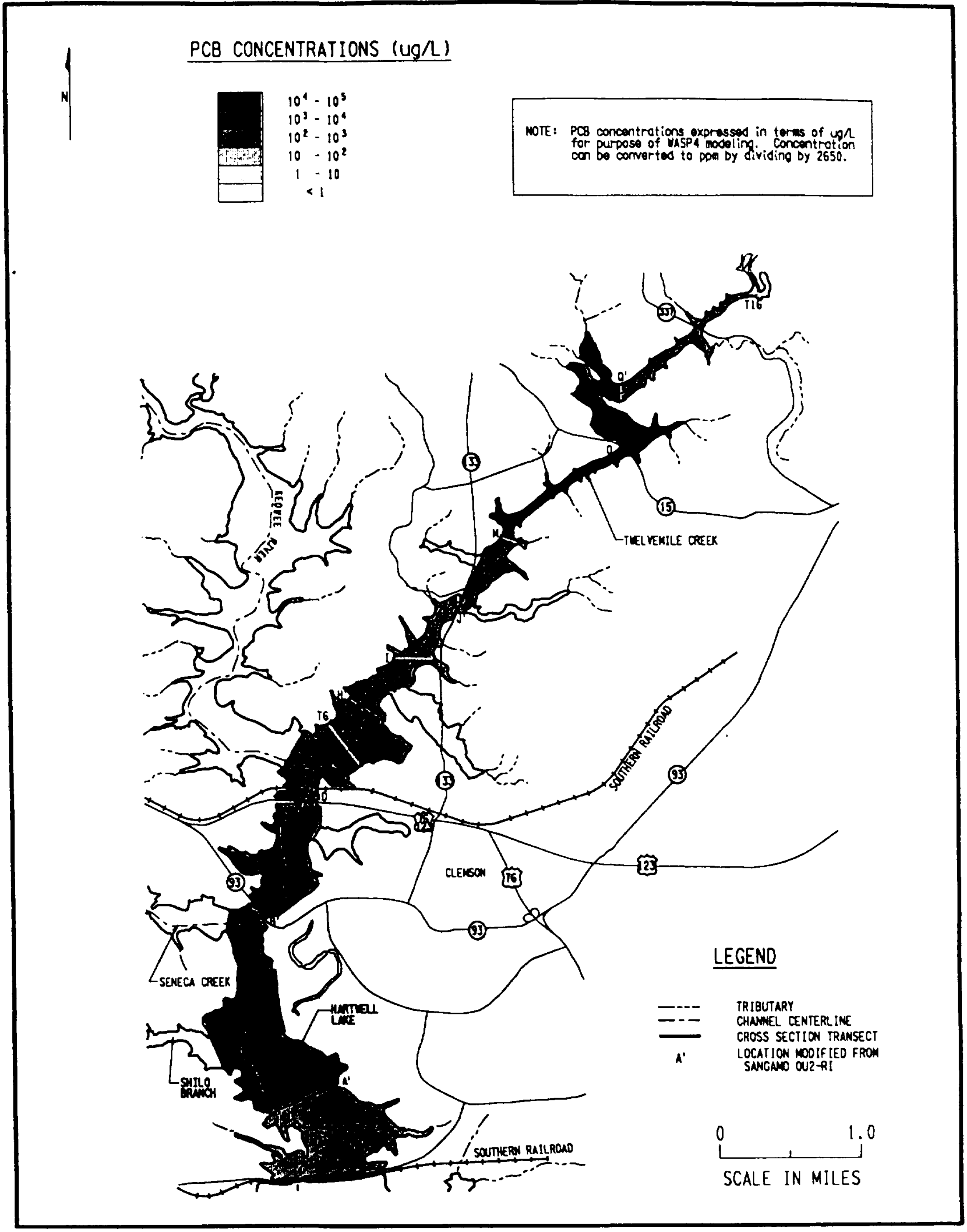


Figure 5-13
Initial WASP4 Surface Sediment PCB Concentrations

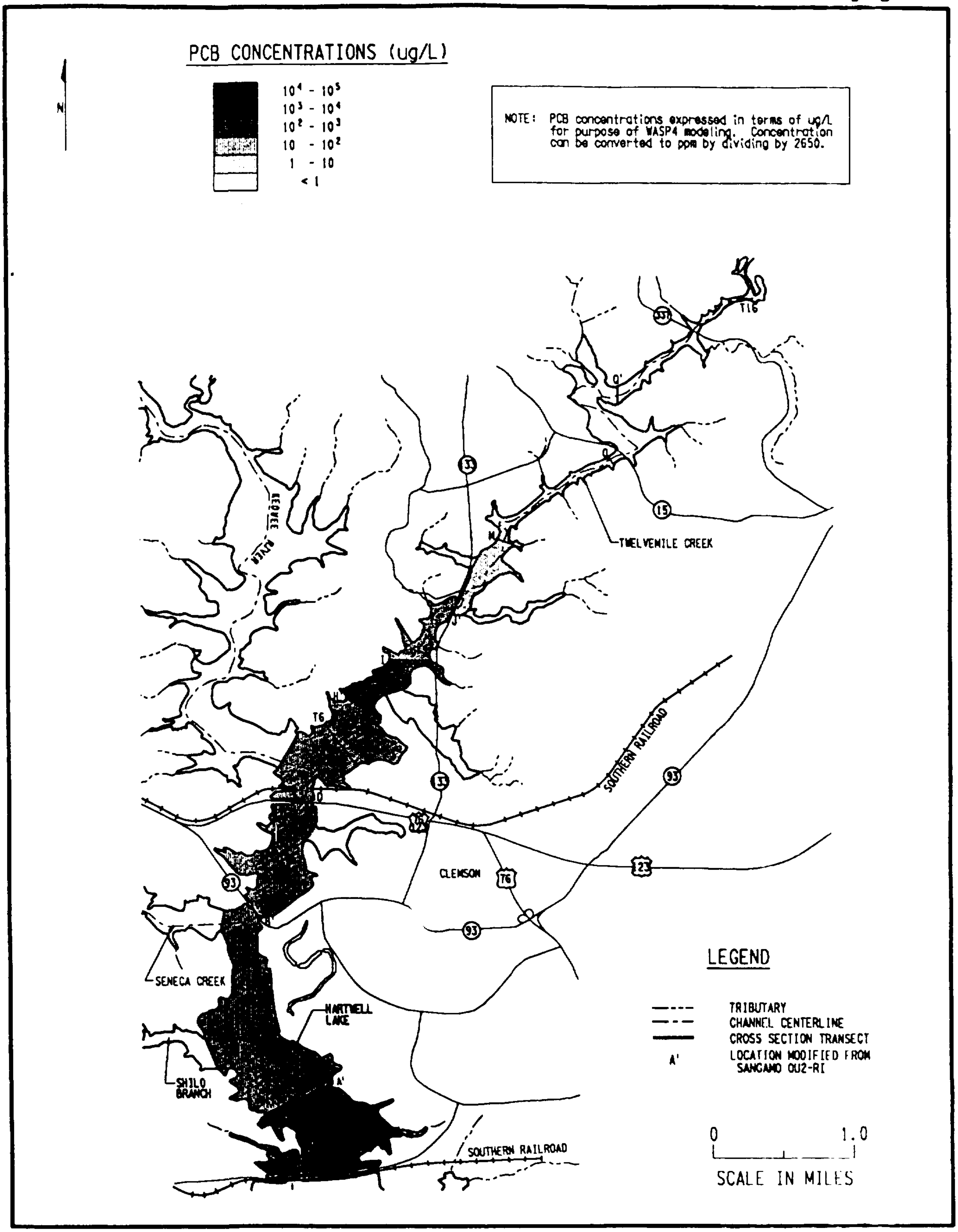


Figure 5-14
WASP4 Surface Sediment PCB Concentrations at 10 Years

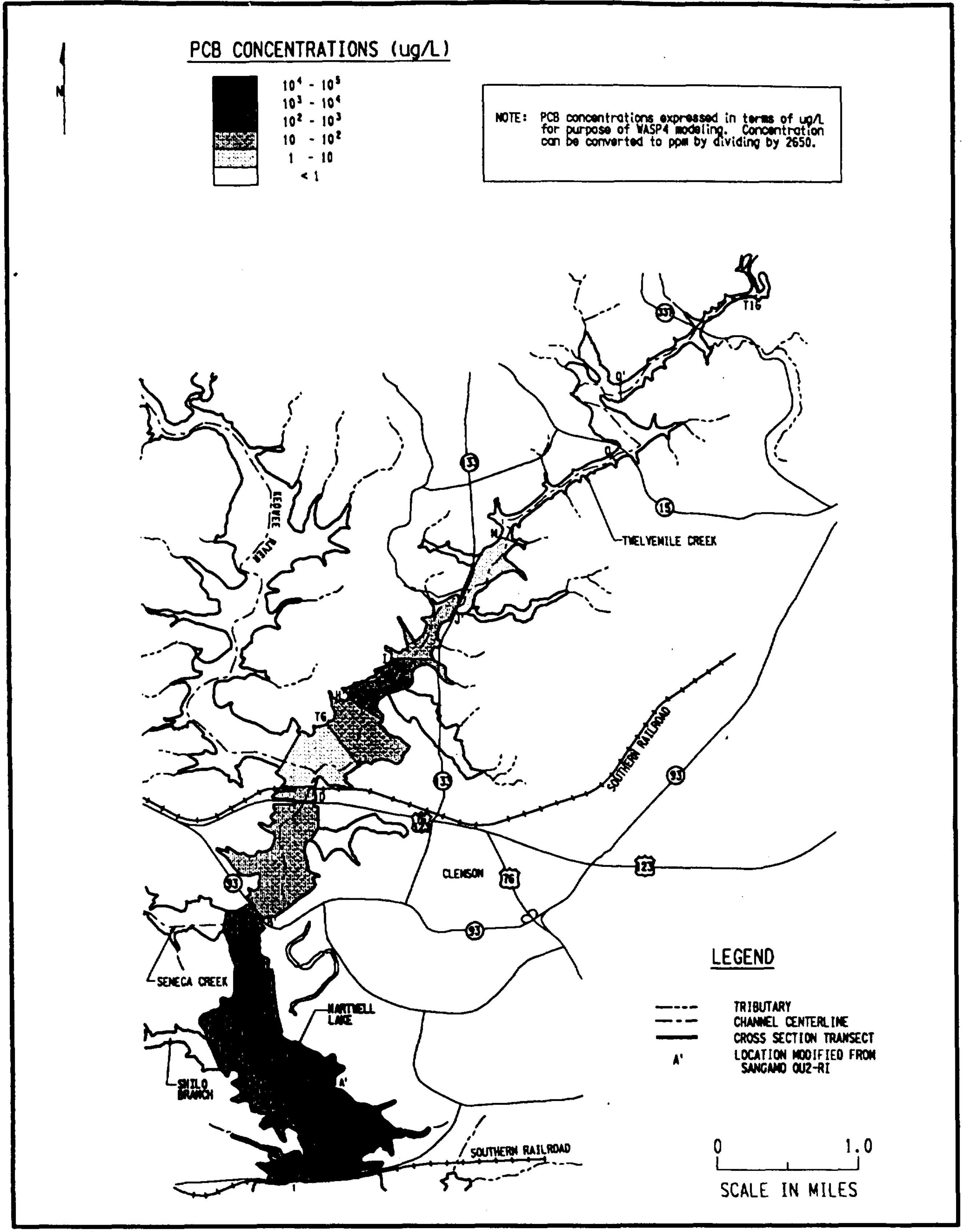


Figure 5-15
WASP4 Surface Sediment PCB Concentrations at 20 Years

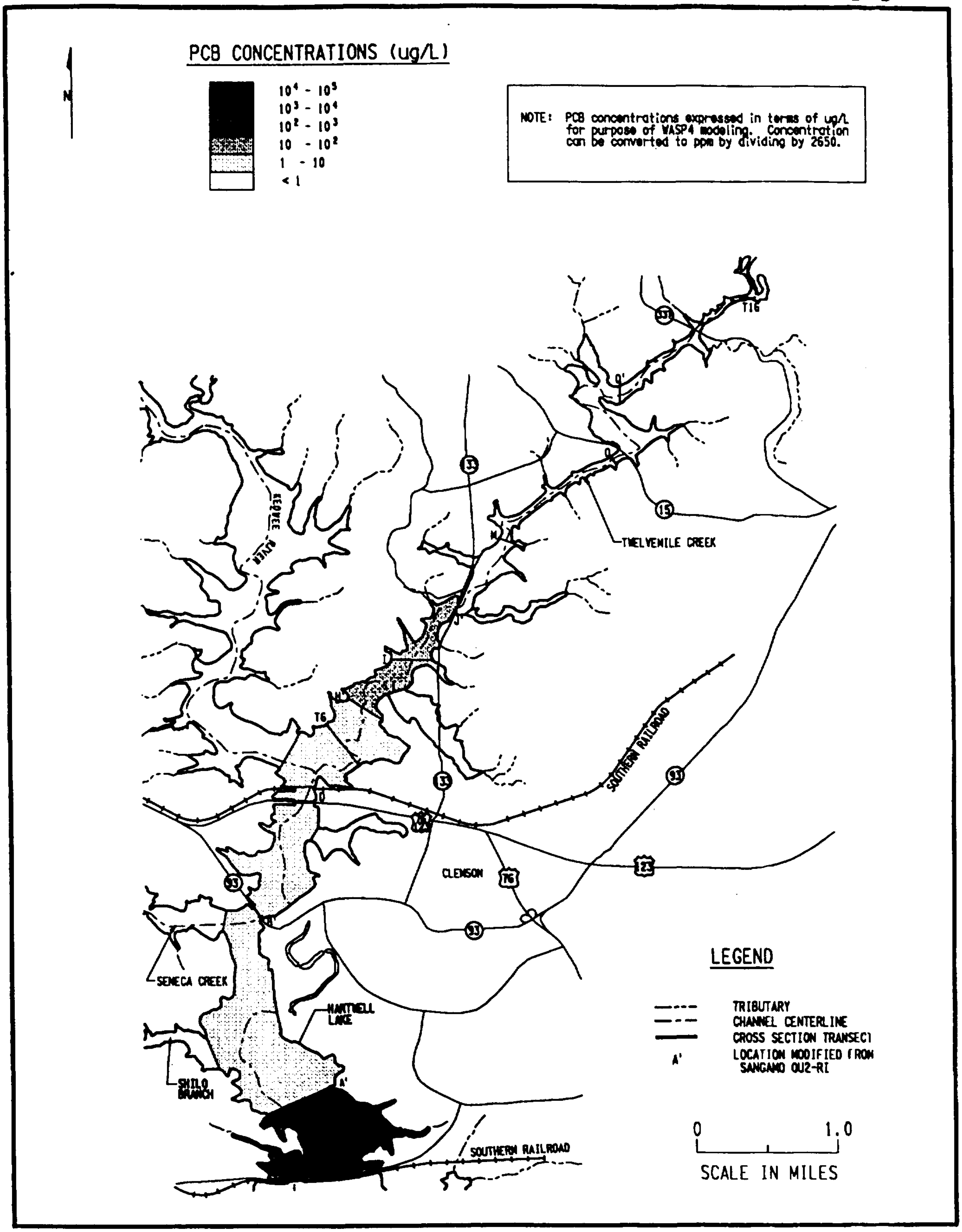


Figure 5-16
WASP4 Surface Sediment PCB Concentrations at 30 Years

bed sediments in the upper and middle portions of the system, and (2) an increase in PCB concentrations in surface and bed sediments near the lower end of the system. Surface and bottom sediments upstream of the Hwy 133 bridge, which had initial PCB concentrations ranging from 1,600 to 10,000 μg/L, are predicted to decrease to near zero levels within the first 5 years. This reduction in concentration is due to burial by clean sediments derived from upstream reaches along with removal by sediment resuspension.

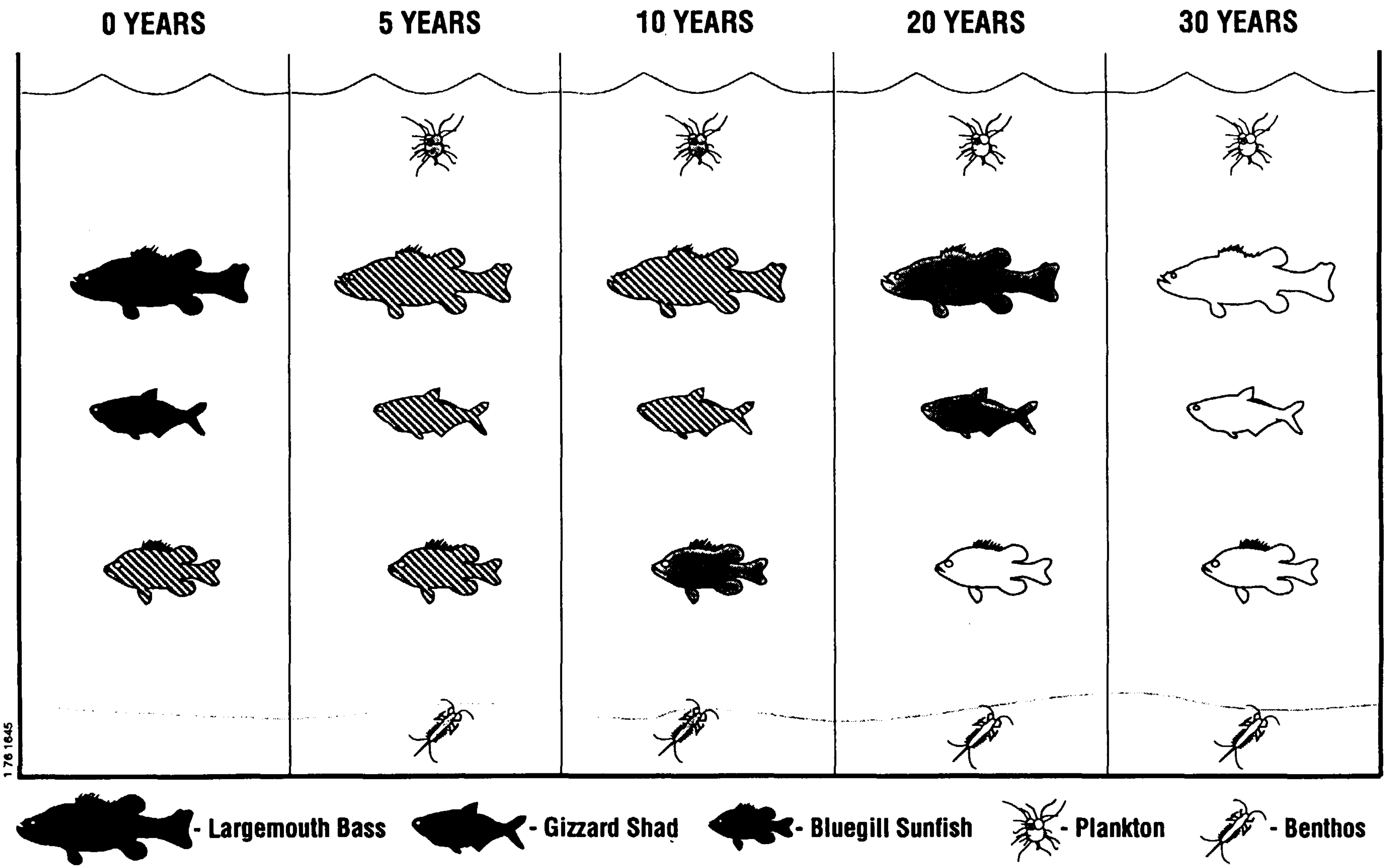
In the middle reach of the system between the Hwy 133 bridge and the Hwy 93 bridge, PCB concentrations also decrease over time for the same reason but at a much slower rate. Initially, concentrations in this middle reach ranged between 1,800 and 23,000 μg/L. The range is reduced to 400 to 8,000 μg/L after 5 years, 50 to 2,800 μg/L after 10 years, and 0 to 40 μg/L after 30 years. Surface and bottom sediments lying between the Hwy 93 bridge and the Hwy 37 bridge show PCB concentrations increase over time. Initially, concentrations in these segments ranged between 400 and 1,400 μg/L; after 30 years, concentrations in these segments are predicted to range up to 8,800 μg/L. This predicted concentration increase is attributed to hydrodynamic influences associated with the Hwy 37 embankment.

5.4.3 Bioaccumulation and Future Fish Concentrations

Aquatic bioaccumulation modeling was conducted to predict future PCB levels in the fish of the Twelvemile Creek/Hartwell Lake system using the FGETS model. This work was conducted to assess: (1) how PCB levels in fish would change over the next 30 years if the contaminated sediments were left unmanaged, and (2) how long it would take for levels to drop below the current FDA tolerance level of 2 mg/kg in several species. The results of the aquatic bioaccumulation modeling study are summarized below. Figure 5-17 provides a graphical summary of this effort.

FGETS is a time-dependent model that predicts whole-body fish residues at specified points in time. The outputs of the model are averaged residues for each year of the fish's life. FGETS can predict chemical uptake by fish through two principal pathways: (1) directly from water via respiration, and (2) through consumption of contaminated food and sediments. For hydrophobic organic chemicals, such as PCBs, the second pathway is known to be the more significant one.

Application of the FGETS model requires the construction of a conceptual model, which includes selection of a representative food web. Three species of fish were chosen to be included in the representative food web, based on the species present in Hartwell Lake, the availability of data for calibration, and the potential for human exposure. Largemouth bass was selected as the top predator for the food web model, since it is the most frequently harvested species and currently has the highest PCB residues for game (harvest) fish. Gizzard shad and bluegill sunfish were identified as the two most important forage fish for Hartwell Lake largemouth bass. Plankton and benthos composed the lower levels of the food web. Plankton and benthos were assumed



NOTE:
Predicted PCB concentrations are based on outputs of the FGETS model and represent averaged whole body fish residues per fish lifetime. Plankton and Benthos concentrations represent equilibrium with predicted surface water and sediment concentrations, respectively.

PCB CONCENTRATION (ppm)

0.001 - 0.1	0.1 - 1	1 - 10	>10

Figure 5-17
Initial and Predicted PCB Concentrations for Selected Biota
Lake Hartwell

to be in chemical equilibrium with the dissolved-phase PCB concentrations of the water column and particulate-phase PCB concentrations of the surficial sediments, respectively, as predicted by the WASP4 water quality model.

Actual modeling consisted of a long-term simulation to predict future PCB fish tissue concentrations over the next 30 years. Results show PCB concentrations in all components of the aquatic bioaccumulation model decreased over the 30-year simulation period (Figure 5-17). PCB concentrations in plankton and benthos, assumed to be in chemical equilibrium with the water column and surface sediments, showed a rapid rate of decline consistent with the WASP4 predictions. In response to decreasing water column and surface sediment PCB levels, concentrations in fish declined as well. Mean concentrations in largemouth bass fillets (10.75 mg/kg initially) declined to 5.16 mg/kg by year 5 and fell to 1.74 mg/kg and below the 2.0 mg/kg FDA tolerance level by year 10 (year 2003).

Although the mean largemouth bass concentration fell below the FDA limit by year 10, a longer period of time is required for concentrations in older age classes to fall below the FDA limit. PCB concentrations in 10-year-old fish, representing the highest age class and largest fish in the model, required 12 years (year 2005) to fall below the 2.0 mg/kg FDA limit. By year 30, mean concentrations in largemouth bass fillets are expected to be very low, with a mean value of 0.025 mg/kg predicted.

6.0 SUMMARY OF SITE RISKS

CERCLA directs EPA to protect human health and the environment from current and potential exposure to hazardous substances at the Sangamo OU2 Site. The Baseline Risk Assessment provides the basis for taking action and indicates contaminants and the exposure pathways that need to be addressed by the Remedial Action. It serves as an indication of what risks the Site poses if no action were taken. A Baseline Risk Assessment was conducted to evaluate the potential current and future human health and ecological impacts associated with exposure to PCBs in sediment and fish. This section of the ROD contains a summary of the results of the Baseline Risk Assessment conducted for this Site. Tables utilized and referenced in this discussion are included at the end of this Section to facilitate the readability of this Section.

6.1 CONTAMINANTS OF CONCERN

The Baseline Risk Assessment focused only on PCBs as the chemical of potential concern. As described in Section 5.0, full-screen analyses were conducted on a limited number of sediment and fish tissue (biological) samples. These analyses did not detect appreciable quantities of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and/or inorganics (metals).

The human health exposure pathways that were quantitatively evaluated under this Baseline Risk Assessment were as follows:

1) Ingestion and dermal absorption of PCBs in shallow sediment by a child and an adult at:

- The upper section of Twelvemile Creek Arm,
- The upper Twelvemile Creek Watershed,
- The Hagood Reservoir, and
- Immediately downgradient of the Sangamo Plant Site.

2) Ingestion of PCB-contaminated fish by a recreational fisherman.

Sediment data were divided into two overall categories in order to best define exposure. These included sediment sample locations which were 2.1 m (7 ft) or less below the water surface, and sediment sample locations which were between 2.1 m and 3 m (7-10 ft) below the water surface. As discussed previously, the lake level fluctuates an average of 4 ft, hence exposing additional sediment. The lower interval was developed to evaluate this potential exposure. Table 6-1 summarizes the information used to calculate sediment exposure point concentrations at the four locations. Sediment data is from the Phase I and Phase II Sediment Investigation.

The risks posed by the ingestion of PCB-contaminated fish were evaluated at all six Lake Hartwell fish sampling locations (SV-107, SV-106, SV-532, SV-535, SV-642, SV-641). These locations are depicted on Figure 5-7 in Section 5.3 of this ROD. In addition, risks posed by the ingestion of fish caught in the Twelvemile Creek watershed, tributaries of the watershed, and a background location were quantified. Risks were evaluated separately by fish species and also for all species combined to account for both individuals who may eat one specie exclusively and individuals who consume all types of fish. Table 6-2 summarizes the information used to calculate fish tissue exposure point concentrations at these locations. Fish tissue data are from the 1991 and 1992 Biological Investigations prepared in accordance with standard FDA fillet method (i.e. fillet including rib cage and belly flap with skin on/scales off - except catfish where skin is removed).

6.2 EXPOSURE ASSESSMENT

For purposes of this Baseline Risk Assessment, it was assumed that in the future the Twelvemile Creek/Lake Hartwell system will continue to exist in its present state. All exposure pathways that are complete under the current land-use conditions were also assumed to be potentially complete under the future land-use scenario. The exposure pathways that were quantitatively evaluated under the current/future use scenarios are described in Section 6.1 of this ROD.

EPA employed a reasonable maximum exposure (RME) approach to estimate the potential exposures and associated risks at the Sangamo OU2 Site. The RME is the highest exposure that is reasonably expected to occur at the Site. The intent of the RME is to estimate a conservative exposure case that is still within the range of possible exposures. The calculation of risk posed by exposures to PCBs requires the combination of exposure point concentrations with assumptions regarding frequency, duration, and magnitude of receptor contact. RME exposure point concentrations for sediment and fish tissue are listed in Tables 6-1 and 6-2, respectively. The RME exposure parameter assumptions for sediment and fish that were used to characterize risk posed by PCBs are listed in Tables 6-3 and 6-4, respectively. The exposure parameters for ingestion of fish were derived from results the site-specific recreational angler survey discussed in Section 5.3.

6.3 TOXICITY ASSESSMENT

For risk assessment purposes, individual chemicals are separated into two categories of chemical toxicity depending on whether they exhibit principally carcinogenic (cancer-causing) or noncarcinogenic effects. The carcinogenic and noncarcinogenic toxicity of PCBs are discussed below.

6.3.1 Carcinogenic Toxicity of PCBs

EPA assigns weight of evidence classifications to potential carcinogens. Under this system, chemicals are classified as follows:

<u>Group A</u> - Human Carcinogen: Sufficient evidence from human epidemiological studies to support a causal association between a chemical and cancer.

<u>Group B1</u>- Probable Human Carcinogen: Limited evidence from human epidemiological studies of carcinogenicity to humans.

<u>Group B2</u>- Probable Human Carcinogen: Sufficient evidence of carcinogenicity to animals.

<u>Group C</u> - Possible Human Carcinogen: Limited evidence of carcinogenicity in animals and an absence of data on humans.

<u>Group D</u> - Not Classified: Inadequate evidence of carcinogenicity in animals.

<u>Group E</u> - No Evidence of Carcinogenicity to Humans

PCBs are classified as a Class B2 carcinogen, which indicates that there is sufficient evidence from tests on animals to link exposure of PCBs with carcinogenic effects.

Slope factors (SFs) have been developed by EPA for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic contaminants. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$ or risk per milligram per kilogram of dose, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassay data to which mathematical extrapolation from high to low dose and from animal to human dose has been applied, as well as statistics to account for uncertainty (e.g. to account for the use of animal data to predict effects on humans). A SF of 7.7 $(mg/kg\text{-}day)^{-1}$ for the PCB Aroclor 1260 was obtained from the Integrated Risk Information System (IRIS) for use in this Baseline Risk Assessment.

6.3.2 Noncarcinogenic Toxicity of PCBs

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to the contaminants exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of daily exposure levels for humans, including sensitive populations, that are likely to be without risk of adverse effect. Estimated intakes of contaminants from environmental media can be compared to the RfD. RfDs are derived from human epidemiological and animal studies to which uncertainty factors have been applied. A chronic RfD of 7×10^{-5} mg/kg-day for the PCB Aroclor 1016 was used in this Baseline Risk Assessment. This daily exposure estimate has been documented in studies conducted on monkeys to produce reproductive effects (reduced birth weights).

6.4 RISK CHARACTERIZATION

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a life-time as a result of exposure to the contaminants of concern, in this case PCBs. Excess life-time cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where:

Risk = a unitless probability (i.e. 2×10^{-5}) of an individual developing cancer.
CDI = chronic daily intake averaged over 70 years (mg/kg-day).
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$.

These risks are probabilities that are generally expressed in scientific notation (i.e. 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a reasonable maximum estimate, an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70 year lifetime under the site-specific exposure conditions for the site. EPA's generally acceptable risk range is 1×10^{-4} to 1×10^{-6}.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a Hazard Quotient (HQ). An HQ<1 indicates that an individual's dose of a single contaminant is less than the RfD, and that the toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemicals of concern that affect the same target organ within a medium or across all media to which a given population may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI/RfD}$$

where:

CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units (mg/kg-day) and represent the same exposure period.

The carcinogenic and noncarcinogenic risks associated with direct contact with or incidental ingestion of PCB contaminated sediment and ingestion of PCB-contaminated fish are summarized in Tables 6-5 and 6-6, respectively. Adverse human health risks resulting from direct contact or incidental ingestion with the sediment are unlikely to occur, however, sediments are a continuing source of contamination in the aquatic biota of the study area. Exposures associated with the ingestion of fish caught from all sampling stations resulted in unacceptable risks ranging from 10^{-2} to 10^{-4}. The highest cancer risk of 4×10^{-2} was calculated for anglers exclusively consuming largemouth bass from the Twelvemile Creek watershed. The highest cancer risk for ingestion of all species combined, 1×10^{-2}, was calculated for the Twelvemile Creek Arm. The lake-wide risk associated with ingestion of all species combined was 5×10^{-3}.

6.5 MONTE CARLO

The human health risks presented under Section 6.4 are referred to as the deterministic risks. That is, the resultant risk is a single value for a single set of specific exposure parameters. A refined approach to risk assessment can be achieved by taking into account the probability distributions of possible values for each of the exposure parameters rather than relying on discrete parameter values. Such an approach was taken in the Sangamo OU2 risk assessment through Monte Carlo analysis. The advantage of this approach is that it furnishes more information of the variability of the full range of potential risks that may occur.

The fish ingestion pathway was chosen for Monte Carlo analysis evaluation because this pathway is associated with the highest potential risks. The potential cancer risk associated with exposure to PCBs was evaluated for ingestion of bass (largemouth and hybrids) lake-wide and for ingestion of bass (largemouth and hybrids) caught in the area associated with the highest PCB concentrations (i.e. SV-107). The mode of the risk distribution is of most interest when interpreting the final distribution of risks since it represents the most frequently occurring risk. The most frequently occurring risk in the distribution, or mode, was estimated to be 2×10^{-4} and 3×10^{-4} for ingestion of lake-wide bass and bass at SV-107, respectively. The results of the Monte Carlo analysis indicated that the 1×10^{-2} risk associated with the ingestion of bass from location SV-107 represented the 95th percentile of high end of the overall risk distribution, while the 5×10^{-3} risk associated with ingestion of lake-wide bass corresponded to the 90-95th percentile of the overall risk distribution.

6.6 ECOLOGICAL RISK ASSESSMENT

An ecological risk assessment was conducted to evaluate the impact PCBs may be having on aquatic receptors (plant, invertebrates, and fish) and terrestrial receptors (birds and mammals) of the Sangamo OU2 study area. The Biological Investigations clearly document PCB contamination at all levels of the aquatic food web. However, although PCBs appear to be impacting the fish and macroinvertebrate communities in Twelvemile Creek, habitat degradation from man's influence is likely causing additional adverse impacts.

A 1990 investigation conducted independently of these RI studies provided evidence that fish health and populations can be affected as concentrations in fish increase to an average of 20 mg/kg and greater. Results from the bioindicator analyses support the contention that individual largemouth bass may be impacted at SV-107 and SV-106, areas closest to the Sangamo Plant Site. However, at the present level of PCB concentrations in fish tissue (approximately 5 mg/kg), the data from the Biological Investigations do not support a conclusion that significant impacts to the overall health and the population/community levels to Lake Hartwell fish are occurring.

Ecological exposures to surface water were not directly evaluated in the ecological assessment because PCBs were not detected in surface water at detection limits ranging from 1.2-1.3 μg/L during the RI. Aquatic plants are not likely to suffer adverse impacts from PCB concentrations just below the detection limit. Aquatic invertebrates that are intimately associated with sediments (primarily benthic organisms) may be adversely impacted in the study area based on a comparison of PCB concentrations in sediment to EPA's interim sediment quality criteria for aquatic organisms. Reliable population estimates for avian species (eastern phoebe, green-backed heron, belted kingfisher, osprey) and mammals (mink, otter) that would feed in the study area were not obtainable. Therefore, the certainty of the extent of any population impacts caused by PCBs in the study area is unknown. However, population effects on these terrestrial species is not likely.

6.7 UNCERTAINTY ASSESSMENT

In any risk assessment, there is some degree of uncertainty associated with the estimates of human and ecological risks. The primary sources of uncertainty included environmental sampling, exposure parameter estimation and toxicological data. Typically, these uncertainties are compensated for by employing conservative assumptions. Consequently, the qualitative and quantitative risk estimates for Sangamo OU2 should not be construed as absolute estimates of risk, but rather as conditional estimates based on a number of assumptions regarding exposure and toxicity.

6.8 SUMMARY

The primary human health exposure pathway of concern at the Sangamo OU2 Site is the ingestion of fish contaminated with PCBs. Exposures associated with ingestion of fish caught from all sampling locations resulted in unacceptable carcinogenic risks ranging from 10^{-2} to 10^{-4} and HQs greater than 1. As discussed under Section 5.4 (Contaminant Fate and Transport) of this ROD, PCB concentrations in sediment are predicted to decrease over time. The impact of decreasing sediment concentrations on overall risk was evaluated for the ingestion of largemouth bass at SV-107. The output from the food-chain bioaccumulation model (FGETS Section 5.4.3) was utilized in this analysis. It was found that the total modeled risk over a 30-year time frame (2×10^{-3}) was not substantially different from the calculated deterministic RME risk of 1×10^{-2}. This was largely because risk over this time period is dominated by the very high risks calculated for the first eight years of exposure. In actuality, a period of approximately 22 years appears to be required for one-year risks to drop to the 10^{-6} risk level. It would require more than 22 years for the entire 30-year risks to decline to $< 10^{-6}$. With respect to noncancer risks, a period of approximately 20 years appears to be required for the HQ to drop below one. After the next 20-30 years, long-term risk associated with the consumption of fish harvested from Lake Hartwell should be substantially lower.

Actual or threatened releases of hazardous substances for the Sangamo OU2 Site, if not addressed by implementing the response action in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

TABLE 6-1
PCB Exposure Point Concentrations in Shallow Sediment

Area/ Interval	PCB Concentration (mg/kg)			
	Mean[a]	95% UCL of Mean[b]	Maximum Detected Concentration	RME Exposure Point Concentration[c]
Upper 12 Mile Creek Arm				
Beneath 0-2.1 m of Lake Water	0.91	1.65	7.54	1.65
Beneath 0-3 m of Lake Water	1.51	2.93	7.88	2.93
Upper 12 Mile Creek Watershed				
Beneath 0-2.1 m of Lake Water	0.45	0.70	0.76	0.70
Beneath 0-3 m of Lake Water	0.45	0.72	0.91	0.72
Hagood Reservoir				
Beneath 0-2.1 m of Lake Water	0.29	0.36	0.33	0.33
Beneath 0-3 m of Lake Water	0.28	0.33	0.33	0.33
Downgradient of Sangamo Plant				
Beneath 0-2.1 m of Creek Water	1.51	---	3.52	3.52

a) Arithmetic mean concentration (including one-half detection limit for non-detects).

b) Value represents 95th percent Upper Confidence Limit (UCL) on the arithmetic mean.

c) RME=Reasonable Maximum Exposure; value listed is the lower value of the 95th percent UCL on the arithmetic mean and the maximum detected concentration.

TABLE 6-2
Exposure Point Concentrations in Fish

Species	PCB Concentrations (mg/kg)			
	Mean	95% UCL of Mean	Maximum Detected Concentration	RME Exposure Point Concentration
SV-107				
Largemouth Bass	6.8	8.5	19.7	8.5
Hybrid Bass	1.4	2.0	2.3	2.0
Largemouth Bass and Hybrid Bass	5.7	7.9	19.7	7.9
Channel Catfish	5.6	7.8	8.3	7.8
All Species Combined	5.4	7.0	19.7	7.0
SV-106				
Largemouth Bass	3.3	3.8	9.2	3.8
Hybrid Bass	4.7	8.0	9.7	8.0
Channel Catfish	2.5	3.9	4.0	3.9
All Species Combined	3.6	4.3	9.7	4.3
SV-532				
Largemouth Bass	1.7	3.8	3.5	3.5
Hybrid Bass	3.9	5.9	9.6	5.9
Channel Catfish	1.7	4.4	3.5	3.5
All Species Combined	2.5	4.0	9.6	4.0
SV-535				
Largemouth Bass	0.80	1.3	1.7	1.3
Hybrid Bass	1.8	3.3	3.9	3.3
Channel Catfish	0.60	0.82	0.90	0.82
All Species Combined	1.2	1.7	3.9	1.7
SV-642				
Largemouth Bass	0.56	0.98	1.1	0.98
Hybrid Bass	2.3	3.7	7.0	3.7
Channel Catfish	0.71	2.6	2.8	2.6
All Species Combined	1.3	2.1	7.0	2.1

TABLE 6-2
Exposure Point Concentrations in Fish

Species	PCB Concentrations (mg/kg)			
	Mean	95% UCL of Mean	Maximum Detected Concentration	RME Exposure Point Concentration
SV-641 (Lake Background)				
Largemouth Bass	0.22	0.3	1.2	0.3
Hybrid Bass	2.0	2.8	9.3	2.8
Channel Catfish	0.41	1.4	0.8	0.8
All Species Combined	0.74	1.1	9.3	1.1
All Areas of Lake Hartwell + 12 Mile Creek				
All Species Combined	3.0	3.9	19.7	3.9
Largemouth Bass and Hybrid Bass	3.2	4.2	19.7	4.2
12 Mile Creek Watershed				
Largemouth Bass	4.0	25	13.9	13.9
Redbreast Sunfish	1.7	2.2	7.1	2.2
Tributaries of Watershed				
Redbreast Sunfish	0.74	0.2	1.2	0.2
Watershed Background	ND	ND	ND	ND

TABLE 6-3
Exposure Parameters for Incidental Ingestion of and Dermal Contact with Sediment (Current/Future Use Conditions)

Parameters	Reasonable Maximum Exposure Case	
	Child	Adult
Age Period (years)	4-12	>18
Exposure Frequency (days/year)[a]	105	75
Exposure Duration (years)	8	30[b]
Soil Ingestion Rate (mg/day)[c]	138	100
Skin Surface Area Available for Contact $(cm)^2$	700[d]	1,230[d]
Sediment to Skin Adherence Factor (mg/cm^2)[e]	1.0	1.0
Dermal Absorption Fraction (PCBs)[f]	0.01	0.01
Body Weight (kg)[g]	27	70
Averaging Time (years)		
Carcinogenic[h]	70	70
Noncarcinogenic	8	30

a) For children, assumes that children will swim 7 days/week from Memorial Day to Labor Day (15 weeks) for a total of 105 exposure events/yr. For adults, assumes that adults will swim 5 days/week for same 15 weeks for a total of 75 exposure events/yr.
b) Based upon national upper-bound time at one residence (USEPA 1991a, 1989a).
c) Value for children is a weighted-average ingestion rate, assuming 4, 5, and 6 year olds ingest sediment at a rate of 200 mg/day and older children ingest sediment at 100 mg/day (USEPA 1989a, 1991a). Value for adults is the standard default value recommended by USEPA (1991a, 1989a)
d) Surface area based on 50th percentile values from USEPA (1985) for feet. Values for child and adult are the time-weighted averages.
e) Based on USEPA Region IV guidance (USEPA 1992b).
f) Based on USEPA Region IV guidance (USEPA 1992b).
g) Value for 4-12 year old child is the time-weighted average based on data provided by USEPA (1989b). Value for adult is the standard default value recommended by USEPA (1991a).
h) Based on USEPA (1991a, 1989a) standard assumption for lifetime.

TABLE 6-4
Exposure Parameters for Ingestion of Fish by Adult Recreational Fisherman (Current/Future Use Conditions)

Parameters	Reasonable Maximum Exposure Value
Fish Ingestion Rate (grams/meal)[a]	357
Exposure Duration (years)[b]	30
Exposure Frequency by Sampling Location (meals per year)[c]	
Twelvemile Creek Watershed	60
SV-107	30.6
SV-106	27.6
SV-532	20.6
SV-535	22.5
SV-642	37
SV-641 (Lake Background)	22.7
Lake-Wide Average	27.6
Body Weight[d]	70
Averaging Time (years)	
Carcinogenic[e]	70
Noncarcinogenic	30

a) Based on the arithmetic mean of fish ingestion rates reported for 52 anglers surveyed at Twelvemile Creek on Lake Hartwell.
b) Value is based on the national upper-bound time at one residence (USEPA 1991a, 1989a).
c) Values based on January to December 1992 data obtained from Lake Hartwell Recreational Angler Survey. These values are the arithmetic mean exposure frequency in meals/month, multiplied by 12 months/year reported for a total of 677 anglers surveyed at Twelvemile Creek/Lake Hartwell. Final report of survey stated that some anglers were interviewed more than once, indicating that the survey results may include fishing habits of subsistence fisherman as well as recreational fisherman.
d) Standard default value provided by USEPA (1991a, 1989a).
e) Based on USEPA (1991a, 1989a) standard assumption for lifetime.

TABLE 6-5 Potential Direct Contact Risks Associated with PCBs in Sediment		
Exposure Pathway	Upper Bound Excess Lifetime Cancer Risk	HQ for Noncarcinogenic Effects[a]
INCIDENTAL INGESTION OF SEDIMENT		
Upper Twelvemile Creek Arm		
Child (4-12 years)	2×10^{-6}	<1 (0.03)
Adult	3×10^{-6}	<1 (0.01)
Upper Twelvemile Creek Watershed		
Child (4-12 years)	9×10^{-7}	<1 (0.01)
Adult	7×10^{-7}	<1 (0.003)
Immediately Downgradient of Sangamo Plant Site		
Child (4-12 years)	5×10^{-6}	<1 (0.06)
Adult	3×10^{-6}	<1 (0.02)
Hagood Reservoir		
Child (4-12 years)	4×10^{-7}	<1 (0.006)
Adult	3×10^{-7}	<1 (0.001)
DERMAL ABSORPTION FROM SEDIMENT		
Upper Twelvemile Creek Arm		
Child (4-12 years)	1×10^{-7}	<1 (0.002)
Adult	4×10^{-7}	<1 (0.001)
Upper Twelvemile Creek Watershed		
Child (4-12 years)	5×10^{-8}	<1 (0.0007)
Adult	9×10^{-8}	<1 (0.0004)
Immediately Downgradient of Sangamo Plant Site		
Child (4-12 years)	2×10^{-7}	<1 (0.004)
Adult	5×10^{-7}	<1 (0.002)
Hagood Reservoir		
Child (4-12 years)	2×10^{-8}	<1 (0.0003)
Adult	4×10^{-8}	<1 (0.0002)

TABLE 6-5
Potential Direct Contact Risks Associated with PCBs in Sediment

Exposure Pathway	Upper Bound Excess Lifetime Cancer Risk	HQ for Noncar-cinogenic Effects[a]
DIRECT CONTACT WITH SEDIMENT (TOTAL)		
Upper Twelvemile Creek Arm		
Child (4-12 years)	2×10^{-6}	<1 (0.03)
Adult	3×10^{-6}	<1 (0.01)
Upper Twelvemile Creek Watershed		
Child (4-12 years)	1×10^{-6}	<1 (0.01)
Adult	8×10^{-7}	<1 (0.003)
Immediately Downgradient of Sangamo Plant Site		
Child (4-12 years)	5×10^{-6}	<1 (0.06)
Adult	4×10^{-6}	<1 (0.02)
Hagood Reservoir		
Child (4-12 years)	4×10^{-7}	<1 (0.006)
Adult	3×10^{-7}	<1 (0.001)

a) Hazard Quotient >1 indicates exposure to PCBs may result in adverse health effects. Actual value listed in ().

TABLE 6-6
Potential Health Risks Associated with the Ingestion of Fish

Location/Species	Upper Bound Excess Lifetime Cancer Risk	HQ for Noncarcinogenic Effects[a]
SV-107		
Largemouth Bass	1×10^{-2}	>1 (50)
Hybrid Bass	3×10^{-3}	>1 (10)
Largemouth Bass and Hybrid Bass	1×10^{-2}	>1 (50)
Channel Catfish	1×10^{-2}	>1 (50)
All Species Combined	1×10^{-2}	>1 (50)
SV-106		
Largemouth Bass	5×10^{-3}	>1 (20)
Hybrid Bass	1×10^{-2}	>1 (40)
Channel Catfish	5×10^{-3}	>1 (20)
All Species Combined	5×10^{-3}	>1 (20)
SV-532		
Largemouth Bass	3×10^{-3}	>1 (10)
Hybrid Bass	6×10^{-3}	>1 (20)
Channel Catfish	3×10^{-3}	>1 (10)
All Species Combined	4×10^{-3}	>1 (20)
SV-535		
Largemouth Bass	1×10^{-3}	>1 (6)
Hybrid Bass	3×10^{-3}	>1 (10)
Channel Catfish	9×10^{-4}	>1 (4)
All Species Combined	2×10^{-3}	>1 (8)
SV-642		
Largemouth Bass	2×10^{-3}	>1 (7)
Hybrid Bass	6×10^{-3}	>1 (30)
Channel Catfish	4×10^{-3}	>1 (20)
All Species Combined	4×10^{-3}	>1 (20)

TABLE 6-6
Potential Health Risks Associated with the Ingestion of Fish

Location/Species	Upper Bound Excess Lifetime Cancer Risk	HQ for Noncar-cinogenic Effects[a]
SV-641 (Lake Background)		
Largemouth Bass	3×10^{-4}	>1 (1)
Hybrid Bass	3×10^{-3}	>1 (10)
Channel Catfish	8×10^{-4}	>1 (4)
All Species Combined	1×10^{-3}	>1 (5)
All Areas of Lake Hartwell + 12 Mile Creek		
All Species Combined	5×10^{-3}	>1 (20)
Largemouth Bass and Hybrid Bass	5×10^{-3}	>1 (20)
Twelvemile Creek Watershed		
Largemouth Bass	4×10^{-2}	>1 (200)
Redbreast Sunfish	6×10^{-3}	>1 (30)
Tributaries of Watershed		
Redbreast Sunfish	6×10^{-4}	>1 (20)
Watershed Background	ND	ND

a) Hazard Quotient >1 indicates exposure to PCBs may result in adverse health effects. Actual value listed in ().

7.0 DESCRIPTION OF ALTERNATIVES

Based upon the findings of the RI and associated Baseline Risk Assessment (human health/ecological), EPA developed remedial action objectives to support the identification, development and screening of remedial alternatives. These remedial action objectives were:

- Mitigate continued migration of PCB-contaminated sediments into Lake Hartwell by eliminating releases of PCBs into Twelvemile Creek.
- Control or eliminate the downstream migration of PCB-contaminated sediment within the Twelvemile Creek Arm of Hartwell Lake.
- Limit, to the extent feasible, the transfer of PCB contaminants from sediment to biota.
- Prevent or minimize exposure to fish with PCB contamination above target risk (or FDA) levels.

Protection of human health is considered the primary driver for developing and evaluating remedial action alternatives. Thorough development and evaluation of feasible remedial alternatives for the Sangamo OU2 Site required the derivation of cleanup goals for the media of concern: sediment and fish. Cleanup goals were not developed for surface water since PCBs were not detected in any sample collected during the RI above the detection limits of 1.2 to 1.3 $\mu g/l$. Cleanup goals for sediment and fish were also necessary to identify areas to be addressed by the range of remedial alternatives that were evaluated in detail. The Final Cleanup Goals for sediment and fish, and the supporting rationale are presented in Sections 7.1 and 7.2, respectively.

The contaminants of concern for the Sangamo OU2 Site are total PCBs. No Aroclor- or congener-specific distinctions are factored into the evaluation of remedial action alternatives. Discharges from the Sangamo Weston Plant into Town Creek included a variety of PCBs consisting predominantly of Aroclors 1242, 1254, and 1016. Analytical data for the RI included both Aroclor-specific concentrations (from offsite CLP analyses) and concentrations of total PCBs (from onsite field screening analyses). However, all of the results, findings and conclusions in the RI were discussed in terms of total PCBs. The reasons for this approach are as follows:

- A majority of the health-based and environmental criteria for PCBs are stated in terms of total PCBs (i.e., FDA tolerance level).
- EPA uses a carcinogenic slope factor for PCBs that is based on Aroclor 1260; this provides a conservative indicator of potential health effects for all PCB mixtures.

- Evaluation of contamination in terms of total PCBs was cost-effective; it permitted collection of a large number of samples and the use of field screening (Modified Spittler Method) for sediment analyses.

7.1 FINAL CLEANUP GOAL FOR SEDIMENT

Potential cleanup goals for PCB-contaminated sediment at the Sangamo OU2 Site were determined through an evaluation of available criteria and accepted techniques for calculating cleanup goals in sediment. This approach generated a range of potentially viable cleanup concentrations for the Sangamo OU2 sediment based on the following sources:

- Existing (published) criteria for PCBs in sediment, typically derived from either geographic-based, background PCB concentrations or biological effects observed or predicted in aquatic organisms.

- Precedents from other NPL sites where EPA has identified protective sediment cleanup goals for PCBs that have been finalized in RODs.

- Site-specific cleanup goals calculated using EPA's equilibrium partitioning approach based on contaminant partitioning between sediment and sediment pore water, based on protection of aquatic life.

From this evaluation, three representative sediment cleanup goals (1 mg/kg, 0.4 mg/kg and 0.05 mg/kg) were selected for further analysis. The analysis consisted of an evaluation of the long-term impacts of potential sediment cleanup goals on PCB concentrations in fish, and ultimately human health via ingestion of contaminated fish, given that the ingestion of fish is the principal exposure pathway of concern at the site. This evaluation was conducted utilizing the FGETS bioaccumulation model discussed in Section 5.4.3 of this ROD. The rationale for selecting these values is presented below.

- *1 mg/kg* - The most frequently selected sediment cleanup goal for PCBs at NPL sites based on a review of the EPA's ROD database. A concentration of 1 mg/kg also represents a reasonable lower limit considering technical feasibility and cost.

- *0.4 mg/kg* - The mean value for the site-specific sediment quality criteria calculated using the EPA's equilibrium partitioning approach; also equal to the Effects Range-Median criteria based on an evaluation of published criteria associated with biological effects on aquatic life as reported by the National Oceanic and Atmospheric Administration (NOAA).

- *0.05 mg/kg* - Equal to the Effects Range-Low from NOAA based on an evaluation of published criteria associated with biological effects on aquatic life; also representative of the more commonly reported background-based sediment criteria for PCBs.

The time required for 2-8 year old largemouth bass in the Twelvemile Creek Arm of Lake Hartwell to achieve 2 mg/kg for the range of selected sediment cleanup goals are compared to the baseline condition in Figure 7-1. As shown in this figure, fish PCB concentrations decline at about the same rate regardless of the sediment cleanup goal. Therefore, a final sediment cleanup goal of 1 mg/kg was selected based on technical feasibility rather than performance or risk-based considerations. This concentration identified the entire Twelvemile Creek Arm, extending from the headwaters of the lake downstream to the confluence with the Keowee Arm, as an area to be addressed. This area covers approximately 730 acres with a total estimated volume of 4,722,000 cubic yards (yd^3) of contaminated sediment.

7.2 FINAL CLEANUP GOAL FOR FISH

Fish ingestion was identified as the primary exposure pathway of concern at the Sangamo OU2 Site. Potential remediation goals include the FDA tolerance level of 2 mg/kg for PCBs in the edible portions of fish, and risk-based levels that consider the fish ingestion exposure pathway. Both of these options are described below.

The FDA criterion was identified as a contaminant-specific Applicable or Relevant and Appropriate Requirement (ARAR). In addition, the existing health advisory for Hartwell Lake is based on the continuing presence of PCBs in fish in concentrations greater than 2 mg/kg. Selection of risk-based cleanup goals for fish were considered by determining the concentration levels in largemouth bass that would result in acceptable risk to anglers (through ingestion of the fish) based on EPA's target risk range of 1×10^{-4} to 1×10^{-6}. The acceptable concentrations were estimated using the same methodology used for the baseline human health risk assessment and for determining risk levels for the sediment cleanup goals. A fish tissue concentration of 0.036 mg/kg is associated with a 10^{-4} risk, 0.0036 mg/kg with a 10^{-5} risk, and so on.

Using EPA's deterministic, reasonable maximum exposure (RME) approach and site-specific exposure parameters, the 30-year carcinogenic risk associated with the FDA criterion of 2 mg/kg results in an estimated risk of 6×10^{-3}. This is well above the upper end of EPA's target risk threshold of 1×10^{-4}. It is important to note that EPA considers the RME assumptions to be conservative, since they represent upper confidence limits for a given range of values for a particular risk input parameter or variable. It is also important to note that consumption of fish from Lake Hartwell (or other sources) is a strictly voluntary activity.

Use of the risk-based concentrations for fish remediation goals (i.e., 0.036 mg/kg) was determined to be technically impracticable at SV-107 for several reasons. Fish bioaccumulate PCBs from both the water column and food chain; thus, PCB

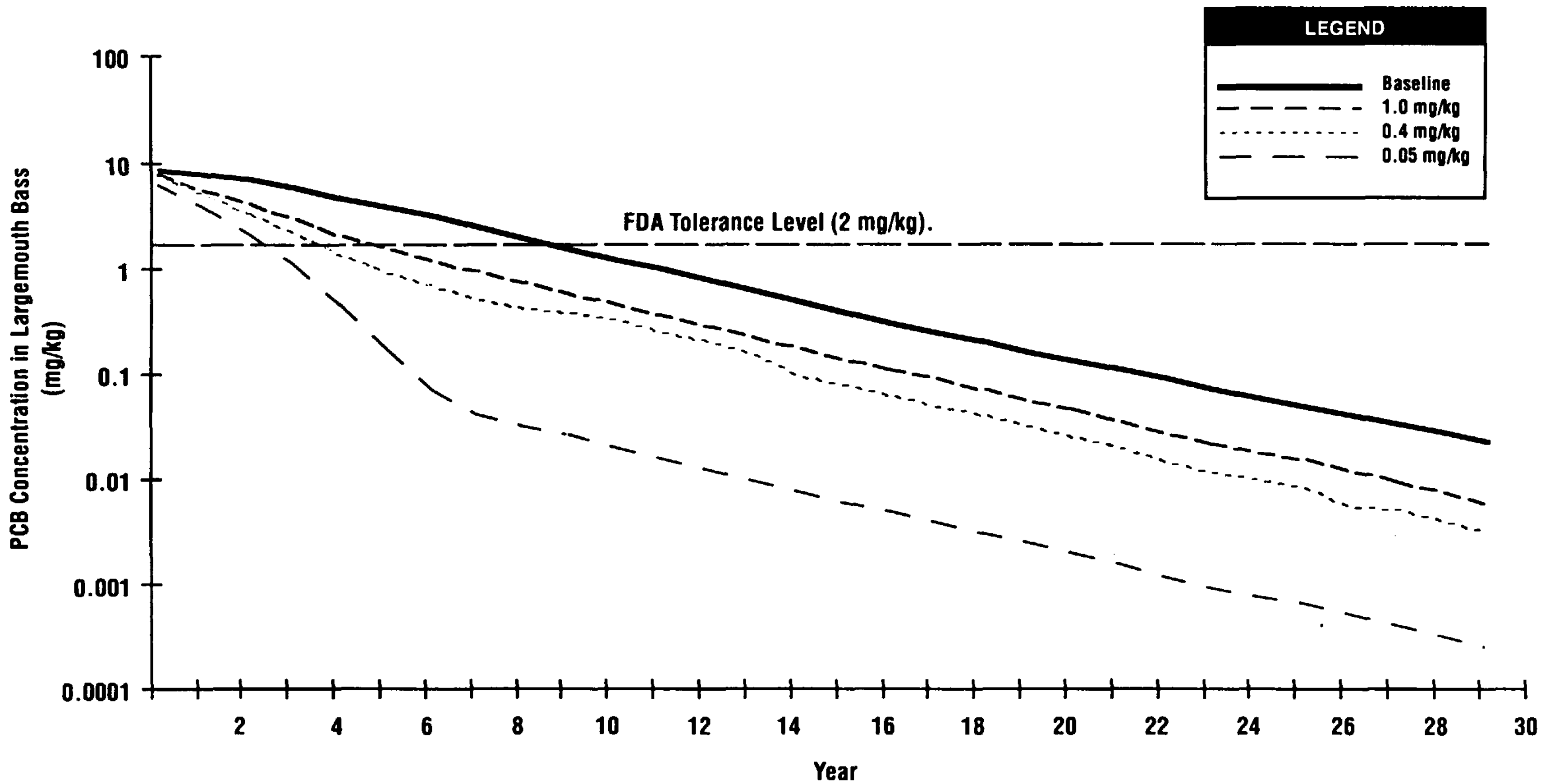


Figure 7-1
FGETS Modeling Results for Selected PCB-Cleanup Goals

concentrations in sediment and surface water would likely have to be reduced to levels in the ranges of parts per billion (0.001 mg/kg) or parts per trillion (0.001 μg/L) to achieve risk-based levels in fish. Reducing surface water and sediment concentrations to these levels is beyond the capability of proven treatment technologies, particularly when the scale of the site is taken into consideration. Moreover, as shown in the FGETS modeling, PCB cycling among fish, plankton, benthos, sediment, and surface water greatly complicates the removal of PCBs from a biological system once the contaminants have been introduced. Even if concentrations in sediment and surface water could be reduced to levels commensurate with the risk-based fish concentrations, it would be many years before the fish concentrations actually declined to acceptable levels.

Given the existence of an ARAR for PCB concentrations in fish, the technical impracticability of establishing risk-based cleanup goals, and the classification of fish consumption as a voluntary exposure, the FDA tolerance level of 2 mg/kg was selected as the Final Cleanup Goal for Lake Hartwell fish.

7.3 REMEDIAL ALTERNATIVES

Response actions that were identified and passed the screening of technologies and process options were assembled into a range of remedial alternatives that included no action, institutional controls, containment, collection, removal/disposal, and removal/treatment/disposal. These eight remedial alternatives were evaluated in detail in the Final March 1994 Feasibility Study Report. A summary description of these alternatives follows. The reader should refer to Final FS Report for a more detailed account of this subject matter.

All alternative cost estimates are expressed in 1993 dollars and are based upon conceptual engineering and design. Capital cost consists of direct (construction) and indirect (non-construction) costs incurred in the first year of operation. Operation and Maintenance (O&M) cost refers to long-term postconstruction items necessary to ensure continued effectiveness of a remedial action. Total present worth cost represents that sum of money, if invested in the base year and disbursed as needed, would be sufficient to cover all costs of a remedy over its planned life.

ALTERNATIVE 1 - NO ACTION

As required by CERCLA, a no further action alternative was evaluated to serve as the basis for comparison with other active cleanup alternatives. Under this no-action alternative, no further remedial actions for the contaminated sediments or fish at the site would be conducted. The no-action alternative would not affect the existing health advisory issued by SCDHEC, who would be expected to continue the advisory until PCB concentrations in fish tissue decline to levels below 2 mg/kg (FDA tolerance level). The advisory currently warns against the consumption of fish from the Seneca River Arm of Hartwell Lake above the Hwy 24 bridge and fish larger than 3 lb throughout the entire lake. The advisory would be modified if warranted by future trends regarding PCB levels in fish. Maintenance of the fish advisory is assumed to entail the periodic replacement of existing signs that advise against fish consumption.

As discussed in Section 5.4.3 of this ROD, the mean largemouth bass PCB concentration is predicted to fall below the FDA limit by year 10. However, a longer period of time is required for concentrations in higher age classes to fall below the FDA limit. PCB concentrations in 10-year-old fish, representing the highest age class and largest fish in the model, required 12 years, or the year 2005, to fall below the 2.0 mg/kg FDA limit. For these reasons, it was assumed that the fish consumption health advisory would remain in effect for 12 years.

The no-action alternative would also entail periodic reviews of site conditions to ensure that the alternative remained protective of human health and the environment. These reviews would be conducted at least every 5 years as required by CERCLA.

Capital Cost = $7,000
Total O&M Cost = $123,000
Total Present Worth Cost = $130,000

ALTERNATIVE 2A - INSTITUTIONAL CONTROLS

This alternative is a limited action alternative that relies on a series of institutional controls to prevent or minimize ingestion of contaminated fish tissue, which was identified as the primary exposure pathway of concern for the Site. Generally, these institutional controls consist of the following components:

- Continuance of the Existing Fish Advisory

- Public Education Program - A program would be initiated to inform the public on available methods for reducing the intake of PCBs through fish consumption. Specific preparation, handling, and cooking techniques can reduce the quantity of contamination consumed. Information of this type would be disseminated to the public through a series of local public meetings and distribution of an informational pamphlet.

- Fish and Sediment Monitoring - In addition to maintaining the current fish advisory, annual monitoring of PCB levels in fish and sediment of Twelvemile Creek and Lake Hartwell would be conducted. Results from this monitoring program would be utilized to support modifications to the fish advisory and to monitor concentrations of PCBs in sediment and fish over time. Results of this program would be made available to the public.

- Regulation of Twelvemile Creek Impoundments - A routine schedule would be developed for flushing of sediment accumulated behind the 3 small impoundments located on Twelvemile Creek. Periodic flushing (most recently in September 1993) of a large load of sediment over a short period of time has been documented to have an adverse impact on the water quality and aquatic biota of the upper portion of the Twelvemile Creek Arm. These adverse impacts are attributed to elevated levels of suspended sediment and not PCBs. A routine flushing schedule would minimize impacts to the ecosystem while enhancing burial of more contaminated sediments with cleaner sediments from the Twelvemile Creek drainage.

Capital Cost = $366,000
Total O&M Cost = $2,842,000
Total Present Worth Cost = $3,208,000

ALTERNATIVE 2B - FISHERIES ISOLATION

Alternative 2B is a more aggressive approach consisting of management of the fisheries resource within the lake to minimize ingestion of PCB-contaminated fish. The primary control measure includes construction of a barrier, or fish fence, to prevent the movement of migratory fish (i.e. striped bass, hybrid bass, and walleye) into or out of the most contaminated portions of the reservoir. These migratory species represent approximately 50% of the fish harvested by weight from Lake Hartwell.

Placement of the barrier in the vicinity of the Hwy 37 Bridge, just south of Clemson, would result in isolation of the Twelvemile Creek, Keowee River, and upper Seneca River Arms, which represent less than 10 percent of the total area of Hartwell Lake. Isolation of these upstream areas is expected to result in an accelerated decline in migratory fish PCB concentrations in the downstream portions of the reservoir (i.e., the remaining 90+ percent of the lake). Reduction of fish PCB levels would allow for rescinding of the existing health advisories in these areas, returning the majority of lake areas to normal use. This approach is consistent with the COE's Best Management Practices for Hartwell Lake, designed to achieve the maximum beneficial uses for the reservoir, which include fish and wildlife management and recreational use.

The fish isolation barrier would be designed/constructed to meet the following performance standards:

- Minimize safety hazards for boaters and other users of the lake (i.e. waterskiers);
- Maximize effectiveness to prevent passage of migratory game fish through the barrier;
- Allow boats to pass unimpeded to minimize disruptions of boating traffic on the lake (i.e. no gate);
- Construct a semi-permanent structure that could be removed once PCB levels decline to health-based levels;
- Incorporate value engineering principles to minimize cost for design and construction;

- Minimize operations and maintenance requirements and costs;
- Design and installation of fish fence will not impede normal lake usage.

This alternative would require an approximate 6 month pre-design (treatability type) phase to develop a detailed design in accordance with the above performance standards. If pre-design studies are successful, full scale construction/installation of this remedy could be accomplished in approximately 1 year. PCBs would continue to accumulate in the fish upstream of the fish fence, therefore, fish are predicted to decline to protective levels (the 2.0 mg/kg FDA tolerance level) in approximately 12 years. By isolating the impacted upstream areas, PCB concentrations in migratory fish from the remaining 90+ percent of the lake are predicted to decline to the 2 mg/kg level in approximately 3-4 years.

Lake use restrictions, such as no-wake zones and warning signs would be implemented to prevent damage to the fence and for boating safety. Alternative 2B also includes the institutional controls described for Alternative 2A.

Capital Cost = $1,232,000
Total O&M Cost = $3,012,000
Total Present Worth Cost = $4,244,000

ALTERNATIVE 3A - CAPPING

Alternative 3A involves the isolation of PCB-contaminated sediments by placing an 18 inch clean sediment cap over the areas with the highest contamination. The cap would be constructed using fine sand (minimum particle size 0.25 mm) to eliminate the further downstream migration of contaminated sediment and the transfer of PCBs from sediment to aquatic biota. The cap would extend 7 miles from just upstream of the Maw Bridge (Rt. 337) to the confluence with the Keowee River, just upstream of Hwy 123. The cap would cover an area of 730 acres and would require approximately 1,800,000 yd^3 of sand to construct the cap. Figure 7-2 provides an illustration of the area to capped under this alternative.

The cap thickness was designed to minimize the impacts associated with bioturbation and sediment burrowing biota (i.e. mayfly). Based upon sediment transport modeling for a cap with a minimum particle size of 0.25 mm, no significant erosion of cap material was observed in areas below the Madden Bridge. However in areas above the Madden Bridge (i.e., the "goose-neck" bend area), the model results showed erosion for all grain sizes tested (i.e., 10, 2, and 0.25 mm). These results indicate that maintenance of the cap would be difficult in the headwaters. Placement of the cap would be accomplished using a hydraulic barge unloader equipped with a sand spreader. The barge and sand spreader would likely be supplied with sand through a slurry pipeline between the barge and the shore or by a separate hopper barge. A local sand source has been identified near the community of Liberty, South Carolina. The cost estimate assumes

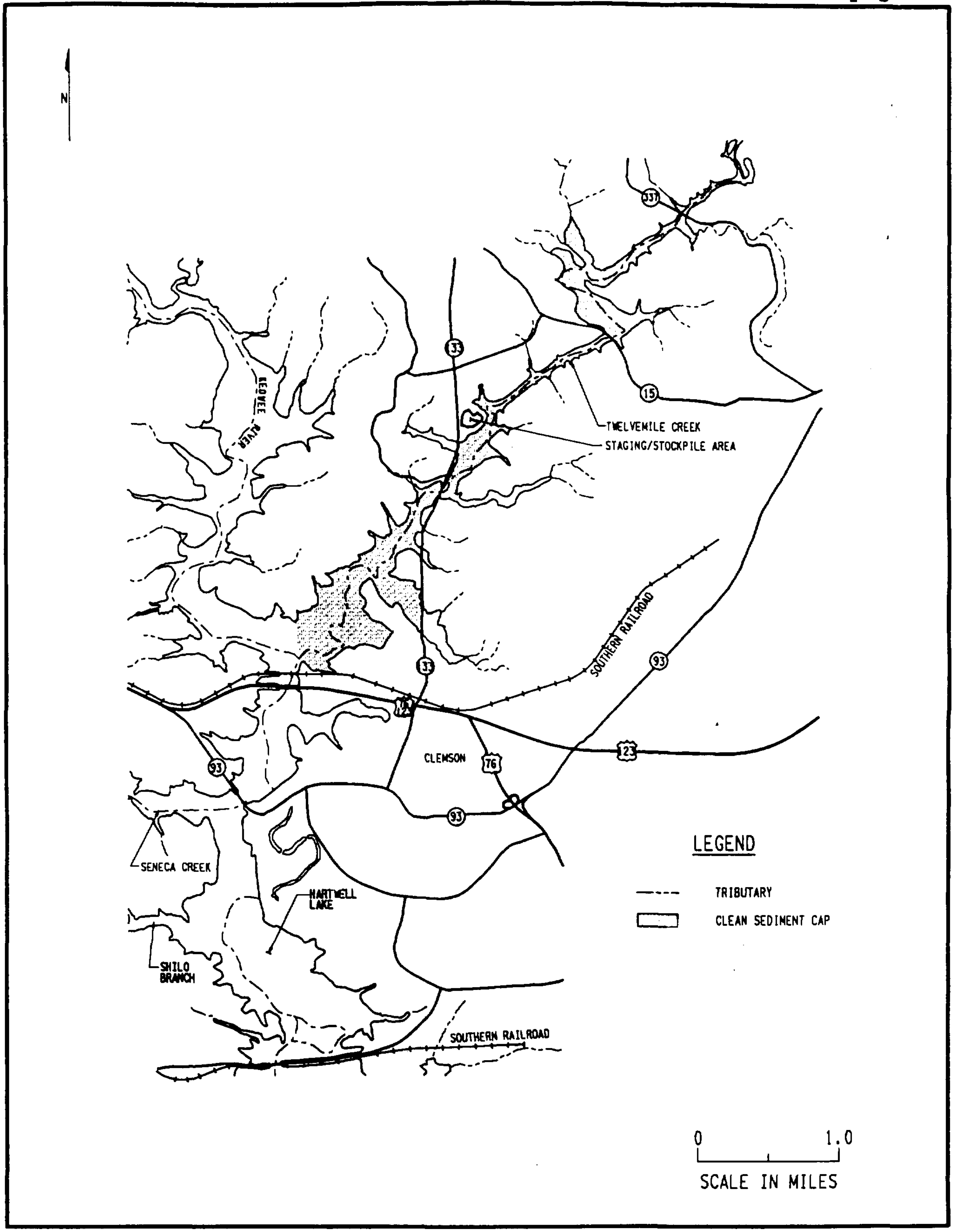


Figure 7-2
Area to be Capped in Alternative 3A

that the sand would be transported by truck to the staging area, converted to a slurry using lake water, and pumped out to the sand spreader barge.

Placement of the cap, including design, procurement, and construction, would require approximately 2 years. Once the contaminated sediments were isolated beneath the cap, further transfer to biota would be significantly reduced, and PCB concentrations in the fish in Twelvemile Creek Arm would decline at an accelerated rate. A period of 3 to 4 years after cap placement would be required for the mean concentration of PCBs in largemouth bass filets to fall below the FDA limit of 2.0 mg/kg. As part of cap O&M, detailed hydrographic surveys would need to be conducted periodically to assess the integrity and overall performance of the clean sediment cap. These surveys would focus on the upstream segment of the cap in the area where sediment deposition and scour processes are most active.

Alternative 3A also consists of lake usage restrictions to minimize erosion of the cap once it is placed and other institutional controls described under Alternative 2A.

Capital Cost = $48,296,000
Total O&M Cost = $2,843,000
Total Present Worth Cost = $51,139,000

ALTERNATIVE 3B - SEDIMENT CONTROL STRUCTURE

Alternative 3B involves the construction of a 1,600 ft. fixed-crest weir near the mouth of the Twelvemile Creek Arm. The weir would maintain a constant pool elevation of 660 ft MSL in the Twelvemile Creek Arm, minimizing the scour/erosion and resuspension of contaminated sediment in the headwaters and thereby reducing the downstream migration of PCB-contaminated sediment into Hartwell Lake. The constant pool elevation may also enhance the burial of these contaminated sediments in the upstream reaches. In addition, the weir would greatly reduce the migration of fish into and out of Twelvemile Creek Arm. The location of the sediment control structure is shown on Figure 7-3.

The weir, or sediment control structure, would be an effective barrier to the downstream movement of suspended bed-load sediments, which are transported just above the sediment-water interface. The weir would allow water to flow from the Twelvemile Creek Arm to Hartwell Lake but would otherwise be an effective physical barrier between the two water bodies. The sediment control structure would not allow the passage of boats or other watercraft, and lakeshore property owners in the Twelvemile Creek Arm would not have direct boating access to or from Hartwell Lake. Monthly pool elevation data and the reservoir operating rule curve were used to select the crest elevation for the weir. Based on the pool elevation data, it is estimated that the pool elevation for Lake Hartwell is above 660 ft MSL approximately 23 percent of the time. The sediment control structure would be constructed of concrete by utilizing proven cofferdam techniques.

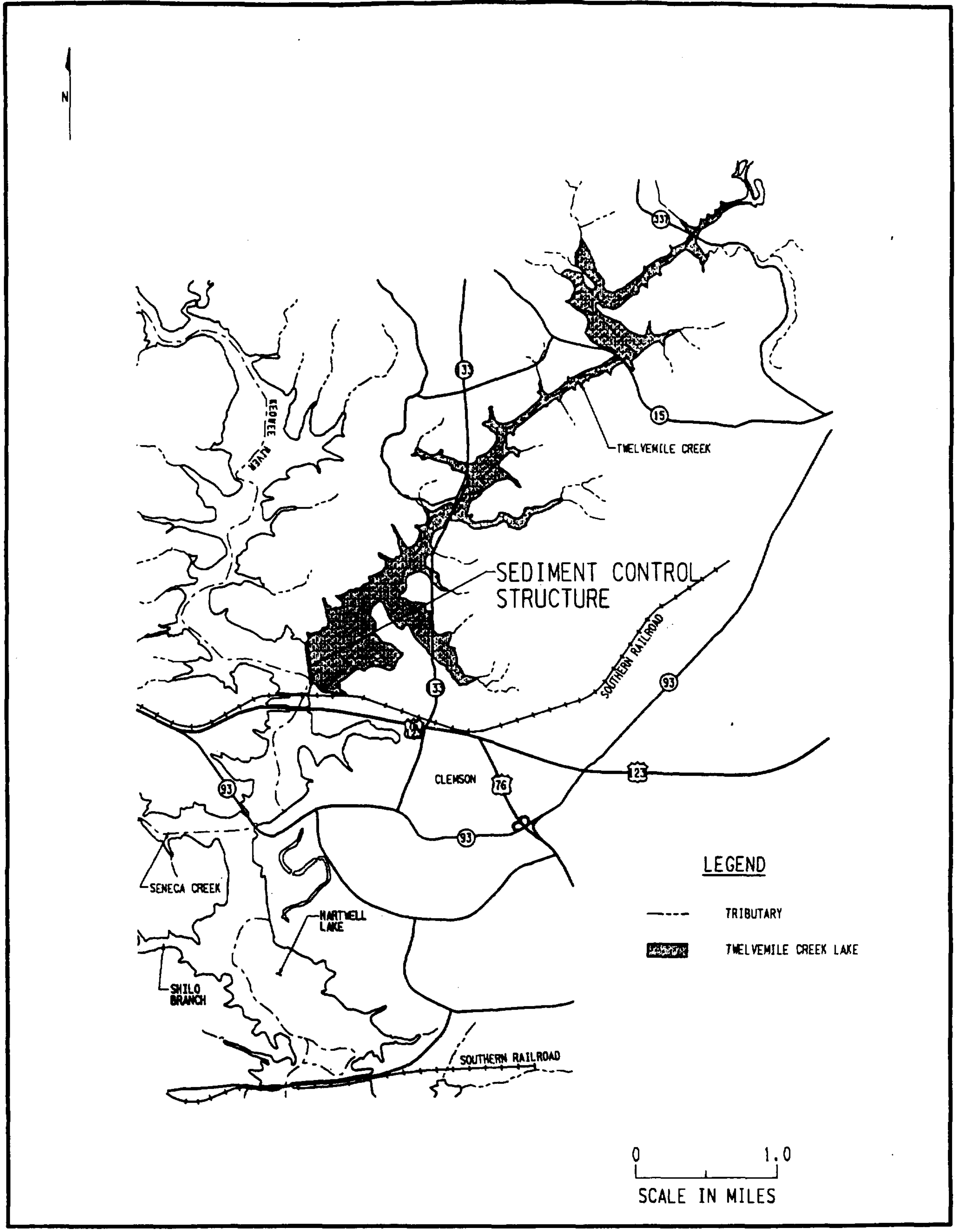


Figure 7-3
Sediment Control Structure Location of Alternative 3B

Implementation of Alternative 3B, including design and construction of the weir and establishment of institutional controls, would require approximately 2 years. Within the newly impounded Twelvemile Creek Lake, contaminated sediments would not be isolated from the biota and future contaminant trends in the fish would be as described under the Alternatives 1 and 2A. The time to achieve protectiveness in the main body of Lake Hartwell (i.e., the approximate 90+ percent of the total lake area downstream of the sediment control structure) was assumed to be comparable to that predicted for Alternative 2B (fish fence), given that both the weir and fish fence would greatly limit the movement of fish into and out of the area with the most highly contaminated sediment. Using this approach, the FDA Tolerance Level in migratory fish downstream of the sediment control structure would be attained in an estimated 3 to 4 years after construction of the weir was completed.

To ensure public safety, watercraft would be restricted from the immediate vicinity of the sediment control structure. Fishing restrictions in the isolated area, as well as institutional controls under Alternative 2A, would be implemented to limit consumption of contaminated fish until protective levels were achieved.

Capital Cost = $51,226,000
Total O&M Cost = $2,365,000
Total Present Worth Cost = $53,591,000

ALTERNATIVE 3C - OPTIMAL CAPPING/SEDIMENT CONTROL STRUCTURE

Value engineering techniques were used to combine elements of Alternatives 3A and 3B to achieve similar results with significantly lower costs and reduced impact to lakeshore residents and property owners. Figure 7-4 provides a conceptual approach to this alternative.

The sediment control structure for Alternative 3C consists of a fixed-crest weir similar in design to the structure proposed in Alternative 3B. The proposed location for the weir under Alternative 3C is approximately 1,000 ft upstream of the Hwy 133 bridge. Placement of the structure at this location would isolate the areas having the highest levels of PCB contamination in the sediment while at the same time effectively isolating a smaller portion of the Twelvemile Creek Arm from the main lake. Moving the weir upstream also allows for its placement at a relatively narrow constriction of the channel, resulting in a much smaller weir (length-wise) and construction cost. The weir would also maintain an upper pool elevation of 660 ft, minimizing scour and resuspension of contaminated sediment in the headwaters of the Twelvemile Creek Arm. This action would minimize the migration of contaminated sediment into the lower portion of the Twelvemile Creek Arm and Hartwell Lake. The weir is also expected to reduce the movement of fish into and out of the areas of highest sediment PCB contamination.

The area downstream of the sediment control structure to the mouth of the Twelvemile Creek Arm would be capped under this

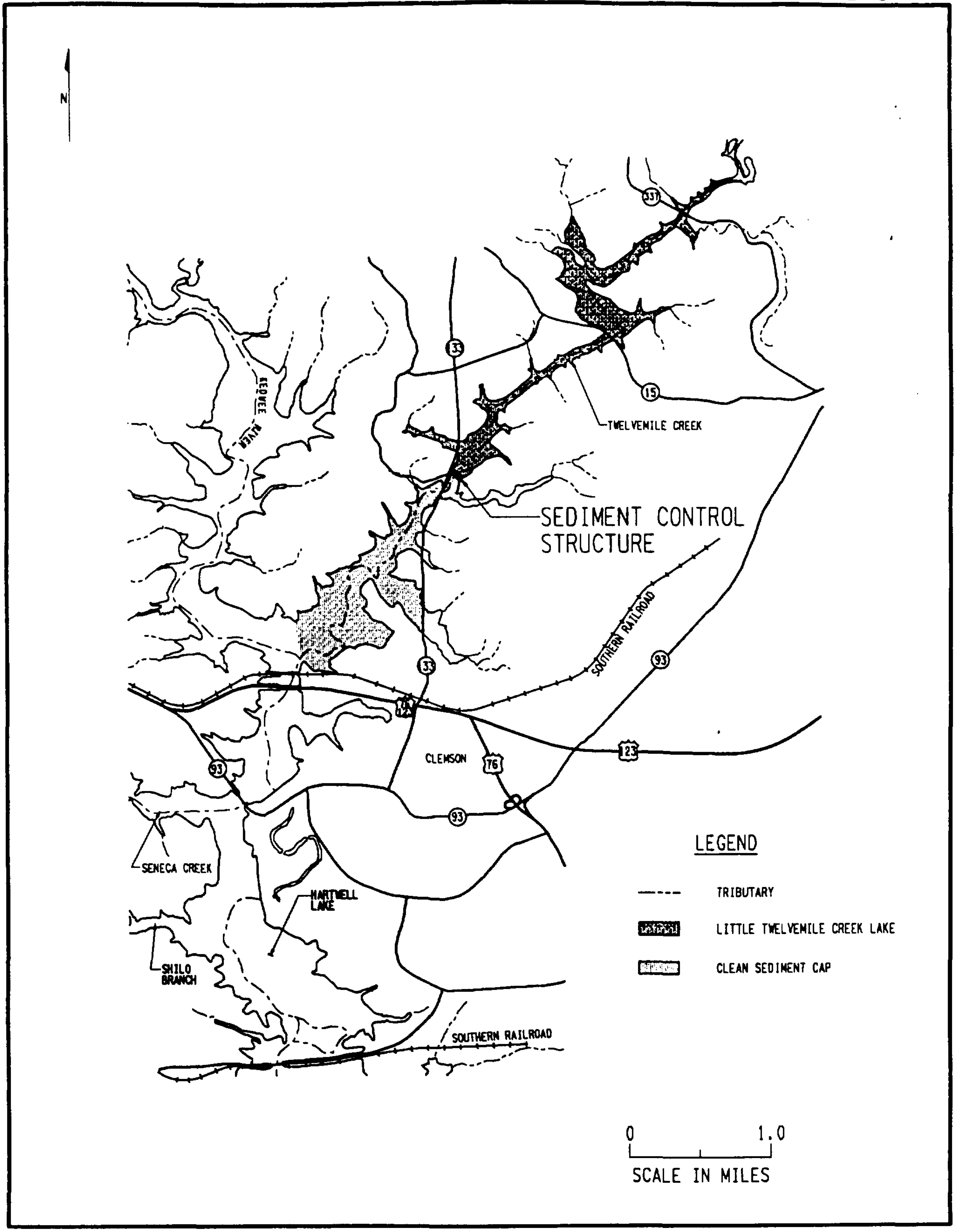


Figure 7-4
Sediment Control Structure/Area to be Capped
Alternative 3C

alternative using the same performance criteria (e.g., prevent burrowing into underlying sediment), conceptual design parameters (e.g., 18-in. thick, sand-silt mixture), and construction methods (i.e., hydraulic sand spreader barge) as described for the Alternative 3A. The area for capping consists of approximately 285 acres and would require approximately 700,000 yd^3 of material to construct. Cap integrity below the weir would be maintained using riprap and other reinforcing materials to prevent scour from flow over the top of the weir.

Construction of the sediment control structure and placement of the cap would require a period of 2 to 3 years. Upstream of the weir, contaminated sediments are not isolated from the biota and thus PCB concentration in fish would continue to exceed the FDA limit of 2.0 mg/kg for the an estimated 12 years. Downstream of the weir in the Twelvemile Creek Arm, cap placement would accelerate the reduction of PCB levels in fish to protective levels because contaminated sediments have been isolated, limiting further transfer of PCBs to biota. An estimated period of 3 to 4 years (after cap placement) is required for PCB concentrations to fall below the FDA limit of 2.0 mg/kg in the capped area as well as in the main body of Hartwell Lake. Institutional controls under Alternative 2A and fishing restrictions upstream of the sediment control structure would be implemented until protective levels in the fish were achieved.

Capital Cost = $31,684,000
Total O&M Cost = $2,365,000
Total Present Worth Cost = $34,049,000

ALTERNATIVE 4 - CONFINED DISPOSAL FACILITY

Alternative 4 involves a much more rigorous remediation approach than any of the alternatives discussed above. This alternative involves removal by hydraulic dredging of contaminated sediment from the Twelvemile Creek Arm with PCB concentrations greater than 1 mg/kg followed by disposal of the dredged material in a Confined Disposal Facility (CDF). The conceptual approach to this alternative is shown in Figure 7-5.

Implementation of Alternative 4 would be a complex undertaking controlled through scheduling and rigid conformance to procedural requirements needed to minimize environmental impacts. The following discussion provides an overview of the remedial construction activities associated with Alternative 4:

- Excavate channel - Rerouting the Twelvemile Creek Arm would begin immediately south of the high-tension powerline crossing and would proceed due south for a distance of approximately 1,600 ft. where it would reconnect with the original lake channel. The rerouted channel would be approximately 50 ft. wide at the base with a maximum excavation depth for the channel at approximately 55 ft. Material excavated during the channeling operation would be used for construction associated with the CDF. Rerouting the channel in this area would only isolate one shoreline residence on the goose-neck bend.

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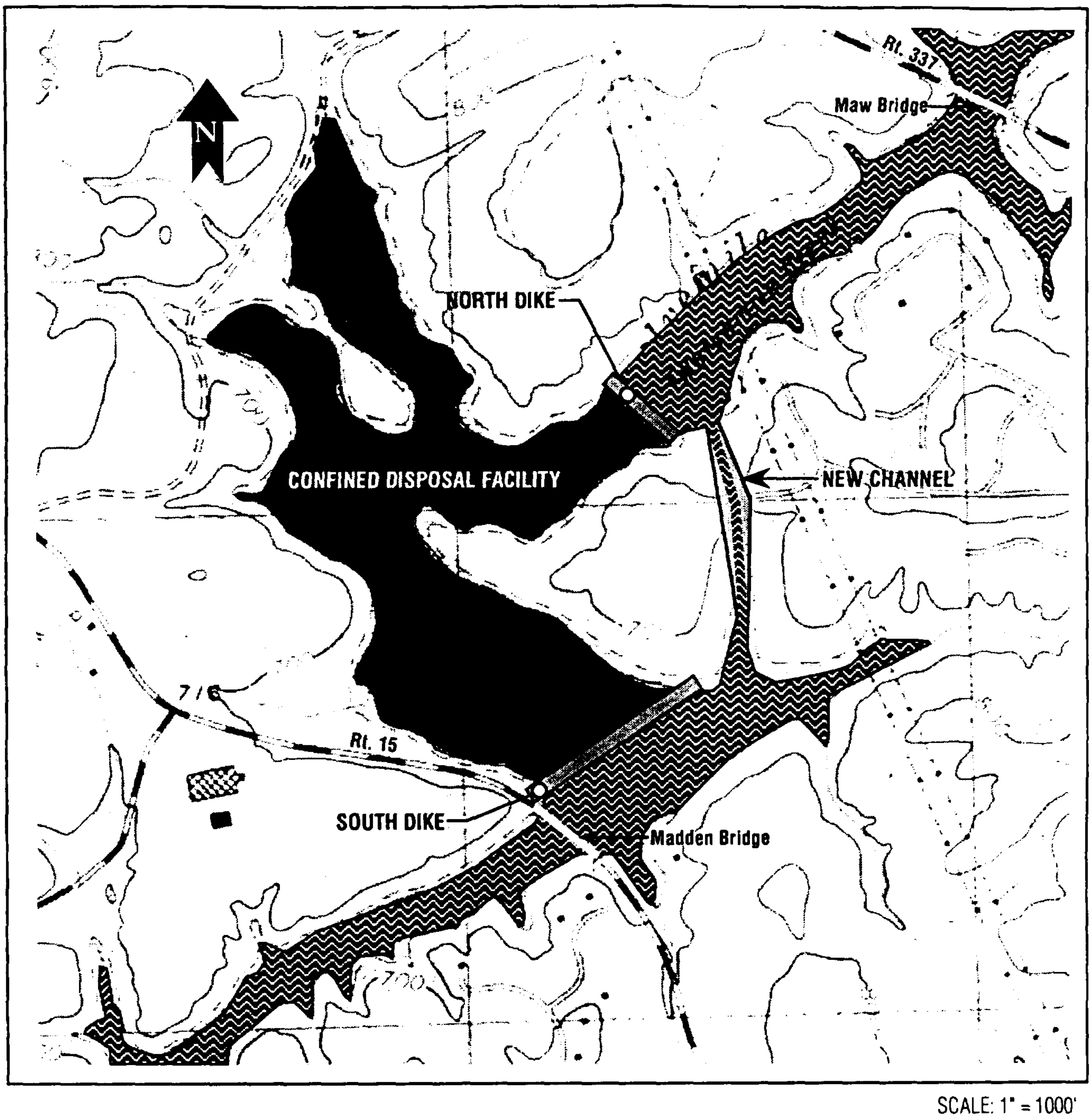

Figure 7-5
Confined Disposal Facility for Alternative 4

- Construct Confined Disposal Facility - The COE commonly uses CDFs for disposal of dredged sediments. The goose-neck bend area between Maw and Madden Bridges was selected as the optimum location for the following reasons: 1) this area has most highly contaminated sediments avoiding the need to dredge approximately 1.3 million yd^3 of material; 2) approximately 113 acres is available providing sufficient capacity for disposal of 5 million yd^3 of material; and 3) minimal impacts on existing residents would occur.

- Dredge and pump dredged sediment into CDF - Sediments from entire Twelvemile Creek Arm with PCB concentrations >1 mg/kg would be removed via hydraulic dredging and transported to CDF via pipeline. Sediment would settle out in CDF, while water was returned to the lake.

- Compact/grade sediment to promote runoff followed by placement of soil cap over CDF.

Additional detailed information regarding dredging techniques, dredged material characteristics, and design of the CDF would be required prior to implementation of Alternative 4. Implementation of the dredging alternative is expected to require a period of 3 to 4 years (including treatability testing, design, procurement and construction). Once sediments with greater than 1 mg/kg of PCBs have been removed from the lake, the FGETS model predicts that the mean PCB concentration in largemouth bass fillets would fall below the FDA limit of 2.0 mg/kg in 5 to 6 years. Institutional controls would be used to limit consumption of contaminated fish until protective levels were achieved.

Capital Cost = $43,422,000
Total O&M Cost = $3,487,000
Total Present Worth Cost = $46,909,000

ALTERNATIVE 5 - STABILIZATION

Alternative 5 is a very complex and costly alternative that involves removal of contaminated sediments with PCB concentrations greater than 1 ppm via a combination of shallow water excavation and hydraulic dredging. Contaminated sediments in the middle and lower portions of Twelvemile Creek Arm would be dredged while the upper portion is dewatered and excavated. The dredged/excavated sediments would be treated by stabilization with cement and placed in a CDF as described under Alternative 4. Fish and other biota in the upstream segment would be collected and destroyed as part of the dewatering operations. This alternative was evaluated in an attempt to satisfy the preference for treatment as a principal element for selected remedial alternatives at NPL sites.

Implementation of Alternative 5 would likely trigger a substantial number of ARARs, the most significant being the Clean Water Act and South Carolina Water Classification Standards. Based on a volume estimate of 4,722,000 yd^3 for excavation and dredging, expected stabilization production rates, and the rate at which the confined disposal facility can be filled, implementation of Alternative 5 would entail a duration of 4 to 5 years. Once the contaminated sediment has been removed, fish PCB concentrations downstream of the Madden Bridge would decline at an accelerated rate, achieving the FDA tolerance level in approximately 5 to 6 years. The time to achieve protectiveness for this alternative therefore is 9 to 11 years.

Capital Cost = $581,957,000
Total O&M Cost = $3,486,000
Total Present Worth Cost = $585,443,000

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section documents the comparative analysis conducted to evaluate the relative performance of each alternative in relation to each of the evaluation criteria. The purpose is to identify and clearly understand the advantages and disadvantages of each remedial alternative described in Section 7.0 of this ROD. As stated in NCP [40 CFR 300.430 (f)], the evaluation criterion are arranged in a hierarchial manner that is then used to select a remedy for the site based on the following categories:

Threshold Criteria:
- Overall Protection of Human Health and the Environment
- Compliance with ARARs

Primary Balancing Criteria:
- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Short-term Effectiveness
- Implementability
- Cost

Modifying Criteria:
- State Acceptance
- Community Acceptance

The Threshold criteria must be met before an alternative is eligible for selection as a preferred alternative in the Proposed Plan and ultimate selection in the ROD. The five Primary Balancing Criteria provide the basis for determining which alternative provides the best balance of trade-offs among all others considered. The State of South Carolina has reviewed this ROD and concurs with EPA's selected remedy described in Section 9.0. The State of South Carolina concurrence letter is attached as Appendix A to this ROD. Community Acceptance is addressed in the Responsiveness Summary attached as Appendix B to this ROD. The following discussion addresses the Threshold and Primary Balancing Criteria.

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Complexities related to the cycling of PCBs in the biota of Lake Hartwell cause residual risk levels to remain above 1×10^{-4} regardless of which remedial action alternative is implemented. A reduction in sediment PCB concentrations does not result in an immediate reduction in PCB concentrations in fish. High PCB concentrations in fish during the initial years of the 30-year exposure duration result in average risk estimates exceeding acceptable levels. Therefore, all of the alternatives rely on institutional controls to minimize exposures to PCB-contaminated fish tissue (limiting these exposures was identified as one of the primary remedial action objectives). These controls include public education and continuation of the current fishing advisory.

The most protective alternatives are those that rely principally on engineering rather than institutional controls to reduce or eliminate exposures, given the uncertainty regarding the performance/reliability of the institutional controls. The removal/disposal and removal/treatment/disposal actions under Alternatives 4 and 5, respectively, provide the highest level of protectiveness, as the contaminated material is removed from the lake and isolated in an engineered disposal facility. Alternative 2B entails construction of a fish fence to be designed and constructed so as to maximize effectiveness while minimizing operations and maintenance; however, additional, pre-design studies would be needed to develop the actual design for the structure. Alternatives 3A and 3C involve capping actions that should permanently isolate the contaminated sediment in all or a major portion of the Twelvemile Creek Arm. The capping would be highly protective of human health and the environment; its reliance on long-term monitoring and maintenance to assure cap integrity is a disadvantage but does not compromise the overall protectiveness or long-term effectiveness of the action.

8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Section 121 (d) of CERCLA requires that remedial actions at NPL sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria and limitations which are collectively referred to as "ARARs", unless such ARARs are waived under CERCLA section 121(d)(4). Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address hazardous substances found at the site ("contaminant-specific ARARs), the remedial action to be implemented at the site ("action-specific ARARs"), the location of the site ("location-specific ARARs"), or other circumstances at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law which, while not applicable to the hazardous substances found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

All of the alternatives rely on natural fate and transport processes to reduce PCB concentrations in Lake Hartwell fish to the FDA tolerance level of 2 mg/kg. Several alternatives include actions designed to speed up the rate at which these natural processes act (i.e. by capping or removing contaminated sediment). No contaminant-specific ARARs for PCBs in sediment were identified, which led to the identification of To-Be-Considered (TBC) criteria and the selection of a sediment cleanup goal of 1 mg/kg based on an evaluation of these criteria. Alternatives 3A (Capping), 4 (Confined Disposal Facility) and 5 (Stabilization) would best achieve the TBC criteria for sediment. The sediment control structures (Alternatives 3B and 3C) are expected to impact PCB concentrations in the sediment, but not to the same extent as capping or removal.

Alternatives 4 and 5 would trigger the largest number of and most complex action- and location-specific ARARs, including the Clean Water Act dredge-and-fill requirements, South Carolina requirements for surface water discharges, and, if PCB concentrations in dredged/excavated sediments exceed 50 ppm TSCA requirements for handling/storage/treatment/disposal. The alternatives could be designed and implemented to attain compliance with these requirements. Capping activities under alternatives 3A and 3C would also trigger Clean Water Act and South Carolina requirements related to surface water discharges; compliance with these requirements would be factored into the design and implementation. Action-specific ARARs were not identified for the institutional controls under any alternative or for construction of the fish fence under Alternative 2B.

8.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence refers to the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time. The criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Contaminant transport and bioaccumulation modeling conducted during the RI showed that Lake Hartwell is a dynamic system in which PCB concentrations in sediment and biota are gradually declining in response to natural fate and transport processes such as burial by clean sediment, resuspension and desorption followed by flushing out of the reservoir, and other processes. The modeling results indicate that PCB levels in the sediment will decline below the 1 mg/kg cleanup goal in 5 to 10 years (depending on location within Twelvemile Creek Arm) and that PCB concentrations in fish will decline to the FDA tolerance level in 12 years. If the modeling predictions are accurate, even Alternative 1 (No Action) would eventually result in a permanent solution for the site in approximately 12 years, given that consumption of contaminated fish was the primary exposure pathway of concern.

Alternatives 2 to 5 rely on institutional controls to prevent exposure to contaminated fish; the performance and reliability of these controls is dependent on site-specific factors and therefore difficult to predict. In the context of technology performance and reliability, the fish fence (Alternative 2B) has not been proven for the same scale of application proposed for Sangamo OU2. Capping (Alternatives 3A and 3C) is a proven technology but is dependent on an extensive program of monitoring and maintenance to ensure cap integrity and long-term effectiveness. Capping of only the downstream portion of the Twelvemile Creek Arm under Alternative 3C would result in a cap that was easier to maintain, and therefore, it should have a higher degree of long-term effectiveness. Sediment control structures (Alternatives 3B/3C) are also widely used and are less dependent on maintenance.

Although dredging and confined disposal facilities are widely recognized as reliable technologies, further technology evaluation, in the form of pilot-scale treatability studies, would be needed to obtain design and operating data essential to minimize environmental impacts. Similarly, stabilization treatability studies under Alternative 5 would require further technology evaluation to determine material handling and process requirements (e.g., optimum stabilization mixture). Treatability studies are also needed to determine effluent treatment requirements for the dewatering fluids from the confined disposal facility or material handling/stockpiling areas.

8.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies for the remedy. None of the alternatives has an effect on the toxicity of the contaminants, expect Alternative 5 which involves treatment by stabilization. Alternative 5 would accomplish the most significant reduction in the mobility of PCBs through a stabilization treatment process, followed by disposal in a confined disposal facility. Contaminant mobility would also be reduced through disposal in a CDF, with no treatment, in Alternative 4.

The capping alternatives (Alternatives 3A and 3C) also accomplish a reduction in contaminant mobility, but the effect is contingent upon proper maintenance of the cap. Reductions in contaminant mobility are expected with the sediment control structures (Alternatives 3B and 3C), primarily through maintaining pool elevation, thereby decreasing scour/erosion in the headwaters. The capping, sediment control structures and fish fence alternatives also reduce PCB transfer to migratory fish by isolating the contaminated sediment (through capping) or restricting the migration of fish into and out of the areas with the highest sediment contamination (through the fence or weirs). The net result is a reduction in the level of PCB contamination in lake-wide migratory fish.

8.5 SHORT-TERM EFFECTIVENESS

Short-term effectiveness refers to the period of time needed to complete the remedy and any adverse impacts on human health and the environment that may be posed during the construction and implementation of the remedy.

Implementation of Alternatives 1 (No-Action) and 2A (Institutional Controls) would have the least impact on the community, workers, and the environment; Alternative 2B has only a slightly greater impact. Alternatives 3A/3B/3C have greater impacts on the local community due to construction of sediment control structures and excessive truck traffic associated with the transportation of capping material. The greatest impacts (and least short-term effectiveness) are associated with the more aggressive alternatives that entail dredging, re-channeling, and construction of the CDF (Alternatives 4/5).

Table 8-1 summarizes the estimated schedule for each alternative, presenting the time required to implement, time required for fish PCB concentrations to decline to protective levels (FDA tolerance level), and total time for alternative to achieve protectiveness. Because the most highly contaminated sediment is concentrated in a relatively small, upstream portion of the lake that represents less than 10 percent of the reservoir area, separate estimates are shown for the time to attain FDA levels and time to achieve protectiveness in both this upstream portion (i.e., the Twelvemile Creek/Seneca River Arm) and in the main body of Hartwell Lake. The impact on a given alternative with regard to protective levels throughout the lake is an important consideration given the significant resource potential of the reservoir. It is important to note that the time required for implementation includes design, procurement, and construction but does not consider the time between issuance of the Proposed Plan/signing of the ROD and initiation of the Remedial Design.

The table shows that isolation or removal of the most highly contaminated sediment, through fisheries isolation, capping, sediment control structures, or dredging often has a much greater effect on PCB levels in downstream areas than within the Twelvemile Creek Arm. This response is mostly due to the impact of limiting or preventing the movement of migratory fish into and out of the areas with the more highly contaminated sediment (lake-wide, non-migratory fish have exceeded the FDA levels on an infrequent and isolated basis while migratory fish have typically had PCB levels higher than 2 mg/kg). Accelerated declines in PCB levels would be expected for alternatives involving capping or removal; otherwise, PCB reductions would be accomplished only through natural fate and transport processes conditions.

The most favorable alternatives with regard to the estimated time to achieve protectiveness would be Alternatives 2B and 3A; fisheries isolation (Alternative 2B) is more quickly implemented and therefore leads to a slightly faster reduction in PCB levels in the main body of Hartwell Lake but the capping alternative would have a much greater effect in the Twelvemile Creek/Seneca River Arm. If more than 1 to 2 years elapse between the signing

Table 8-1
Estimated Time to Achieve Protectiveness

ALT. NO.	DESCRIPTION	TIME TO IMPLEMENT[1] (yrs)	TIME FOR FISH TO ATTAIN FDA LEVEL (yrs)		TIME TO ACHIEVE PROTECTIVENESS[4] (yrs)	
			TWELVEMILE CREEK/SENECA RIVER[2] ARM	MAIN BODY OF HARTWELL LAKE[3]	TWELVEMILE CREEK/SENECA RIVER ARM	MAIN BODY OF HARTWELL LAKE
1	No action	0	12	12	12	12
2A	Institutional Controls	0.5	12	12	12	12
2B	Fisheries Isolation	1	12	3-4	12	4-5
3A	Capping	2	3-4	3-4	5-6	5-6
3B	Sediment Control Structure	2	12	3-4	12	5-6
3C	Optimal Capping/Sediment Control Structure	2-3	3-4 (downstream) 12 (upstream)	3-4	5-7 (downstream) 12 (upstream)	5-7
4	Confined Disposal Facility	3-4	5-6	5-6	8-10	8-10
5	Stabilization	4-5	5-6	5-6	9-11	9-11

NOTE: (1) Includes time needed for pre-design studies, design, procurement, and construction, but does not include time between Proposed Plan/Record of Decision and initiation of Remedial Design.

(2) Twelvemile Creek Arm only; FGETS modeling results indicate that fish will decline to FDA tolerance level (2 mg/kg) in approximately 12 years under baseline conditions; none of the alternatives will extend the period required for this to occur (i.e., none of the alternatives can have a period to achieve protectiveness of greater than 12 yrs).

(3) Downgradient of the Twelvemile Creek Arm (i.e., main body of Hartwell Lake), PCB concentrations will decline more rapidly for actions involving isolation, capping or removal of contaminated sediment (Alternatives 2B, 3A-C, 4 and 5). It was assumed that this rate of decline would be comparable to that observed in the Twelvemile Creek Arm for Alternatives involving capping (3-4 yrs) or removal of the sediment (5-6 yrs); further modeling is needed to verify this estimate.

(4) Duration only; based on estimated time to implement remedy and duration thereafter needed for fish PCB levels to decline to FDA level, based on the FGETS modeling results presented in Section 3.3 and assumptions regarding migratory fish PCB concentrations trends.

of the ROD and the initiation of the Remedial Design, the dredging alternatives (Alternatives 4/5) will not achieve protectiveness appreciably faster than that obtained under baseline (no-action) conditions.

8.6 IMPLEMENTABILITY

Alternatives 1 and 2A would be the most readily implementable; the main activity associated with the institutional controls under Alternative 2A (and other alternatives) involves planning and coordination with COE, SCDHEC, and other agencies. Alternative 2B (Fish Fence) would be somewhat more complex to implement, primarily due to the predesign testing to assess the suitability of various designs.

Alternatives 3A, 3B, and 3C represent an intermediate range of implementability. Capping and weirs have been successfully constructed at a wide variety of sites and conditions at Hartwell Lake and should not present any unusual difficulties. The reduced scale of the area to be capped and size of weir for Alternative 3C would simplify both design and construction activities associated with these individual components. A limitation to Alternative 3A and, to a lesser extent, 3C, concerns the availability and transportation logistics of as much as 1.8 million yd^3 of capping material. From a technical and engineering perspective, construction of the fixed crest weirs for Alternatives 3B and 3C should be much more implementable than capping due to the likelihood of encountering problems with the capping materials.

The most difficult alternatives to implement, in terms of both technical and administrative feasibility, would be Alternatives 4 and 5; both involve dredging, which is a widely used technology, but they would still require considerable predesign testing and evaluation to optimize operations and minimize environmental impacts. Construction of the confined disposal facility in what is currently a large body of open water and rechanneling the Twelvemile Creek Arm through a forested ridge would also present a number of technical challenges, while not insurmountable, the challenges do make implementation of Alternatives 4 and 5 considerably more complex than the other remedial alternatives. These alternatives would also have the greatest administrative requirements due to the need to fulfill permit-related requirements related to Clean Water Act dredge-and-fill permits, South Carolina NPDES permits, and possibly other permitted activities.

8.7 COST

Costs for each alternative were provided under Section 7.3 of this ROD. Alternative 5 is the most expensive alternative to implement, and is considered cost prohibitive. The more aggressive alternatives (Alternatives 3A/3B/3C/4) that involve engineering controls to satisfy the remedial action objectives have total present worth costs that generally range from $30-50 million. Alternative 2B achieves protectiveness in the main body of Lake Hartwell in a shorter amount of time than the other more aggressive and passive (Alternatives 1/2A) alternatives for only an additional $1 million over the cost of Alternative 2A (estimated present worth cost of $3,208,000). The No-Action alternative is the least expensive.

9.0 THE SELECTED REMEDY

This section of the ROD discusses EPA's selected remedy in detail for the Sangamo OU2 Site. EPA has selected Alternative 2A - Institutional Controls to address the contaminated sediments and fish at the Site. The selected remedial alternative for the Sangamo OU2 Site consists of the following components: 1) continuation of existing fish advisory; 2) public education program; 3) future sediment and aquatic biota monitoring; and 4) regulation of the Twelvemile Creek Impoundments. These primary components are discussed below.

9.1 CONTINUATION OF EXISTING FISH ADVISORY

The existing fish advisory on Lake Hartwell shall remain in effect. Signs warning against consuming fish have been posted at the majority of the public boat launch and recreation areas since 1987. Figure 9-1 provides an illustration of the posted advisory. The advisory is currently maintained by SCDHEC, and SCDHEC will remain responsible for management, supervision, and administration of the fish consumption advisory in the future. The advisory will be modified if warranted by future trends regarding PCB concentrations in fish. Modifications shall be fully supported and justified by the annual monitoring program discussed in Section 9.3 of this ROD.

Maintaining the fish advisory will likely entail the posting and replacement of signs describing the advisory at access points along the shoreline. For purposes of enhancing the effectiveness of the advisory, additional signs may be posted. Additional activities designed to increase public awareness of the existing fish consumption advisory are discussed in Section 9.2 of this ROD.

As discussed in the Section 5.4.3, FGETS bioaccumulation food-chain modeling, the mean PCB concentration in 2-8 year old largemouth bass is predicted to fall below the FDA limit by year 10. However, a longer period of time is required for concentrations in higher age classes to fall below the FDA limit. PCB concentrations in 10-year-old fish, representing the highest age class and largest fish in the model, required 12 years to fall below the 2.0 mg/kg FDA limit. For these reasons, it was assumed that the fish consumption health advisory would remain in effect for a minimum of 12 years, or the year 2005.

9.2 PUBLIC EDUCATION PROGRAM

Proper preparation of contaminated fish can reduce the quantity of contamination consumed. Contaminants (PCBs) are generally stored in fatty tissue (i.e., belly flap, strip along the backbone and lateral line, and skin). By removing these

ATTENTION

FISH CONSUMPTION ADVISORY - LAKE HARTWELL
S.C. DEPARTMENT OF HEALTH AND
ENVIRONMENTAL CONTROL (SCDHEC)

- **ALL FISH TAKEN FROM THE SENECA RIVER ARM OF LAKE HARTWELL NORTH OF SC HIGHWAY 24 AND 12 MILE CREEK SHOULD BE RELEASED AND NOT EATEN.**
- **ALL FISH LARGER THAN THREE (3) POUNDS TAKEN FROM THE REMAINDER OF LAKE HARTWELL SHOULD BE RELEASED AND NOT EATEN.**
- **FISHING IS NOT PROHIBITED BUT SCDHEC ADVISES THAT THESE FISH NOT BE EATEN DUE TO THE PRESENCE OF ELEVATED LEVELS OF POLYCHLORINATED BIPHENYLS (PCBs). SWIMMING, BOATING, AND OTHER WATER RELATED ACTIVITIES ARE NOT RESTRICTED BY THIS ADVISORY.**

FOR ADDITIONAL INFORMATION,
CONTACT SCDHEC AT:

COLUMBIA	GREENVILLE	ANDERSON
734-5300	242-9850	225-3731

Figure 9-1
Current Lake Hartwell Fish Advisory

areas when cleaning the fish, individuals can substantially reduce their intake of PCBs. Broiling, baking, and grilling fish also provides additional risk reduction. Many states, including Georgia, provide fish preparation suggestions to the public in pamphlets and other publications on state fishing regulations; South Carolina currently does not.

EPA shall develop a pamphlet that outlines methods, including those described above, for reducing the intake of contaminants through fish consumption. This pamphlet will be distributed to the general public and to frequent Lake Hartwell resource users. The most effective method of distribution to the general public is to provide the pamphlet to everyone who purchases a fishing license. Thus, all establishments that sell fishing licenses in the Hartwell Lake area will be supplied with the pamphlets, as will marinas and selected retail establishments (i.e., convenience stores) in the area. In addition to the pamphlets, advertisements will be placed periodically in newspapers from all of the counties surrounding the lake. The advertisements will reiterate the potential risks associated with consumption of PCB-contaminated fish from Lake Hartwell.

Printed information regarding the fish advisory will also be supplemented with periodic public meetings hosted by EPA, SCDHEC, and the COE. Public meetings will begin the first year following signing of the ROD and will be held at a minimum of 5-year intervals. The public meetings will serve to update the general population on PCB concentration trends in sediment and fish as well as the latest estimates of PCB-related risks resulting from consumption of contaminated fish. Analytical results from the annual monitoring program described in Section 9.3 and the five-year reviews, as required by CERCLA, will be disseminated to those attending these meetings, local citizens, and frequent lake users. The meetings would also provide a forum for public input into the decision-making process regarding continued institutional controls for the lake. The proposed locations for these meetings include:

- Anderson, S.C.
- Cateechee/Norris S.C.
- Clemson, S.C.
- Hartwell, Ga.
- Seneca, S.C.

The above public education program represents a baseline approach. EPA, COE, and SCDHEC will periodically evaluate the overall approach and effectiveness of this program by soliciting public comment and input from Lake Hartwell resource users. Creel surveys, similar to those conducted as part of the Biological Investigation, may also be utilized as a mechanism to obtain information from anglers on Lake Hartwell. The public education program is expected to evolve while attempting to identify the most productive method(s) for reaching the targeted audience. EPA, in close consultation with SCDHEC and the COE shall modify the public education program as required.

9.3 AQUATIC BIOTA AND SEDIMENT MONITORING

This section describes the program of annual monitoring of PCB levels in the fish, corbicula, and sediment of Lake Hartwell and the Twelvemile Creek watershed.

9.3.1 AQUATIC BIOTA MONITORING

In the interest of consistency and to support trend analysis, fish samples will be collected from the same 6 Lake Hartwell stations that have been utilized historically by SCDHEC and also during the Biological Investigation. These stations are shown on Figure 9-2 and are generally described as follows:

- SV-107 Twelvemile Creek Arm of Lake Hartwell in the vicinity of County Road 37; Pickens County, SC.
- SV-106 Seneca River Arm of Lake Hartwell in the vicinity of Martin Creek; Anderson County, SC.
- SV-532 Seneca River Arm of Lake Hartwell in the vicinity of Eighteen Mile Creek; Anderson County, SC.
- SV-535 Andersonville Island area of Lake Hartwell near the confluence of the Tugaloo and Seneca Rivers; Anderson County, SC.
- SV-641 Tugaloo River Arm of Lake Hartwell in the vicinity of Interstate I-85; Oconee County, SC.
- SV-642 Open water area of Lake Hartwell in the vicinity of Hartwell Dam; Anderson County, SC.

Fish samples shall be collected annually in the spring using gill nets and/or electrofishing techniques. Hybrid bass (weight class 3.0-5.0 lbs.), largemouth bass (weight class 1.5-3.0 lbs.) and channel catfish (weight class 2.0-4.0 lbs.) will be collected from the above 6 stations in Lake Hartwell. In past sampling events, 10 hybrid bass, 10 largemouth bass, and 4 catfish were collected at each station to calculate a representative mean. The adequacy of these respective numbers in determining a representative mean concentration in fish tissue is currently under review by SCDHEC. In any event, sampling conducted pursuant to this ROD will at a minimum include 10 hybrid bass, 10 largemouth bass, and 4 catfish. Game fish shall be prepared in accordance with the standard US FDA fillet method (i.e., fillet including rib cage and belly flap with skin on and scales off - except for catfish where skin is removed.). All fish shall be analyzed for the PCB component of EPA's Target Compound List (TCL).

Forage fish, consisting of gizzard shad/blueback herring, threadfin shad and bluegill, shall be collected at stations SV-107, SV-532, and SV-641. Forage fish will be collected concurrently with game fish sampling discussed above using electrofishing techniques. Samples will consist of whole body composite samples for each species. All forage fish samples

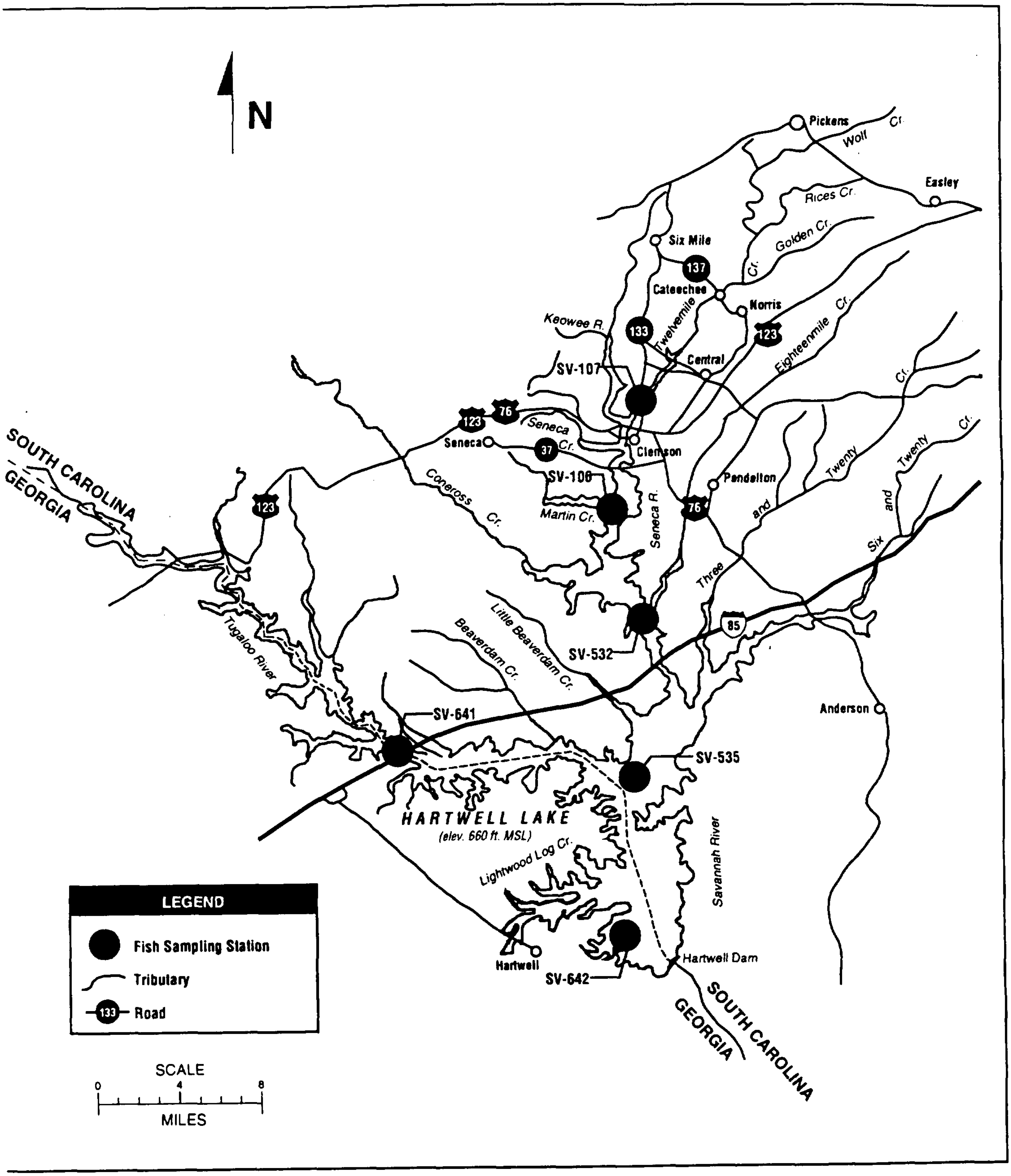

Figure 9-2
Fish Sampling Stations in Lake Hartwell

shall be analyzed for PCBs. Data generated from the forage fish collection and analyses shall be utilized to support future food-chain modeling activities.

In addition to fish sampling in Lake Hartwell, corbicula (fresh water clams) baskets will be placed at 6 locations in Twelvemile Creek for 28 days each in the spring of each year to determine current PCB loading into the Twelvemile Creek system. The sampling locations for corbicula baskets are shown on Figure 9-3. Corbicula baskets will be deployed concurrent with the fish sampling activities described above. After 28 days, baskets shall be recovered and analyzed for PCBs.

9.3.2 SEDIMENT MONITORING

Sediment monitoring locations are shown in Figures 9-4 and 9-5. Sediment samples shall be collected annually from 15 locations in Hartwell Lake and 5 locations in the watershed. Sediments will be collected using a ponar dredge. Stations SD-001 through SD-005 in the Twelvemile Creek watershed will be discrete samples. For the remaining 15 locations in Lake Hartwell, a transect shall be established at each station and 5 grab samples will be collected along the transect. These 5 samples shall be composited to provide a mean concentration of PCBs in surface sediments from a given transect. Sample and transect locations shall be established with sufficient accuracy to enable collection of future samples from same locations. Details of the sediment sample locations in Twelvemile Creek and Lake Hartwell are presented in Table 9-1.

All sediment and aquatic biota monitoring shall continue under the direction of EPA. Data from the annual monitoring will allow EPA, SCDHEC and COE to continue ongoing efforts to evaluate contamination trends in the sediment and biota. These trends will be used to support decisions to modify the advisory, in response to PCB concentration trends in the fish. Annual monitoring results shall be summarized and disseminated to the public in support of the public education program described under Section 9.2. For purposes of the cost estimate described in Section 9.6, it was assumed that this annual monitoring program will continue for a minimum of 15 years from signature of the ROD.

9.4 REGULATION OF TWELVEMILE CREEK IMPOUNDMENTS

The Federal Energy Regulatory Commission (FERC) regulates hydroelectric facilities in the U.S. Currently, the middle and lower impoundments on Twelvemile Creek, Woodside I and II, respectively, are non-licensed hydroelectric impoundments based on the date of construction and navigability of Twelvemile Creek. These impoundments effectively trap a large portion of the sediment load from Twelvemile Creek, and as a result, are flushed periodically to remove sediment and to restore storage capacity within the impoundments. Historically, these trapped sediments have contained high levels of PCBs. However, the RI and subsequent sampling in response to a recent flushing event (September 1993) have shown that more recent sediment

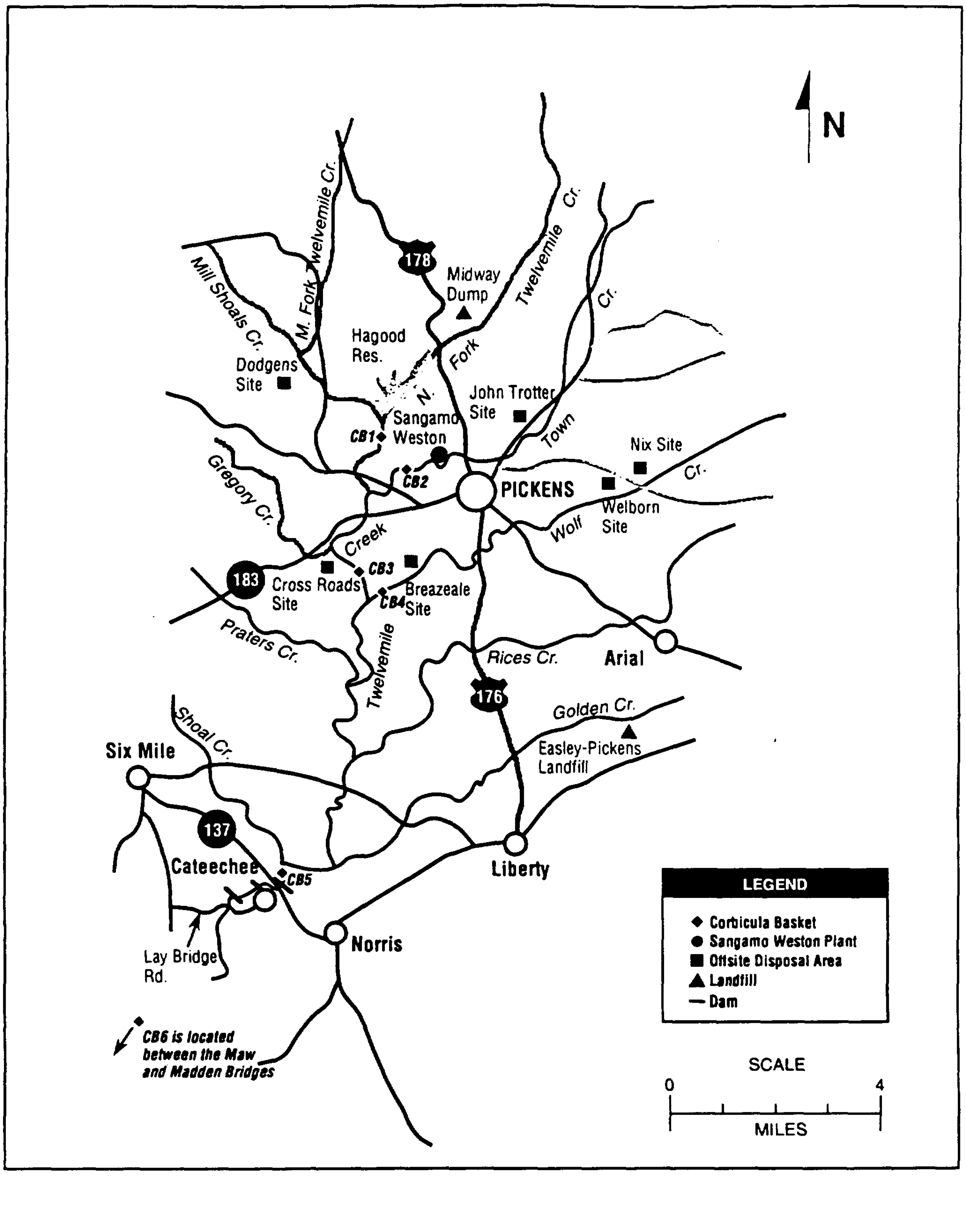

Figure 9-3
Corbicula Basket Sampling Locations in Twelvemile Creek Watershed

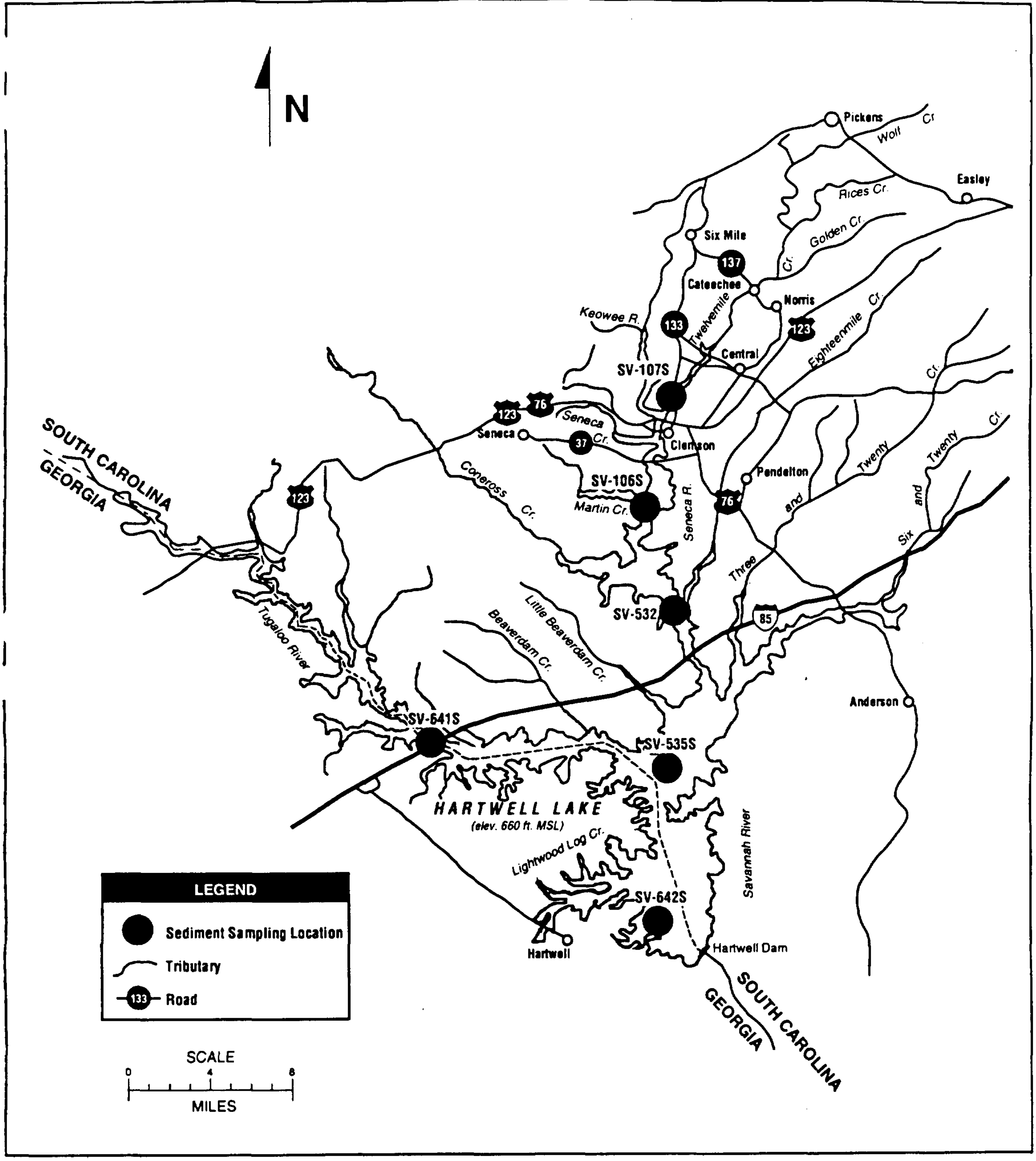

Figure 9-4
Sediment Sampling Stations in Lake Hartwell

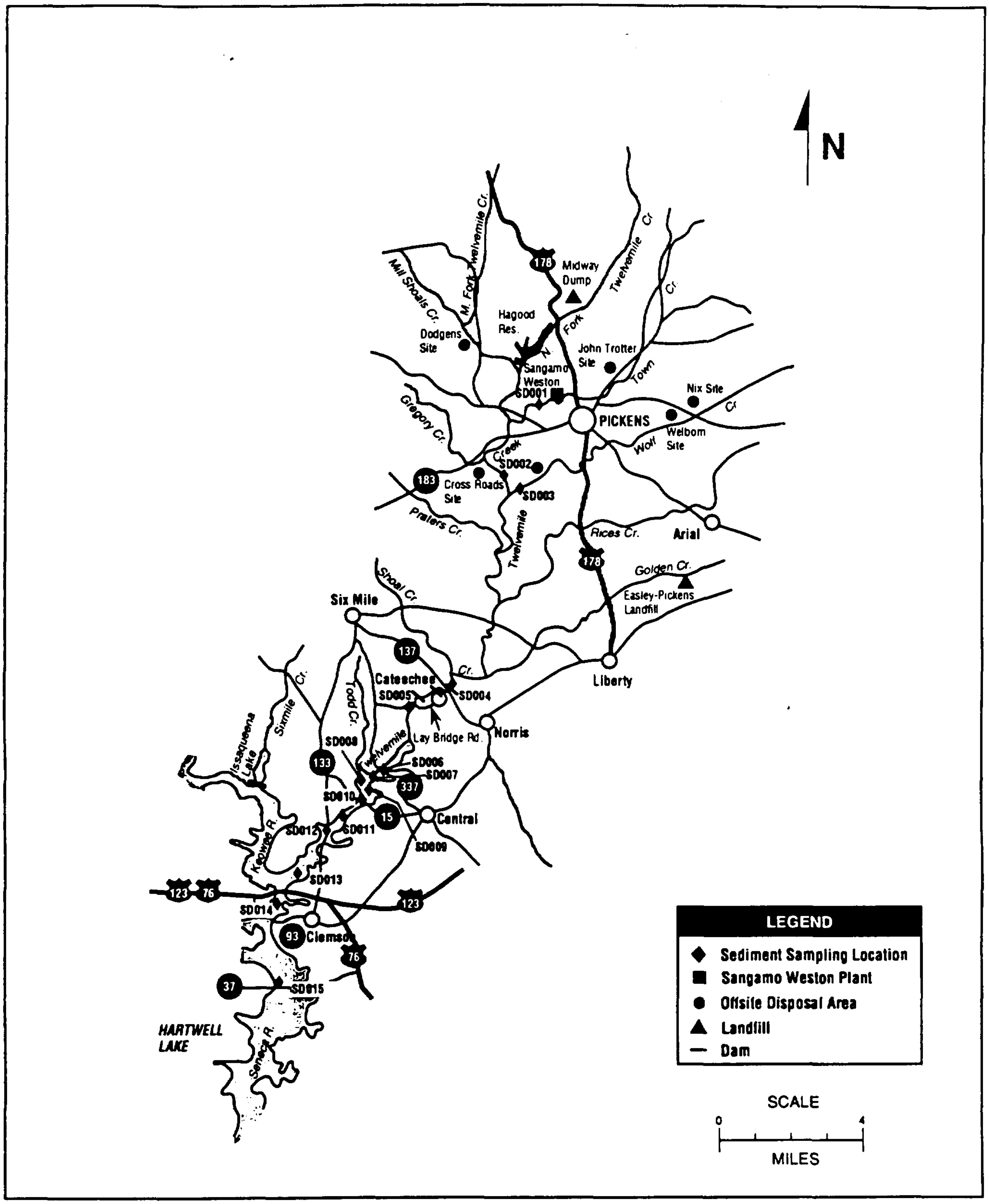

Figure 9-5
Sediment Sampling Stations in Twelvemile Creek

TABLE 9-1
Sediment Sample Locations in Twelvemile Creek Watershed and Arm of Lake Hartwell

Station ID	Location
SD-001	Town Creek downstream of Sangamo Weston outfall - same location as corbicula basket 2
SD-002	Twelvemile Creek upstream of Wolf Creek confluence - same location as corbicula basket 3
SD-003	Wolf Creek downstream of Breazeale site - same location as corbicula basket 4
SD-004	Twelvemile Creek at Easley-Central impoundment - same location as corbicula basket 5
SD-005	Twelvemile Creek at Lay Bridge
SD-006	Maw Bridge
SD-007 - 009	Between Maw and Madden Bridges
SD-010	Madden Bridge
SD-011	Between Madden and Hwy 133 Bridges
SD-012	Hwy 133 Bridge
SD-013	Mouth of Twelvemile Creek Arm
SD-014	Between US 123 and Hwy 93 Bridges
SD-015	Hwy 37 Bridge
SD-106	SV-106 fish sampling station
SD-532	SV-532 fish sampling station
SD-535	SV-535 fish sampling station
SD-641	SV-641 fish sampling station
SD-642	SV-642 fish sampling station

accumulating behind the small dams has relatively low levels of PCB contamination (1 to 3 mg/kg). These low concentrations confirm that PCB-contaminated sediments continue to flow down Twelvemile Creek into Hartwell Lake, but the magnitude of this contaminant flux is small.

Although flushing of these impoundments is not currently contributing appreciable quantities of PCB contamination to the Twelvemile Creek Arm of the lake, the release of the equivalent of a half-year's sediment load (or more) during a short time period (typically less than 1 week) has been documented to have potentially significant adverse effects on water quality in the upper portion of the Twelvemile Creek Arm. The influx of sediment in the most recent flushing event (September 1993) was observed to result in a notable fish kill in Twelvemile Creek below the impoundments and in the upper portion of the Twelvemile

Creek Arm. This was attributed to elevated levels of suspended sediments and not PCBs. Similar and possibly more damaging effects to benthic organisms within the upper portion of the reservoir are also likely to occur.

The frequency at which these impoundments are flushed is based primarily on an operations schedule established by the owner/operator rather than hydraulic or other technical constraints. To minimize the negative impacts on water quality, and to facilitate burial of relatively more contaminated sediments downstream, EPA's selected remedy shall include the development of a routine schedule for sluicing of all three impoundments (i.e., Woodside I and II, and Easley-Central Water District). Quarterly flushing of these impoundments is thought to be adequate to minimize the negative impacts.

Preliminary discussions with Consolidated Hydro, Inc., owners/operators of Woodside I and II, have indicated a willingness to comply with this requirement. It is estimated that approximately $200,000 in capital improvements to the gating mechanisms are necessary to fulfill the objectives of this component of EPA's selected remedy. Compliance with the routine schedule shall be monitored by SCDHEC. In addition, water quality and sediment monitoring will be conducted on downstream areas during the sluicing events to facilitate modification of the schedule as needed.

9.5 FIVE YEAR REVIEWS

As required by CERCLA, 5-year reviews will be conducted to ensure that the alternative remains protective of human health and the environment. The results of the annual monitoring studies shall be incorporated into the 5-year reviews. The 5-year reviews shall continue at intervals no less often than 5 years following signature of this ROD until protectiveness has been achieved.

9.6 COST ESTIMATE

Table 9-2 provides a cost breakdown, by component, of Alternative 2A - Institutional Controls. The estimated total present worth cost for EPA's selected remedy is $3,208,000, which includes $366,000 of capital costs.

TABLE 9-2
Cost Estimate for EPA's Selected Remedy, Alternative 2A-Institutional Controls

Remedy Component/ Cost Item		Capital Cost($)	O&M Cost ($/yr.)	O&M Cost ($5/yrs.)	Present Worth Cost($)
Fish Advisory		$4,000	$1,000		$12,000
Public Education			$33,000	$25,000	$314,000
Biota & Sediment Monitoring			$132,000		$1,202,000
Twelvemile Creek Impoundments		$200,000			$200,000
5-Year Reviews				$28,000	$60,000
Subtotal		$204,000	$166,000	$53,000	$1,788,000
Engineering	10%	$20,000	$17,000	$5,000	$179,000
Procurement	5%	$10,000	$8,000	$3,000	$89,000
Construction Management	15%	$31,000	$25,000	$8,000	$268,000
Subtotal		$265,000	$216,000	$69,000	$2,324,000
Indirects/Profit		$40,000	$32,000	$10,000	$349,000
Subtotal		$305,000	$248,000	$79,000	$2,673,000
Contingency	20%	$61,000	$50,000	$16,000	$535,000
TOTAL		$366,000	$298,000	$95,000	$3,208,000

10.0 STATUTORY DETERMINATIONS

This section of the ROD describes how EPA's selected remedy, Alternative 2A - Institutional Controls, meets the statutory requirements as delineated in Section 121 of CERCLA.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The extent to which EPA' selected remedy is protective of human health and the environment is directly dependent upon the effectiveness of the institutional controls that are the principal components of this response action. The reliability of the institutional controls in limiting exposure is difficult to predict due to the significance of site-specific demographic factors governing the likely response of the public to the advisory and other component of this remedy that are designed to limit exposures. Risks posed by the primary exposure pathway, ingestion of PCB contaminated fish, are declining due to natural fate and transport processes, primarily the burial of contaminated sediment. Baseline modeling activities predict that PCB concentrations in largemouth bass fillets would decline to the FDA tolerance limit in approximately 12 years (year 2005).

Effective implementation of the institutional controls described in Section 9.0 of this ROD would limit exposures until PCB contamination dropped to these protective levels. Therefore, this alternative is considered to be adequately protective of human health and the environment.

10.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The only applicable requirement identified for the selected remedy is the contaminant-specific ARAR governing PCB concentrations is fish. Continuation of the existing fish advisory in conjunction with the aggressive public education program addresses the FDA requirement governing consumption of PCB contaminated fish.

No sediment-related, contaminant-specific ARARs were identified. TBC and health-based criteria for sediment were identified in the discussions of ARARs and sediment cleanup goals. Alternative 2A does not attain the TBC or health-based levels directly, but these levels would be attained through natural sedimentation processes in the reservoir. Depending on the area of the Twelvemile Creek Arm, the selected TBC sediment cleanup goal of 1 mg/kg will be attained in a period of 5-10 years.

10.3 COST EFFECTIVENESS

EPA believes this remedy will minimize risks posed to human health and the environment at an estimated cost of $3,208,000. Complexities related to the cycling of PCBs in the aquatic biota of Lake Hartwell cause residual risk levels to remain above acceptable levels regardless of which remedial alternative is implemented. The most effective means to limit exposure to PCB-contaminated fish is by the effective implementation of the primary components of EPA's selected remedy, Alternative 2A - Institutional Controls. Therefore, in terms of risk-reduction for money spent, Alternative 2A is the most cost-effective remedial alternative that was evaluated in detail by EPA.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

EPA has determined and the State of South Carolina has concurred with EPA's determination that the selected remedy represents the maximum extent to which permanent solutions can be utilized in a practicable manner for Operable Unit Two of the Sangamo Site. Engineering controls and treatment technologies did not offer a significant advantage in terms of overall risk reduction for the cost. EPA and the State have determined that the selection of Alternative 2A - Institutional Controls, provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and community acceptance. The selected remedy addresses the primary risk associated with Sangamo OU2, the ingestion of PCB contaminated fish, by the most effective means practicable.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

EPA's selected remedy does not satisfy the preference for treatment as a principal element due to the excessive costs (> $500 million) associated with removal, treatment and disposal of approximately 4.7 million cubic yards of PCB contaminated sediment spread out over approximately 730 acres. Moreover, alternatives that involved aggressive engineering controls to contain, remove, and dispose of PCB contaminated sediment ranged from $30-$50 million without offering a significant advantage in terms of overall risk reduction.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

Pursuant to the requirements of Section 117(b) of CERCLA, this section of the ROD documents and discusses the reasons for significant changes made to the selected remedy from the time the Proposed Plan was released to the public to the final selection of the remedy in this ROD. For reference, the Proposed Plan is attached to this ROD as Appendix C. Specific written and/or oral comments received during the formal 60-day public comment period held from April 11 through June 10, 1994 are discussed in the Responsiveness Summary (Appendix B).

EPA's preferred alternative, as delineated in the Proposed Plan, was Alternative 2B - Fisheries Isolation. In addition to the Institutional Controls under Alternative 2A, Alternative 2B also involved the construction of a fishery isolation barrier ("fish fence") to prohibit the movement of migratory fish into or out of the area of Lake Hartwell with the highest PCB concentrations in sediment. Placement of the fish fence near the Hwy 37 Bridge, just south of Clemson on the Seneca River Arm, would result in isolation of less than 10 percent of the total area of Lake Hartwell. Isolation of these upstream areas was expected to result in accelerated declines in PCB concentrations in migratory fish in the downstream portions of Lake Hartwell (i.e. the remaining 90+ percent of the lake).

The reasons supporting EPA's preference for Alternative 2B were simply: 1) Migratory species represent approximately 50% of the fish harvested by weight from Lake Hartwell. Accelerated reductions of PCB concentrations in these fish, for the majority of Lake Hartwell, would achieve a higher degree of protection by eliminating, or at the very least, minimizing exposures to this group of migratory fish; 2) Reduction in fish PCB levels would allow for rescinding of the existing fish advisories in the areas downstream of the fish fence, in an accelerated time frame, thus returning the majority of Lake Hartwell to its highest beneficial use; 3) The incremental cost to implement Alternative 2B was only approximately $1 million over that of Alternative 2A.

Moderate, yet unwavering public opposition was expressed to EPA's preferred alternative at the Proposed Plan public meeting held in Clemson, SC on April 19, 1994. This and subsequent comments received during the public comment period suggest that the general consensus supports Alternative 2A and/or no-further action. In summary, the reasons supporting public opposition to Alternative 2B were essentially two-fold. First, the public does not believe EPA is capable of designing, constructing and installing a safe fishery isolation barrier that would meet the specified performance standards (See Section 7.3) at the estimated cost. Secondly, given the fact that Institutional Controls provide the most reliable mechanism for reducing exposures to PCB contaminated fish, the incremental cost for constructing a fish fence is not justified.

EPA has given serious consideration to the concerns that were voiced by the public. In response to these concerns, EPA, in close consultation with SCDHEC and the Savannah District Corps of Engineers, has selected Alternative 2A - Institutional Controls as the Final remedial alternative for the Sangamo OU2 Site.

APPENDIX A

5 9 0112

Appendix A

State of South Carolina Concurrence Letter

5 9 0114

South Carolina
DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201

Commissioner: Douglas E. Bryant

Board: Richard E. Jabbour, DDS, Chairman
Robert J. Stripling, Jr., Vice Chairman
Sandra J. Molander, Secretary

William E. Applegate, III,
John H. Burriss
Tony Graham, Jr., MD
John B. Pate, MD

Promoting Health, Protecting the Environment

June 14, 1994

John H. Hankinson, Jr.
Regional Administrator
U.S. EPA, Region IV
345 Courtland Street
Atlanta, GA 30365

RE: Sangamo Operable Unit Two - Record of Decision

Dear Mr. Hankinson:

The Department has reviewed the Record of Decision (ROD) dated May 20, 1994 for the Sangamo Weston, Inc./Twelve Mile Creek/Lake Hartwell PCB Contamination Superfund Site-Operable Unit Two (Sangamo) and concurs with the ROD. In concurring with this ROD, the South Carolina Department of Health and Environmental Control (SCDHEC) does not waive any right or authority it may have under federal or state law. SCDHEC reserves any right and authority it may have to require corrective action in accordance with the South Carolina Hazardous Waste Management Act and the South Carolina Pollution Control Act. These rights include, but are not limited to, the right to ensure that all necessary permits are obtained, all clean-up goals and criteria are met, and to take a separate action in the event clean-up goals and criteria are not met. Nothing in the concurrence shall preclude SCDHEC from exercising any administrative, legal and equitable remedies available to require additional response actions in the event that: (1)(a) previously unknown or undetected conditions arise at the site, or (b) SCDHEC receives additional information not previously available concerning the premises upon which SCDHEC relied in concurring with the selected remedial alternative; and (2) the implementation of the remedial alternative selected in the ROD is no longer protective of public health and the environment.

The State concurs with the selected remediation alternative of Institutional Controls. This alternative involves the continuation of the existing fish consumption advisory on Lake Hartwell, implementation of a public education program to increase awareness of the advisory and methods to prepare fish to reduce the quantity of contaminants consumed, continued monitoring of fish and sediment conditions, and the flushing of the Twelve Mile Creek Impoundments. State concurrence with ROD is based heavily upon the comments received during the public comment period. The majority of these comments supported the selected alternative of Institutional Controls.

5 9 0115

I would like to encourage the EPA to utilize the resources of the Department as much as possible to implement the selected alternative for this site. The State plans to take an active role during the implementation of the Institutional Controls for Sangamo Operable Unit Two.

Sincerely,

R. Lewis Shaw

R. Lewis Shaw, P.E.
Deputy Commissioner
Environmental Quality Control

cc: Hartsill Truesdale
Russell Sherer
Keith Lindler
Gary Stewart
Richard Haynes
Doug Johns, APP. II EQC

APPENDIX B

5 9 0116

Appendix B

Responsiveness Summary

APPENDIX B - RESPONSIVENESS SUMMARY

TABLE OF CONTENTS

1.0 INTRODUCTION

The Responsiveness Summary provides a written summary of significant comments, criticisms and new relevant information that was submitted to EPA during the formal public comment period. The Responsiveness Summary is an integral component of the Record of Decision and the final step of the remedy selection process. This document allows EPA to reassess its initial determination that the preferred alternative provides the best balance of trade-offs by factoring in any new information or points of view expressed by the community during the public comment period. These comments may prompt EPA to modify aspects of the preferred alternative or decide that another alternative provides a more appropriate balance.

A brief background on community involvement at the Sangamo OU2 Site is provided in Section 1.1. A summary of oral comments received during the April 19, 1994 Proposed Plan public meeting in Clemson, South Carolina is presented in Section 1.2. Written comments received from the public during the formal public comment period are summarized in Section 1.3. Section 2.0 of the Responsiveness Summary provides EPA's response and concluding remarks to all public comments received on its Proposed Plan.

1.1 Background of Community Involvement

Since the signing of the ROD for OU1 of the Site in December 1990, community interest and concern about the site has been ongoing and has intensified on occasion. EPA has interacted with local officials, residents, environmental groups and news media representatives.

Community concerns regarding levels of heavy metals in groundwater at some of the OU1 land disposal areas and other issues lead to the issuance of an Explanation of Significant Differences (ESD) in September 1991, and another ESD which was issued in June 1993. EPA held an availability session on May 12, 1992 during the public comment period on the Proposed Consent Decree between EPA and Schlumberger Industries, Inc. (SII) for OU1.

Section 3.0 of the ROD, Highlights of Community Participation, presents highlights of community relations efforts for OU2. In addition to the public meetings, fact sheets and public notices discussed, EPA has had an ongoing dialogue with community groups and residents. Early on in the RI/FS for OU2, numerous calls were received on EPA's 800 number from concerned residents. EPA solicited public input into the work plans that were developed to conduct the investigations for OU2. EPA has also released various documents to the information repositories, and at times documents were mailed directly to interested groups, such as "Toxics Watch", a local environmental group. EPA also responded to concerns regarding PCB contamination in the Easley-Central Water District and a release of sediments from impoundments on Twelvemile Creek which resulted in a fish kill. EPA has provided updates for meetings of groups such as the Lake Hartwell Association.

EPA Superfund Coloring Books have been distributed to many of the Elementary Schools in the area by a local resident. EPA has provided information to numerous high school and college students doing various reports and studies on Lake Hartwell. EPA's community relations efforts were used as a class project by a group of Clemson University students. A group of law students from the University of South Carolina attended the Proposed Plan meeting and presented a report to their class.

EPA also added an additional site information repository location for OU2, the Lake Hartwell Natural Resources Management Center, Hartwell, GA. This was done to provide easier access to information to more of the users of the Lake.

Specific community concerns regarding EPA's preferred alternative are discussed below. Background on community involvement prior to the signing of the ROD for OU1 can be found in the Responsiveness Summary for OU1, dated December 1990.

1.2 Summary of Public Comments Received at April 19, 1994 Proposed Plan Public Meeting

In April 1994, EPA released the Final FS Report and Proposed Plan Fact Sheet to the public. The Proposed Plan Fact Sheet identified EPA's preferred alternative for remedial action and explained the rationale behind that preference. In addition, the Proposed Plan Fact Sheet announced the initiation of the 30-day public comment period from April 11, 1994 through May 11, 1994; and the date, time and location of the Proposed Plan public meeting.

On April 19, 1994, EPA held the Proposed Plan public meeting at the Ramada Inn in Clemson, South Carolina. At this meeting, representatives from EPA, the U.S. Army Corps of Engineers (COE), and the South Carolina Department of Health and Environmental Control (SCDHEC) discussed the various remedial alternatives under consideration and the details of EPA's preferred alternative, Alternative 2B - Fisheries Isolation. The rationale behind EPA's preference for Alternative 2B-Fisheries Isolation, which included the construction of a fish fence to prohibit movement of migratory fish into the impacted Twelvemile Creek Arm of Lake Hartwell, is discussed in the Proposed Plan Fact Sheet attached to the ROD as Appendix C.

Pursuant to the requirements of Section 117 of CERCLA, a verbatim transcript of the Proposed Plan public meeting was kept. This transcript is included as Attachment 1 to this Responsiveness Summary. The reader is referred to the transcript for a detailed account of the public comments received at this meeting. In general, meaningful opposition to EPA's preferred alternative was expressed by many of the approximate 100 citizens in attendance. The consensus seemed to support EPA taking no-further action or at a maximum implementing Alternative 2A - Institutional Controls. The following is a general summary of public concerns regarding construction of the fish fence:

- Overall effectiveness - Public doubted EPA's ability to construct a safe fishery isolation barrier that would prohibit movement of migratory fish while allowing boats to pass unimpeded. This fact is further complicated when considering the fluctuating lake levels and significant volume of boat traffic that passes through that area.

- Excessive accumulation of debris on fish fence.

- Lack of proven experience at other sites of similar nature.

- Potential for cost over-runs associated with construction, operation, and maintenance of an unproven idea.

- Construction of fish fence would decimate fishing above the barrier.

- Overall boating safety concerns.

- Construction of fish fence would actually promote fishing on and around barrier.

- Returning greater than 90% of Lake Hartwell to its highest beneficial use (by construction of fish fence) is actually at the expense of those living on the upper 10% (i.e. inconvenience, property values, etc..).

EPA acknowledged that the concerns regarding the construction of the fish fence were valid, but the Agency believed these were engineering problems that could be solved. It was further explained that if Alternative 2B was selected as the final remedy, a six-month pre-design testing phase would be initiated to identify an effective barrier that would meet the specified performance standards.

The following is a general summary of public comments offered at the meeting that supported no-further action or Alternative 2A - Institutional Controls.

- Carcinogenic risks posed by ingestion of PCB contaminated fish are exaggerated and overly conservative. Furthermore, the likelihood of an individual consuming anywhere from 30-60 meals a year, at 357 grams per meal for 30 years is improbable.

- Risk posed by eating fish caught from Lake Hartwell is strictly voluntary similar to cigarette smoking. For example, people continue to smoke cigarettes in light of all the documented evidence supporting adverse health effects.

- Risks remain "unacceptable" regardless of which remedy is selected. In light of this fact, time is the best solution by allowing nature to run its course.

- The money slated for this project could be spent on more beneficial purposes such as health care, immunizations, and education.

These comments were acknowledged by EPA and addressed specifically as required during the course of the meeting.

1.3 Summary of Written Comments Received During Formal Comment Period

During the April 19, 1994 public meeting, a request was made for a 30-day extension to the formal public comment period. Pursuant to Section 300.430 (f)(3)(i)(C) of the NCP, EPA extended the public comment period to June 10, 1994, for a total of 60 days. During this time period, EPA received approximately 45 written comments, one of which included a petition with 42 signatures, on EPA's preferred alternative. Almost all of the comments received, including the petition, expressed adamant dissatisfaction with Alternative 2B - Fisheries Isolation, and fully supported no-further action or implementation of Alternative 2A - Institutional Controls. Two individuals expressed support for the more aggressive engineering components of Alternatives 3A/3B/3C/4.

Copies of all written comments received during the 60-day comment period are included with this Responsiveness Summary as Attachment 2. All written comments submitted during this time expressed themes very similar to those communicated at the Proposed Plan public meeting. The most frequently occurring criticisms included: The fish fence is an unproven, experimental design with no documented success in the field; PCBs pose a minimal risk if any and EPA has exaggerated risks posed by ingestion of PCB contaminated fish by employing unrealistic exposure assumptions; the additional money needed to construct the fish fence is an example of government waste of taxpayer money; and EPA has more urgent problems to address with its limited resources. However, most individuals did express strong support for an aggressive public education program, continued monitoring, and continuance of the fish advisory, all of which are components of Alternative 2A - Institutional Controls.

In addition to comments received from members of the general public, comments were received from SII, responsible party for the Sangamo OU1 Site. SII's comments on EPA's Proposed Plan, the Remedial Investigation Report, and the Final Feasibility Study were presented in a lengthy deliverable dated June 9, 1994. SII's comments have been recognized and placed in the Administrative Record for the Sangamo OU2 Site. In this document, SII states, "that Alternative 2A (Institutional Controls) clearly represents the best balance of National Contingency Plan (NCP) remedy selection criteria at this site relative to the other alternatives evaluated by EPA". Furthermore, SII offers the following criticisms of EPA's preferred alternative:

- There is a substantial body of evidence that PCBs in fish in the Twelvemile Creek Arm will rapidly decline to levels below 2 mg/kg within 4 or 5 years.
- The fish fence, if needed at all, may be located too far downstream.
- The time to achieve protectiveness in the Twelvemile Creek Arm is not decreased by this remedy over no-action.
- The fish fence is not a proven technology.
- The fish fence will be subject to damage or failure due to debris carried downstream during storm events.
- The fish fence would disrupt boating activities in this area of the lake.
- The fish fence could present a danger to boat operators.
- The community is opposed to the fish fence.

2.0 CONCLUSION

Community and State of South Carolina acceptancé are modifying criteria that are considered in the remedy selection process. EPA has given serious consideration to all comments received, written and oral, during the 60-day public comment period, and has consulted with the State of South Carolina. Based on these considerations, EPA has determined that Alternative 2A - Institutional Controls provides a more appropriate balance between the remedy selection criteria, particularly the modifying criteria.

The most effective means to limit human exposure to PCB-contaminated fish is by effective implementation of the primary components of Alternative 2A - Institutional Controls. Therefore, Alternative 2A is the most cost-effective in terms of risk reduction for money spent. Alternative 2A is adequately protective of human health and the environment and complies with ARARs, thus satisfying the threshold criteria. Based upon these considerations, EPA has selected Alternative 2A - Institutional Controls as the final remedial alternative for the Sangamo OU2 Site.

ATTACHMENT 1

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5 9 0125

U.S. EPA REGION IV

PROPOSED PLAN PUBLIC HEARING

for the

SANGAMO WESTON, INC./TWELVE MILE CREEK/

LAKE HARTWELL PCB CONTAMINATION SUPERFUND SITE

OPERABLE UNIT TWO

PICKENS, SOUTH CAROLINA

APRIL 19, 1994

7:00 P.M.

RAMADA INN

CLEMSON, SOUTH CAROLINA

Deborah Garrison
Court Reporter
245-D East Broad Street
Greenville, S.C. 29601
(803) 244-0973

BY CYNTHIA PEURIFOY:

Good evening everybody. My name is Cynthia Peurifoy and I'm the Community Relations Coordinator for EPA.

On behalf of EPA, the U.S. Army Corps of Engineers and the South Carolina Department of Health & Environmental Control, I would like to welcome you here this evening.

We are here tonight to conduct a proposed Plan B for the Sangamo site, Operable Unit Two.

Before Craig Zeller comes up and gets started, I want to cover a few things with you.

We have tonight Ms. Deborah Garrison, our court reporter. I would like to ask that when you speak up or ask a question or whatever that you identify yourself, make sure that she can hear what you're saying. We are recording this in order to provide a transcript that we will use to prepare our Responsiveness Summary for this project.

I want to bring your attention to the fact that the comment period ends on May 11th. However, that can be extended for an additional thirty days if we receive a request for extension.

I am sure that you all have got the fact sheets and know that we have five locations where you can go and look at the records which is a compilation of the all the documents that we used to make the proposal that we are supposed to be discussing here tonight.

One other thing, I know that you know that we're part of the Superfund Program. Right now the Superfund Program is up for reauthorization. So I would like to encourage you to get involved in that process. Look at some of the things that are being proposed, particularly important is Community Relations, and let us know what you think about that or let your congress-person know what you think about that.

With that, I want to turn it over to Mr. Craig (Zeller) who is the EPA Program Manager for Operable Unit Two of the Sangamo Site.

BY MR. ZELLER:

Thank you, Cynthia.

If you'all can't hear me tonight, just ask me to speak up. I don't normally have a problem with voice projection, but -- (pause).

As Cynthia mentioned, I am the Project Manager of the EPA office in Atlanta, the regional office there.

Myself and Mike Alexander, who is a District Fisheries Biologist with the Corps of Engineers, will be kind of going back and forth tonight.

There's a lot of information to cover. We have fifty-some slides. I will try to -- Mike and I will try to get through the slides in, say, less than an hour, hopefully; so that we don't sit up here and drone on and on and on.

We're really here to hear what you all have to say about our preferred alternative tonight. This is a very important part of the process, one that I always look forward to.

It is very easy for Government officials to make decisions in a government office sometimes two hundred miles away. It is you folks that have to live in this community. It is indeed a very nice community.

And we hope that by the end of this meeting that you'll be familiar with our preferred alternative, and we hope to get it implemented shortly.

A lot of these over-heads or a lot of these slides may be hard to read. If you pick up one of these fact sheets that are at the front table, a lot of the Figures that will be referred to are sort of summarized in there. If you have problems seeing something or if there is anything that you don't understand, just let us know.

At the very end we'll have hopefully about an hour or more for questions and answers. We'll stay around here as long as you'all have questions.

Just a little bit about what we're going to be talking about tonight. We're going to go over the remedial investigation findings. We initiated a remedial investigation for the Sangamo site back in late '90 or 1991, early 1991.

It consists of sediment biological components, and we're going to talk about the sediments really quickly, how the biological investigation was conducted.

I will go into the baseline risk assessment, what all this PCB contamination means to you and the ecology.

We'll talk a little bit about the remedial action objections which were used to develop a series of remedial alternatives to address the PCB contamination in the watershed; and summarize those alternatives. As you can see, we have approximately seven or eight alternatives that were looked at in detail. Each were given equal consideration.

We will spend most of our time on EPA's preferred alternative, which is called Alternative 2B. It is called "Fisheries Isolation".

As most of you know, it consists of -- along with other institutional controls, it is public education and then continued monitoring and also includes the construction of a fishery isolation barrier near the Highway 37 bridge area. The main purpose of that barrier would be to keep migratory fish from moving into and out of the impacted area of the lake.

From there, I am going to turn it over to Dick Austin, who is the Resource Manager for Lake Hartwell. He wanted to offer you his perspective and how the Corps feels about EPA's preferred alternative.

I want to give Bernie Hayes, who is also an EPA Regional Project Manager for the Operable Unit One. OU1 will refer to the source areas or the land-based areas. There are satellite disposal areas and that -- that cleanup is currently underway and I wanted to let Bernie have a few minutes to summarize what has been happening there recently.

Then at that point in time we will stop doing the talking and I will turn it over to you folks for questions and answers.

Lake Hartwell is a 56,000-acre impoundment created by the Corps of Engineers in 1955 to 1963 through the gathering of the Seneca, Tugaloo and Keowee Rivers. It has approximately a thousand miles of shoreline. It was a fairly major undertaking when we took off on this investigation.

The area that we primarily focused on for this operable unit, Operable Unit Two, has been the downstream migration pathways from the satellite disposal areas.

Sangamo Weston operated a capacitor manufacturing plant nears Pickens, South Carolina, on Town Creek. Town Creek is a small tributary to Twelve Mile Creek. Twelve Mile Creek flows approximately fif-teen miles before it reaches the actual headwaters of the lake itself and dumps into the Twelve Mile Creek arm of the lake.

This area represents about fifteen miles down through the study area. (Indicating slide), here you can see the six satellite disposal areas.

Sangamo Weston, from the period of 1955 to 1977, manufactured capacitors. In the manufacture of the capacitors, a dielectric fluid was used which con-tained polychlorinated biphenyls, or "PCBs".

Sangamo disposed of its waste primarily two ways. Their solid waste consisted of off-specification capacitors, the wastewater treatment sludge and the solid-type stuff was buried or disposed of either on the plant site itself or in six satellite disposal areas. That investigation and subsequent cleanup has been done by Operable Unit One.

The primary focus of this investigation has been to evaluate the downstream migration pathways, primarily the sediment, the surface water and the aquatic biota -- fish and all the little creatures that dwell in the sediment, little fish and what-have-you.

(Next slide): Here is just a brief summary of the Sangamo Weston operations. As I mentioned, PCBs were used from 1955 to 1977, prior to an EPA ban on their use in January of 1978.

(Next slide): This is an estimate of PCBs that were received at the Sangamo Weston plant. On top, they used primarily three different arochlors or three different mixtures of PCBs. The bottom figure shows you the cumulative discharge that we have estimated entered the Twelve Mile Creek system over the lifetime of their operation. It is estimated based on purchasing orders of Sangamo during this time that approximately 400,000 pounds of PCBs entered the Twelve Mile Creek system.

(Next slide): This is a slide that shows the PCB distribution in the surface sediment of the study area.

Let me back up here real quick (returning to previous slide showing Sangamo Study Area). Something that would be helpful for you'all -- when I talk about -- when we talk about the summary of contamination, there are certain landmarks that we have used in trying to ease the explanation.

The first one is -- as you come to the Twelve Mile Creek watershed, the first notable features you come to are three small hydroelectric impoundments. The first one is used by Easley-Central Water District for a water reservoir. They actually draw their water for treatment and distribution for the Easley-Central system. The next two are small hydroelectrical impoundments owned by a small firm in Greenville, South Carolina. They do generate some electricity.

From there we go to what we are calling Maw Bridge, which is the Highway 337 bridge.

The next bridge down is Madden bridge, the (Route) 15 bridge.

Following, the next bridge downstream is the (Highway) 133 bridge.

Then we get to the Keowee confluence where the Twelve Mile Creek arm meets the Keowee Arm. Right there is basically where we are standing tonight, near the Highway 123 bridge.

As you move south, again you drop to the (Highway) 93 bridge.

Then finally the South Carolina Route 37 bridge; which, for all particular purposes, represents the downstream migration of PCB-contaminated sediment.

Let me move forward here, back to what we were discussing.

Getting back to the surface sediments of this area, I think the primary thing you all need to grasp from this slide is that on the surface, the upper fifteen centimeters of sediment, about this much (hand gesture), you can see that the average concentrations, as you move through that ten-mile reach are, most of the time, under four parts per million. Not real high concentration when compared with some other PCB sites across the nation.

Another notable feature of this graphic is that there seems to be a slight bell curve, that the higher concentrations are found between Maw and Madden bridges, the 337 and the 15 bridge. That's where we are seeing high levels of deposition in the sediment. Historically that is where the PCBs tend to fall out. You're getting into more of a lake-type environment there, velocity in the reservoir drops and therefore the majority of the sediment coming into the impoundment begins to be deposited there. That's why we are finding, historically, the higher concentration of the PCBs in the sediments there.

(Next slide): Here is a -- we call it a "sandwich figure." What this does is that it has broken up the same area again, basically stretching from the headwaters of the lake to Maw Bridge to the Highway 37 bridge at the southernmost end of the site. It has been broken into four intervals:

0 to 15 centimeters,

15 to 30 centimeters,

30 to 45 centimeters, and

greater than 45 centimeters.

When we were conducting our sediment investigation, we took not only surface samples but we also took in sediment core samples, that went down to try to get an idea of not only the horizontal extent of the contamination in the sediment but also the vertical extent. What we are seeing here, and it is not a great surprise, is that the higher concentration are deeper.

If you take a core fifty centimeters in depth, the deeper sediments -- the sediments down there at the fifty centimeter range are sediments that were deposited, say, in 1950 and 1960. That would have been when Sangamo was in the heyday of their operation and you'd expect to see the higher concentrations there.

As you move up through the sediments to the surface, as I mentioned, most of the concentration, on the average, as you can see by this slide, were one to five parts per million.

The yellow represents one to five parts per million. The green area then is under a part per million, essentially the nondetect area.

What you can see, and the primary thing that you need to grab from this, again the high concentration in the deeper sediment are between the Maw and Madden bridges; clearly high up in the system.

From there -- that basically summarizes, real quick, what we found from the sediment investigation.

Another very important part of this investigation was the biological and I will let Mike Alexander summarize those results.

BY MR. ALEXANDER:

Since we have so much to go through, I will try to shorten this as much as possible, and just get to the important parts.

(Next slide): Basically I drew a diagram of Twelve Mile Creek rather than -- and some of you have seen this diagram before. This summarizes the contamination found up in the creek itself.

You can see that up above, this is where -- this is where the plant site would be (indicating). There is a small dam located on Twelve Mile Creek (indicating Section 4). It is upstream from where Town Creek comes in. Those values are .0, .1, things of that nature up in that area.

Then upstream of the plant here, they are very low, PCBs, parts per million.

But downgradient of the (indicating plant on slide) -- the values tend to be higher. And of course we were looking to see at that time what the concentration of PCBs were in fish in the stream, and we were also trying to see if we could determine and see if PCBs were affecting the health of fish.

This investigation started off not only looking at the human health risk but also how it affected the environment itself or the fish populations.

To kind of summarize some of the things that we did to try to determine how it affected the fish population, we did something called an IBI, Index of Body Integrity. Basically what that is is that you collect a sample of fish at a site and you compare it to what you expected to collect at that site. That expectation is based on samples that would be collected in eco-regions. What you're looking for is certain numbers of predators, certain numbers of fish that would feed on the benthic organisms, things of that nature, and you come up with an index score.

Within the study area, the tributaries all fell out fair to good on the IBI index. Downstream, Site 5 was the lowest and it was "poor", considered poor.

We also did the benthic macroinvertebrates indexes and -- that was looking at the invertebrate population to see if they were what we would expect. Most of them came out in tributaries to be moderately impaired. In the Twelve Mile Creek, at Site 5, downgradient of Town Creek, it had the lowest score -- 15.

We also did what we call an HAI, a Health Assessment Index, where we -- it is an autopsy-based index to look and see if the fish is unhealthy by looking at the various anomalies and organs and things of that nature. What we saw from that was that the mean value for all our sites was 49, with a range in the tributaries of 39 to 62. The range within Twelve Mile Creek was quite similar, with a mean of 51. So our Health Assessment Index didn't show any difference in the health of fish in Twelve Mile Creek downgradient of the site or in the tributaries.

Again, the graph that I showed you, the PCBs were particularly lower in the tributaries and upstream and a little bit higher in Twelve Mile Creek itself. You know, we interpreted this that there was still some PCBs coming off the plant site or out of Town Creek itself; and our understanding is that that probably is the case.

We also used some corbicula baskets where we put clean corbicula -- that's a little freshwater clam -- in baskets. We collected them from a site where there was no PCBs, we tested samples of those, and then we put them in there and left them for twenty-eight days. They accumulated PCBs downgradient of the site. So there were some PCBs coming off the site. I think that all of those problems have been identified and they're working on remedying those problems. I don't think that they're involved in this investigation anymore, particularly.

The sediments up in the streams, we couldn't find lots of PCBs in the sediments themselves. Mostly just in the aquatic biotas.

But what this -- after we got to looking at all this and trying to evaluate it, I felt more like a medical doctor trying to figure out what our problem was. It was obvious from looking at IBI samples that the fish population had been impacted by man. They were not what you would expect in a stream in that particular area. They weren't terrible, but they were not what you would expect. But then when you look at the Health Assessment Index and also some of the work that Oak Ridge National Lab did for us looking at bio indicators of health of fish, those did not show that there were problems that particularly would be caused by a contaminate, per se, in that these values were similar in tributaries and in the stream itself. And the bio indicator enzymes, they are typically elevated when a fish takes up contaminates in its body. Things that affect the liver and that affect the gills, stuff like that, were not particularly evident in the Twelve Mile Creek drainage.

So, therefore, kind of like a doctor asking you 'Where does it hurt?' or 'How do you feel?', takes your temperature and then comes to some conclusion, using that rationale, I think that PCBs, at best, in the Twelve Mile Creek drainage probably only contributed to any impairment of the fish population and that there's lot of other things impacting the fish up there.

It is quite easy to see, because the heavy sedimentation comes down the stream and the sedimentation in that stream would affect those fish populations.

So I cannot say that we collected information to show that the health of fish in Twelve Mile Creek is affected by the PCBs.

Now, down in the lake, we collected at sites all over the lake. These big red dots (indicating slide displayed), this is of course in the Twelve Mile Creek embankment; then Martins Creek (indicating); Eighteen Mile Creek; down around Andersonville Island, at the dam, and over on Tugaloo River. We have collected these sites for lots of years. All along, DHEC has collected and they have historic information, plus what we have collected. At these sites too, we also did some of the work

that we did up in the streams.
Now, IBI's can't be done in reservoirs because reservoirs are a fairly unnatural ecosystem, so it's hard to say what really should be there.
But we did do the health assessment indexes and the bio indicator work at these sites. Consistently when we did this the Health Assessment Index, the most contaminated area would always have a high score and it would decrease as you moved farther from the site. Also the bio indicator work indicated that the fish were being affected by something. And since we -- we collected sixty specimens the first year that we sampled and ran them through a private pollutant list of approximately a hundred and forty-some different chemicals. We didn't find anything other than PCBs that was of concern, so we assumed that these effects on the liver and the gills and things like that was caused by PCBs in the fishes' bodies.
Now, to try to find out what does that mean to the fish population out there, and the health of the population, we looked at the age and growth information from various sites around the impoundment.
Up in this area, some studies that we did in 1990 with Oak Ridge, EPA and several agencies, we saw

where there were elevated levels of enzymes that affected the liver. There were problems with the gills of the fish themselves. This things coupled with information to show that we had chronic mortality in older-aged fish led us to believe that PCBs were affecting those fish to the point that there was death in the population when they became old.

Now, that was over a very small area of the whole impoundment, probably no more than a thousand acres out of the 55,000 acres.

Then when you got out of that area, it didn't appear to be as severe.

During these investigations during 1990, '91 and '92, -- we went back and redid some of this, the PCB levels in the fish flesh had decreased from around fourteen parts per million down to around five parts per million. When we looked at those same enzymes and tried to determine whether it had affected the fish population again, we also repeated our age and growth information, we could see that the growth of the fish seemed to be somewhat slowed up in this area but that there were overaged fish in the population and that there was not any climb in mortality that was present. What my conclusion was then is that basically if you have PCBs up in the range of fifteen, twenty or thirty parts per million, then certainly I would expect it to begin to affect fish health to the point that you'd probably start losing over-age fish, fish that had bowel concentration over a time and it was actually starting affecting body function.

Whenever the PCBs levels are down in the range within the flesh of five parts per million, like it is now, I think that it does affect fish. But it's probably like us when we have cholesterol in the bloodstream as we get older. Maybe we don't run quite as fast and breathe quite as well, but we still live and we're doing all right. I don't think that the population of fish is affected at those low levels of examination.

So, really, I kind of surmised that anything that was going on the past seems to be rectifying itself and, at this point, similar to some of the sediment information that has begun to rectify itself as far as the actual cause of death in the fish population.

Now, this is what the contaminate levels were in the fish in the past few years, 1990, '91, '92 and '93.

Now, some of the work that we did on the bio indicator work back in 1990, we actually had fish that had values that were much higher than the fourteen parts per million that you see on the screen. That's because whenever we present this information, this is based on a sample, that we always select fish that is between one and a half to three pounds, so that we can compare apples to apples every year; for human health consumption advisories and stuff.

When we were doing that other work, we did have some larger and older-aged fish to try to pick up those health problems as the fish age and stuff. But the important part in this is, I guess, that in largemouth bass that there has been a decrease in the Twelve Mile Creek embankment in the past couple of years. We don't know for sure that that will consistently stay that way. We have had some ups and down, historically. But the general trend of having the most contaminated fish in the Twelve Mile Creek embankment decreasing has been consistent from 1977, when they began collecting samples up there, until present. That's the way that it really is.

Once you move out of the Twelve Mile Creek embankment, away from Clemson and further downstream, the problem is not as severe.

With channel catfish, basically you see exactly the same pattern.

But this is -- this is one of our main problems right here, the hybrids. Hybrid bass. You can see that at two parts per million that on those years, throughout Hartwell Lake, all 55,000 acres of it, that hybrid bass remained well above two parts per million. That's been our big concern and that's really why we have come to the conclusion of the particular remedy that we are proposing.

I will let Craig get into this risk assessment. That is the part that he gets heat from.

BY MR. ZELLER:

That was very, very interesting information. I think that the important thing that you all need to draw from that is that in the sediments, in the creek itself, the drainage itself, it appears that the system is cleaning itself out. There is a lot of velocity in there, there is a lot of sediment that is being carried into the reservoir itself. We just could not find, duplicate -- the results duplicate themselves very well as far as the sediment trend. Okay? But we did see residual levels in the fish and aquatic biota.

It was important to note that we traced, essentially "fingerprinted", those PCBs all the way up to the discharge point on Town Creek.

There were some discussions early-on as to whether there were any other sources of contamination besides Sangamo. We looked at it and it is our conclusion is that Sangamo is the sole source of PCB contamination into Twelve Mile Creek and into Lake Hartwell. That was confirmed by some information that Mike collected, as well as the sediments.

This gets into the other end of the remedial investigation, besides the actual data collection of the sediments and the fish; then it come to an assessment of what this means to human health and to ecological health. This is where we get into the risk assessment that was conducted. As I mentioned, we looked at both human health and eco health.

(Next slide): On the human health side, you're looking at carcinogenic and noncarcinogenic risks. I'll talk about carcinogenic first. The were three exposure pathways that were evaluated here, based on completed exposure pathways. The first one was an ingestion of PCBs and sediments. We wanted to evaluate if people are actually wading, possibly ingesting sediment in the watershed itself while they're playing around out there in the beach areas and that type of thing. Also through dermal contact associated with PCBs in the sediment. Then lastly, which we guessed was going to be the primary exposure pathway, and it turned out we were right, was the ingestion of PCBs that had to do with humans eating the fish. That was evaluated for the six different stations that Mike referred to earlier.

Talking about carcinogenic risk, EPA has split up carcinogenic risk based on six classifications, ranging from "A" to "E".

"A" would be a known human carcinogen.

"E" would be there are no carcinogens.

PCBs are Class B2 carcinogenic, meaning that there is sufficient evidence of carcinogenisity based on animal studies. We haven't went to great lengths to prove cancer-causing agents PCBs on humans. We have sufficient evidence from rat studies and what-have-you to say that they are carcinogens.

This is where it gets confusing. If any of you are unclear on this, stop me and we will get it straightened up right away. It's taken me years to understand it myself.

EPA's protected risk range, as mandated by Congress, is 'EPA, you will protect human health population due to hazard constituents in the environment.' Now, the risk range that we have defined as "protective" is what we call one times ten in the minus four or one times ten in the minus six. If it falls within that range, it is what we called "acceptable risk". What that looks like in decimal form is one in ten thousand or one in one million (indicating chart). Meaning that you're under the specific exposure assumption for this site, that your incremental chance of developing cancer is that it falls between a one in ten thousand, and one in one million, chance of developing cancer from the exposure at this site. That's "acceptable."

Now, if it falls in, say, the one in one hundred of that range, or one in ten, that is defined as "unacceptable"; and, 'EPA, you must do something to address that unacceptable risk.'

Now, it is important to note that the baseline risk of developing cancer is that one in three people in this room have a chance of developing cancer over their lifetime. When you look at the human health summary from this site, the risk associated with direct contact and incidental ingestation of the sediment were in the "acceptable" range. There would be no adverse affects associated with dermal contact or incidental ingesting of sediment.

It should be noted, however, that sediment is an existing contribution to the problems in the fish. We know that these fish are picking up the sediment. We have fish linked to PCBs all the way up through the food chain, from the sediment dwellers to the small fish to the big fish. So they pose no risk on the human health side, we pose the risk when we eat the fish. The risk associated with the ingesting of fish is, as we expected to find, "unacceptable." That is not in the "acceptable risk" range.

We looked at the range posed at the ingesting of fish at the six different stations and by a combination of different fish. We looked at the possibility of exclusively consuming largemouth bass, and we looked at the possible risk of people consuming all types of fish in Lake Hartwell from different locations. We considered -- say you fish in the Tugaloo arm and then you move your boat up into the Twelve Mile Creek arm. We wanted to get an idea of what that risk was.

These risk assumptions are based on a creel survey that was conducted during the calendar year 1992. What I mean by a "creel survey", we actually had people deployed in the field, roving. They had clipboards and a list of questions, like ten or fifteen questions, that had all kinds of questions such as:

"Do you eat the fish that you catch in the lake?"

"What area of the lake do you fish the most?"

"How much fish do you eat in a meal, if you eat fish?"

That type of thing.

So the assumptions here were not just pulling figures out of the air. They are actually based on the activities of the resource users.

In summary, what we found is that the incremental risk for eating largemouth bass from the Twelve Mile Creek watershed was four times ten in the minus two or .04, meaning that the percentage increase now from your baseline of .30 has gone up to a thirty-four percent chance under the exposure conditions for this site; or the chances for developing cancer are now thirty-four percent as opposed to thirty.

Likewise, for all fish species in the Twelve Mile Creek arm, the risk was defined as one times ten to the minus two; or, now, your risk has gone up to thirty-one percent.

For all fish species lakewide, you're seeing -- you're working with the cleaner fish with the contaminated fish and the risk is much lower. Yet it is still "unacceptable".

Those are the rules that EPA has to operate within and we were told, by the law that we operate under, that, 'This is unacceptable, EPA. You must develop remedial alternatives to address this contamination.'

We also looked at noncarcinogenic risks, based on existing research out there conducted by epidemilogists. They developed exposure estimates. Exposure estimates were developed from the exposure conditions for the site, based on reference to the existing data that says that 'If you're exposed to a certain amount of this contaminate, PCB contaminate, that you're likely to see this type effect in humans.' The net -- your end result is what they call a "hazard quotient." If your hazard quotient is greater then one, it suggests adverse human health impact are expected from PCBs on this site.

All of our hazard quotients are greater than one. It is important to note from the noncarcinogenic factor that this pertains to reproduction. These risks to do not pertain to children or males, primarily only to females.

The ecological risk assessment then looked at the PCB contamination in all types of aquatic food web. As Mike mentioned earlier, we collected drift-net samples and set out freshwater clams, collected plankton floating around in the water itself that fish would feed on. We looked at mayflies that actually burrow into the first upper six inches of sediment in the lake and then they hatch out and do their thing. We also looked at fish. It is important to note that PCB contamination was detected in all levels of the food web.

As Mike said, we sat out corbicula samples, freshwater clams, for a short period of time, twenty-eight days, in that watershed. Over that short period of time they accumulated less than a part per million contaminate per sample, PCBs. Meaning that there still is some transport mechanism going on there.

Then, again, like Mike said, to summarize, at the current levels of contamination, approximately five parts per million, we don't see an impact from the healthier population life. Fish tend to live with the existing concentration and they tend to do okay. But the caveat is the fact that they go up, and the previous studies in 1990, suggest that there is an impact on the population.

Which kind of leads us to the conclusion of the remedial action objectives.

We have unacceptable risk by the consumption of PCB-contaminated fish. So we had to develop some objective to say, 'Okay, we need to develop some alternatives here. What is it that we're trying to achieve with these alternatives?'

First and foremost, before we do anything else, we've got to stop all existing discharges of PCB to the environment. Okay?

Under the cleanup that is going on under OU1, and some other State action associated with discharge of PCBs into the system, we feel that this first objective is going to be satisfied. It is currently being addressed. By 1995, early, a new water system is being installed up at the plant, which is being leased by Sangamo -- it is being leased by Sangamo Weston to Schlumberger -- and that all charges or discharges to the environment should cease. So we've satisfied that objective.

Now, the other three develop the basis for our alternatives. The first one being, 'All right, let's minimize the exposure to contaminated fish. That's our primary human health exposure, hopefully let's stop it.' As of right now, there is a current existing public advisory that says, "Please Don't Eat the Fish, they are contaminated with PCBs." We want to do more. We want to see if there is anything else that we can do, engineering-type controls, that will help that.

Secondly, we want to control any downstream migration of the contaminated fish. Sediment sampling suggests that the sediment does move farther into the impoundment over time. We would like to keep that as narrow as possible.

Then, lastly, we want to limit the transfer of PCBs from the sediments to the biota. As I mentioned, the sediments are a continuing source of contamination in the fish. Let's see if we can stop that transport mechanism.

In developing these alternatives, we routinely -- we are mandated by law to run these through seven evaluation criteria, the first seven that you see here (indicating slide):

Short-term effectiveness.

Implementation.

Is it going to be accepted in the community?

Workers installing it?

Will it cause adverse health effects?

Long-term effectiveness. Will this thing work over a long term? Is it going to be active for five years and then all of a sudden fail. We don't want that to happen.

Reduction in the toxicity or mobility of the volume of these contaminates. Will it reduce the mobility, keep it in one place and make the situation better?

And the next one is implementability. Can it be done? There are a lot of things out there that are kind of conceptual in nature, but can they we done from the administrative and technical aspects.

Cost is of an obvious consideration to us. We don't want to go out and spend a billion dollars in rectifying this problem. We suggest at that point in time that the remedy would be cost prohibitive and that the benefits are not worth the cost of this alternative.

Another criteria that we call compliance with ARARs, meaning that applicable standards of CERCLA must be complied with during the implementation of this remedy.

And then last, most importantly, is zero health risk to human health and environment. Does this remedy provide for adequate protection for human health and the environment?

Then the two final criteria we call "modifying criteria" would be -- currently that is why we are here tonight, is the remedy State and community acceptable?

We have worked closely with the State regulatory agency, in this case the Department of Health & Environmental Control. We want to know what they think. 'Do you agree with EPA or do you have another idea that you think you prefer better?'

We are currently talking with them and at this point in time we feel very strongly that we concur with EPA, but they want to wait and see what you-'all think; which is one of our criteria, community acceptance.

This is your community. You have to live here. Do you think this is a good plan? Do you think that there is another alternative that is better? That is why we are here. And at the end of this presentation, we hope to hear from you.

Which gets into the "No Action" alternative. As I mentioned, this is a current fish advisory on the lake. This advisory is posted at the majority of the recreational and boat launch areas on the lake itself. It is a three-part advisory:

The first part says, "All fish taken from the Seneca River on of Lake Hartwell, north of South Carolina I-24 (sic) should be released and not eaten due to the presence of PCBs in fish."

"Any fish larger than three pounds taken from the remainder of Lake Hartwell should be released and not eaten." Again, that part of the advisory is primarily triggered by the presence of PCBs in hybrid bass. As I mentioned, hybrid bass are migratory in nature. They tend to move over their lifetime. Those fish have concentration that are above the Food & Drug Administration required tolerance level of two parts per million.

Then, lastly, it says "Fishing is not prohibited. This advisory does not pertain to boating, water skiing and other type uses of the lake."

Under this alternative, called the "No Action" alternative, no further action would be conducted. The estimated cost for this, as summarized in your fact sheet, is approximately $130,000.

That estimate was based on maintaining the advisory, posting signs and maintenance from vandalism and that type of thing. We expect to maintain this advisory for as long as the fish have concentrations over the recommended level, which would be approximately twelve years. That is where that cost comes from.

Under the "No Action" alternative -- the Lake Hartwell system is very dynamic. Changes are expected under the "No Action" alternative. One of the methods and tools that we utilize to try and quantify these changes was looking at existing sediment deposition patterns. As Mike mentioned, there is a lot of sediment coming in from the Twelve Mile Creek and we wanted to see how much would this sediment cover up the existing PCB-contaminated sediment. In effect, it would solve our problem for us. If we want to limit the transfer of PCBs in the sediment to the fish, what better way to do it than to have cleaner sediment to cover up that problem for us?

What we have found is essentially three different regimes of sediment deposition in this watershed. Above the Maw bridge, velocities are still very high. It is kind of what we call a river rain type environment where all the sediment is carried at the river's carrying capacity. There is very little deposition in that area, whatsoever. In fact, there is a little bit of scour; meaning that all of the sediment is being carried further into the reservoir.

Now, between Maw bridge and the Highway 133 bridge, is what we call the depositional environment. That is where the majority of the load, sediment load, coming into the watershed is deposited. All of your bigger -- your velocities drop and, therefore, it is creating a settling -- the velocity is amendable to a lot of deposition of the sediment.

We're predicting over a thirty-year period of time in this area, particularly this "dog leg" area, or the "goose neck" between Maw bridge and that bridge (indicating the Highway 133 bridge) -- we're predicting a ten-foot accumulation of sediment over there over a thirty-year period. That's a lot of sediment. That stuff is kind of forming a "delta", if you will, and moving into the impoundment over time.

Now, below the 133 bridge, most of the sediment is deposited. And, therefore, we're seeing a reduced depositional rate on the order of one to two centimeters per year. That is reflected here in the green and blue areas (indicating on slide). That deposit is into finer clay and silt and, therefore, you'd not getting the large accumulation of the sediment.

We also looked at future trends in sediment and how they would increase or decrease, and we predicted a decrease in sediments over -- sediment concentrations on the surface -- the thirty-year period. Across the 123 bridge, approximately, before you get to the Keowee River arm, we expect concentrations to drop below a part per million in about ten years.

When you get into the Keowee arm, there is a lot of water coming in there and we are still getting some deposition.

We actually expect the concentration in the sediment to increase a little bit right before the Highway 37 bridge. That's due to the fact that the Highway 37 bridge is a natural constriction in the channel there, which was the former Seneca channel. It is approximately five hundred feet in width there and you're getting some settling there; so we're seeing some finer silt and stuff fall out there.

Anyhow, if you're having decreases in sediment, you expect a decrease in the fish concentration (sic) as well.

This would be the jumping off point for the next exercise which we looked at, the food chain accumulation over a thirty-year period of time. We constructed a representative food web that consists of sediment dwellers, smaller species, small fish that the big predators eat, and then finally the large keepers or game fish that would be ultimately consumed by humans. We predict that in twelve years the concentration in largemouth bass for the older species, the ten-year-old species, to drop below FDA's recommended safe tolerance limits of 2 ppm. That is in twelve years.

Under the "No Action" alternative, we expect these things to drop to the FDA permitted limits in twelve years. That means that we pack up our books and we walk out of here right now.

That is the baseline condition, but we want to do better than that. Can we do better? Is it possible?

Then we look at the implementability. But that is the "No Action" alternative. That is if we do nothing, then that's the baseline condition. We can get back to that and talk about that later if you want to.

We go then more into the institutional control. The first alternative that we looked at is what we call Alternative 2A, Institutional Controls. It consists of methods to decrease the consumption of fish contaminated with PCBs. We would accomplish that in basically three ways.

One is the public education program. We have some existing literature out there -- it has been done in the New England area, on the Great Lakes, -- that suggests proper preparation techniques in cooking fish can greatly reduce the contamination risk by humans. Such as, PCBs have a tendency to accumulate in the fatty portions of the fish. Therefore, you trim away these areas -- which is the belly, lateral lines and the dorsal fin areas. You can trim away large percentages of these contaminants. Also, certain cooking techniques such as grilling, baking and broiling can reduce contaminants instead of, say, pan frying in those fatty tissues. Okay?

Under that alternative, we expect to develop pamphlets and educate the public, suggesting that if you fish the lake that you don't eat the fish;

but that if you do eat the fish, please prepare them the following way. That would be kind of the thrust of the program.

Also, another control of the institutional controls is that the fish themselves are monitored. We plan on collecting sediment samples and fish samples, very similar to what we did for the RAI over approximately a fifteen-year period of time. That data would be used to update the advisory as needed. And maybe we could rescind the advisory or, if the fish concentrations go up, go down, -- we are predicting that they will go down. Nonetheless, they will be used to update that advisory and support the continuation of it.

Also, part of this alternative is what we call "regulation of Twelve Mile Creek impoundments."

As I mentioned, there are three small impoundments located on the Twelve Mile Creek drainage. Those impoundments have served to trap sediments coming into the reservoir. Over history, over time, those sediments have been "flushing". Okay?

Flushing of those sediments, while we are no longer accumulating appreciable quantities of PCBs, when you release a large quantity of sediments over a short period of time, they have adverse affects on not only the benthic community but on the various little sediment dwellers as well as the fish. It can result and has resulted in fish kills over the years -- and I will show you some before and after pictures of what has happened at the impoundment.

(Next slide): Here is a "before" picture at the lowest impoundment. This was in '91, during the investigations.

(Next slide): September of '93, that's what happened. The sluice gates were opened up, driving 43,000 cubic yards of sediment into the impoundment and it -- it basically raised the level of sediment, choking out of the fish.

There was a small fish kill in the area that was attributed to the high levels of sediment, not PCBs. The reason is the fish were choking to death on the sediment, couldn't get any oxygen.

Under this alternative, what we want to do is to raise the impoundments. We want them to continue flushing.

We think that by flushing they are covering up the contaminated sediment and we think that's beneficial. We want them to continue to do so, but we want them to do so in a manner that is safe to the environment. We're talking about quarterly-type sampling or quarterly-type flushing instead of one catastrophic event; but to release quarterly and release a small amount at a time, to cover that sediment up.

(Next slide): Again, this is the Twelve Mile Creek area immediate downgradient of that impoundment. You can see it resembles a typical Appalachian-type foothill stream, very rocky, velocity.

(Next slide): After flushing, it looks like a floating sandbar. Very little rock and you've got basically two or three inches of water over a nice bed of sand.

That brings us to the -- the cost for this alternative is approximately $3.2 Million. And you may say, 'Wow, that's a major cost for doing nothing.' But what you've got to consider is that there is a public education program, and that's the fish and sediment monitoring over a fifteen-year period of time. There's a lot of analyses associated with that. There's a lot of manhours associated with that. Over a fifteen-year period of time, you can accumulate costs totaling one or two million dollars.

<u>BY ATTENDEE:</u>

Can you give us a rough breakdown -- go back to the slide.

BY MR. ZELLER:

Right there?

BY ATTENDEE:

Yes.

BY MR. ZELLER:

I would have to look at -- what we do is to prepare relative costs on these, we look at costs incurred over a period of time. You take all those costs back and calculate a net present value of these costs, so whatever resembles -- this cost if the net present value. So if you had $2.3 Million to invest right now, that we said $2.3 Million would be sufficient to fund this alternative over the lifetime of the alternative.

So I can say that Twelve Mile Creek impoundments, I believe that we estimated that, the negotiations with the owners of those impoundments, we in no way intend to shut them down. We want them to continue on with their business, we just want them to do so in a manner that is friendly to the environment. We estimated the overall costs of that to be over $200,000. The public education program, something that EPA is currently conducting. It is just going to take some time to pull it all together. I don't have that cost right off the top of my mind at this time. I will tell you that the bulk of that $3.2 Million is the annual monitoring associated. It consists of fish sampling at six stations, it consists of corbicula baskets at six different areas, and it consists of sediment sampling at twenty locations in the study area itself -- over fifteen years.

BY MR. ALEXANDER:

The administration record at the repository breaks that down.

BY MR. ZELLER:

Thank you.

BY ATTENDEE:

The cost incurred to-date, this $4 Million, does that factor into the estimate of the alternatives?

BY MR. ZELLER:

No. I will tell you that up to this point in time, the Government has incurred -- other than the Superfund programs, EPA has taken the lead on this. Although Schlumberger did pay for the entire investigation and cleanup, EPA took the lead on this and over the last three or four years our investigation and analysis cost has been approximately $1.8 Million.

This bring us to our next alternative, Alternative 2B, which is the EPA preferred alternative. It is called "Fisheries Isolation".

Under this alternative, in addition to the components of 2A, which I just summarized, it would also include the installation of a fish fence at the Highway 37 bridge, to prohibit the movement of migratory fish species into or out of the area that has the highest concentration of PCBs.

We expect that the installation of this fish fence to show reductions in the migratory fish downstream of the barrier in a shorter period of time than the twelve years. We've estimating these fish, in greater than ninety percent of the lake, will achieve FDA tolerance levels in four to five years. Okay?

The cost of this is $4.2 Million, and that's on top of the $3.2, approximately, for Alternative 2A.

BY ATTENDEE:

So you're saying to do 2A and this?

BY MR. ZELLER:

Alternative 2B consists of constructing the fish barrier in addition to the components of 2A.

BY ATTENDEE:

So you're talking $7 Million?

BY MR. ZELLER:

(Negative gesture), that's rolled in there. This $4.2 Million includes the $3.2 for Alternative 2A; so you can see that it is just slightly more, due to the fact of construction, operation and maintenance of that fish barrier.

BY ATTENDEE:

Will you, sometime this evening, describe what that fish fence ---

BY MR. ZELLER:

Yeah, we're going to get into that. What I'm going to try to do now is to briefly go through all the remedies that were considered, identified to be evident by this preferred alternative.

Obviously I'll talk a little bit about it, and I'll let Mike describe the reasons behind this -- briefly. Then we will get into all the alternatives considered. But, yes, we will spend the majority of the time talking about this.

BY MR. ALEXANDER:

The location of this fence would be at Highway 37 down below Clemson. That is a very unique place in this lake in that there is a causeway that runs all the way across the lake and it has an opening of approximately five hundred feet, and the water depth there is -- even at full flow -- only about sixty feet deep. There's not many places in the lake that is like that, you know. And it's the only reason that this alternative even has a possibility of being real effective.

Basically, the idea is this. That largemouth bass and channel catfish and other species of fish that we have collected, including all the forage species, shad, gizzard shad, blueback herring, bluegill, all decrease once you leave this upper area of the Twelve Mile Creek embankment and around the Clemson area. Hybrid bass and stripped bass stay above two parts per million throughout the lake. Now, I'm not a risk assessor and I can't defend whether you eat PCBs and you die tomorrow or not. But I can tell you that when you look at the risk assessment that EPA uses, and their values, to get it down to where it is acceptable would be in the range of .04; .4 being a magnitude higher. What we've talking about is two parts per million or above, in these hybrid bass that are spread throughout the lake.

Now, a lot of people have a kind of -- a lot of people have individual concerns about all this, and you should defend your individual concerns. But I am sure that there are not lots of people that fish over at the dam at the Tugaloo River that should consume fish that are well above the FDA level, which is well above what the EPA risk assessment is; the thing is, if we can prevent them from doing so. And the way that we propose to do that is to build that fence to keep the fish from becoming contaminated. Now, to me, the important part in this is that this is the harvest of fish that we collected in the creel in 1992. And the fish that the people actually catch up there, by weight, are the largemouth bass and crappie -- the 32 percent and the 6 percent, by weight -- and this is hybrid bass and stripped bass, which is the migratory species that we were discussing and it is 47 percent by weight. So we're not talking about an insignificant thing here. We're talking about half the fish that come out of Hartwell Lake are at these elevated levels and they're scattered throughout the 55,000-acre impoundment.

Now, we looked at the records to see how many pounds of these fish are actually harvested up in the Twelve Mile Creek embankment. There's about 6,500 pounds of those harvested last year. That leaves almost 114,000 pounds that are in areas that we could protect. So that's the reason that this was proposed.

It is feasible, because of the Highway 36 causeway, that something could be constructed there. Because this is a significant portion of the fishery. And because we could reduce the level of PCBs in those fish to what would be acceptable for humans.

When I first began this, I got up in front of a crowd in Liberty. We weren't here, we were in Liberty. And I said that if it could be cleaned up that we would do so. Now, we've got through these things and it doesn't appear, with widespread, low-level contamination, that it can be cleaned up very reasonably. We also said that we would manage it as best we could if it couldn't be cleaned up.

This is what I am talking about, is the management proposal that will manage it as best we can manage it.

Now, people may not want it managed. I don't know. But this is the best way that we can manage PCBs getting from fish into the people throughout the entire body of water.

BY MR. ZELLER:

This is a good jumping off point for what Mike was talking about. We've looked at other ways to address the sediment.

It is important to note under 2B, that under 2B there is a significant amount addressed to those remedial alternatives. One, it reduces the -- accelerates the decline of fish downgradient of that barrier, it reduces the potential population that could be exposed to elevated concentration of PCBs. It also, to an extent, limits the mobility of those contaminates by keeping the fish out of that area, getting the fish out of there and thus reducing the mobility. But we also looked at trying to satisfy the other two alternatives, or the one primarily, that would stop the migration of settlement any further into the reservoir.

We also looked at other alternatives to enhance the burial process and therefore the stop the transfers of PCBs in the sediment to the biota.

Now, as I said, they all looked at sediment. As Mike said, we have what we could consider a low-level widespread PCB contamination. On the surface, we're looking at averages of five parts per million but it's over a big area. So, we said, 'Okay, what area or to what level are we going to clean up?' We looked at this figure -- what we have got here, on the horizontal scale, in the PCB concentrations, -- as I said, PCBs in the sediment are causing problems in the largemouth bass. But the baseline condition, we're predicting approximately ten years for this age level of fish to be to the two parts per million level.

What if we clean the sediment up to one part per million?

What if we clean the sediment to a site-specific factor of .4 parts per million?

And what if we clean it up to background levels, .05 parts per million?

What you need to draw from this graph is that if you clean up sediment to background concentrations, .05 parts per million, basically nondetect, you get recovery of the fish fairly quickly -- in three to four years.

If you clean it up to something we call 'technically feasible', something that you can really do and that is implementable, you get that reduction in, say, six to seven years, which beats the ten years. But you can see that there is only a three-year difference.

It is important to note here that risk for all these alternatives, as defined by EPA, are "acceptable." The reason being, no matter what you do to the sediments, the so-called "damage" has been done. PCBs are in the sediment. They will decrease but the high levels in the early years of the thirty-years exposure duration, which you average those together, they still add up to be an unacceptable risk. So to correct the problem after the fact is very difficult. But, nevertheless, we want to take a look at the management of the sediment. As Mike said, if we can fix it with engineering, let's do it. Which brings us to Alternative 3A.

Under Alternative 3A, what we are going to do is the capping process. We selected the remediation goal of one part per million in the sediment. We can deal with sediment that is greater than 1 ppm. When we look at that, the cap would cover an area of 730 acres. We estimated the volume of contaminated sediment of 4.7 million cub yards. That is a lot of mud. So we said, 'let's not touch the sediment. Let's cap it over with eighteen inches of sand.'

To do that, we're going to cap over 730 acres of sediment, requiring 1,800,000 yards of sand that would have to be brought in from another source, and what this accomplishes then primarily is we're putting a clean cap over it, on the contamination, and we should see a reduction in fish concentration in about three to four years.

A very high cost, $51.2 Million Dollars.

Here is a schematic of the alternative way it would essentially consist of. What we would do is cap from the Twelve Mile Creek arm down to the confluent with the Keowee River.

3B addresses the remedial action alternative of limiting the downstream migration of contaminated sediments. Under this alternative, a fixed-crest weir would be -- essentially a dam -- constructed at the mouth of the Twelve Mile Creek that would limit the further migration of the contaminated sediment. It would be approximately a 1,600-foot span, require a lot of concrete.

The cost of that would be approximately $54 Million dollars.

The big drawback to this alternative is that obviously for certain periods of the year it would limit any kind of boat traffic into and out of that area. We expected to hear some input from the public on that alternative.

$54 Million dollars for Alternative 3B.

This is the schematic showing the conceptual nature of that alternative, placing the concrete structure on the Twelve Mile Creek.

Alternative 3C is a combination of 3A, capping, and 3B, the sediment control structure. A little bit of both here.

Under this alternative we would move the sediment control structure just above the 133 bridge to stop migration in this area, down to 285 acres below that at the Twelve Mile Creek arm.

The cost of that alternative is approximately $34 Million.

From there, we get into more aggressive alternatives for the management of the sediment inplace. CERCLA, the law that we work under, says that you must consider all alternatives, including removal of the sediment and disposal of it, with treatment and without treatment.

(Next slide, showing Alternative 4): This is the alternative that removes the sediment with no treatment.

Under this alternative, we would dredge approximately 4.7 million yards of material, via hydraulic dredge. The material would then be pipelined back to a confined disposal facility. The confined disposal facility, what it would entail would --

here is the Maw bridge and here is the Madden bridge (indicating). Between that area, what we are going to do is to take advantage of that goose neck area, which contains a lot of that contaminated sediment. We would reroute the channel and then build dikes around this goose neck area, put all the contaminated material in that goose neck bay and then cap it with three feet of clay and leave it alone.

The cost of that alternative is approximately $47 Million dollars.

Then for the very aggressive alternative, (next slide, showing Alternative 5). Not only are we going to remove it but we're also going to treat it. If you treat 4.7 million cubic yards, you can expect the costs to go through the roof.

Half a billion dollars. We don't need to talk about that any more.

The other alternative that came in -- what we did was that we talked -- we released this document draft. Due to the far-reaching impacts of this site, the big lake, EPA said that it could affect a large number of people and we wanted to hear from you early-on. So what we did was to release the document in draft form, something that EPA normally does not do. We wanted to solicit greater public involvement in this process. We wanted to hear from you early. I was up here at the invitation of Clemson University on March 28th to discuss -- it was a very good working session attended by approximately 150 people, to say 'What do you'all think about these alternatives that are under consideration?'

As part of this draft review process, Schlumberger, the responsible party for this site, they also looked at it. They came up with an idea that they called an 'ecosystem management alternative', that they wanted to be considered in addition to the other alternatives. A very innovative idea which, in -- in essence, what it talked about is: 'Here is the current bio-cycle. You've got PCBs floating out of the sediment, forage fish have PCBs, game fish eat up the forage fish and therefore you have fish that are above the 2 ppm level. Let's try to break that chain.' So what it looked at was basically creating a so-called fish bounty system. We want to pull those contaminated fish out of the lake, get them out of there, and replace them with clean, hatchery-raised fish. Pay the fishermen that harvest these fish -- just everyday bass fishermen, everyday citizens, -- pay them a certain amount per pounds. Then replace those with clean fish.

We did consider this alternative. We considered it as a part of the preferred alternative, 2B. Instead of looking at it on a lakewide scale, let's look at this as a scaled project maybe above the fish fence and see if we can create some benefits above the fish fence. We're talking about the Game & Fish Commission with the respective state, South Carolina. They did consider it but the end result was they believe that the fish advisory, as set out in Alternative 2B, would be the approved way to go. So, I just wanted to share that we have looked at some other innovative alternatives.

(Next slide): This is really the summary of all the alternatives. This is really where it gets down to the time and the money that it takes to achieve protectiveness.

This table is in your fact sheet. You're not going to be able to see these numbers. What it is, it summarizes all the alternatives, one through five, of what we looked at.

The first column is the estimated time to implement the alternative. That doesn't include the time for us to prepare the decision and time for us to negotiate with the responsible party, but once we have gotten a contract onboard it is the time that we think that we can get this remedy up and running. Then we also look at the baseline condition at the time for the fish to attain FDA level, to attain protective levels. If you add those two together, you get the total time to achieve protectiveness. Now, this has been subdivided into two portions of the lake: above the Twelve Mile Creek arm and then in the main body. So we're looking at ten percent of the lake and ninety percent of the lake.

What you can see under the "No Action" scenario is that you need about twelve years to attain this FDA level.

Under Institutional Controls, with public education, it is still twelve years.

Fisheries Isolation, keeping fish out of that impacted area, we expect them to recover very similarly as if we had capped it or that they were exposed to the same background concentrations.

We expect twelve years above the fish fence, because we're doing nothing. But down below the fish fence, we're expecting four to five years for those fish to drop to protected levels.

So what we are hoping is, with the tools that we have available to us today, that with the installation of Alternative 2B, we're hoping that fish decline and in four to five year we can rescind that fish advisory for greater than ninety percent of the lake.

As you can see, Fisheries Isolation, for the money gives you the best result. For $4.2 Million dollars, we get recovery of that fishery resource below the fish fence in four to five years; far greater than the more aggressive and costly alternative to deal with the sediment. That is the big driver. Which brings us to our preferred alternative. As I mentioned, 2B, Fisheries Isolation, consists of 2A public education, continued monitoring and regulation of the Twelve Mile Creek impoundment. It also includes construction of the fish isolation barrier. Again, at an estimated cost of $4.2 Million dollars.

This is where I will turn it over to Mike a little bit. Between EPA and the Corps of Engineers we've designed performance data that would guide in the development and design of this fish fence.

This is really the meat of this presentation.

So we'll begin to take questions and I will begin with you, Gary.

BY MR. ALEXANDER:

Whenever the draft document was put out, the idea of keeping these fish from moving throughout the lake up into the contaminated areas, we went out and looked for -- 'Has anybody done this?' You know, have they done it on a large scale? And we found some places where people had constructed these barriers, physical barriers, to keep fish from moving from one place to another.

And we put a picture of one of those in the draft document, which some of you may have seen. And we got lots of comments about it -- none of them good, none of them. It was, you know, 'you're going to put up a big steel fence for us to run our boats into.' 'You're going to do this, you're doing to do that.' We've rethought about all of this and, in all candidness, we don't know exactly how this fish fence would go in there.

What we did decide on is that these are the things that we have to do. We have to be able to minimize the safety hazards. We can't have -- we can't put a structure in there that kills somebody to protect them from PCBs. I mean, that don't make any sense, you know; and we don't intend on doing so. We need to allow people -- we need to keep the fish from migrating back and forth but we also need to allow boats to be able to move back and forth.

BY ATTENDEE:

Does that mean at all lake levels?

BY MR. ALEXANDER:

Yes. We won't be controlling the lake for this barrier. This barrier will have to function under the normal operations of the Hartwell Lake. As a matter of fact, really right here is where that falls in as one of the criteria, that we have to come up with, you know.

BY ATTENDEE:

Will you have access in all areas?

BY MR. ALEXANDER:

Yes, sir, absolutely. We don't intend on trying to, you know, keep people from moving back and forth between those two areas.

We want to make it safe. We want to make it as cheap as possible. We want to build it to make it as low-maintenance as possible. All of these are things that we want to design into this.

(Next slide): All right, now, that is the bridge. I just wanted some people to actually see it. Some have, some haven't, but that's -- it's about five hundred feet across there.

(Next slide): That is the upstream side of it.

(Next slide): This is the downstream side of it. Basically, there's two bridges here. There's a railroad bridge and a road/highway bridge.

My current thinking on this -- and if anybody has any real good idea, if you think this is a good idea at all, I would appreciate someone telling me exactly what we should do to build this correctly. But the concept behind it would be that the lake there is about sixty-feet deep, at the deepest point across there, that somewhere down there we would build a more or less permanent -- not permanent but solid structure -- that would come up off the bottom and be built like a fence. You know, it could be a chain-link fence, whatever. But it would be built to prevent fish from moving through it.

But the upper section of it would have to be flexible. There's lot of flexible materials that are out on the market now that we can use.

And what I intend on doing is to build it out in a vee, similar to this (gesturing on downstream side of bridge), out away from that structure, back as close to the structure as possible, so that it would mimic a fish weir. I don't know whether many people in here are used to fish weirs, but they guide fish. That is basically the concept of being able to allow boats to go through here and not fish. Between two of these structures here, with this being a floating buoy line with buoys all the way out, so that it warns boaters, but to allow an opening that would be the width of this, barely three to three and a half feet deep, where boats could actually cross it. That would just be open all the time, all the time. There would be no gate there. When you drive up, it'd be two buoys sitting there and it would be that wide apart (gesturing) and you'd drive between two buoys and go on wherever you want to.

Now, the immediate question is how is that going to keep fish from going through? One thing is that fish migrate up through here -- and there are going to be some fish to move through. What we are trying to keep out is hybrids and stripped bass. If we construct a fence in a fish weir-type form, for them to hit an opening that is relatively small in an open body of water, and assuming that they are not all swimming up next to the surface, then we expect to be able to keep a large portion of them out. Fish that actually come and hit this will travel down it. When they get to wherever the opening is, we plan to have weirs to guide them back off in another direction. Although there may be a few fish that actually negotiate this hole, right now we have approximately 120,000 pounds of hybrid strippers that are moving up in there and getting contaminated and moving back out that are being harvested. There are many more of them being moved up in there. And there may be a few that go through, but it certainly would reduce the PCBs a tremendous amount, in these fish.

<u>BY ATTENDEE:</u>

Are there other examples of this structure that are already in place somewhere?

<u>BY MR. ALEXANDER:</u>

No. No, there is not.

<u>BY ATTENDEE:</u>

Have you considered simulation studies?

<u>BY MR. ZELLER:</u>

Let me address that. We don't have all the answers here. We'd be lying to you if we said that we did. But we believe that this is an engineering problem that can be solved.

There are some experiences that have been drawn on from other areas, two similar type structures. One on a lake in a state park in Georgia and there is also one in Lake Seminole on the Georgia/Alabama border. There are also some experiences that we can draw upon that are technologies that have been developed from industry, such as giant water intakes that bring millions of gallons of water, sucking in water and they suck in fish that they don't want. We believe that this is an engineering problem that can be fixed.

We're going to jump into a six-month -- if this preferred alternative is selected, we're going to jump into a six-month -- if EPA says, 'we'll let you give this a shot. We may be skeptical, we don't think that you can solve it, but go ahead and give it a shot.'

If we can't solve the problem, if it turns out to be too far great of a challenge to resolve, we will fall back to Alternative 2A. We will be back up here and we will say, 'Look, we tried and we were unsuccessful.' We will fall back to 2A, which is basically just institutional control.

Let me mention something here real quick.

Let me preface, just real quick, -- hold your questions for just a minute.

I want to turn it over to Dick Austin, who is to give the Corps perspective of this. Dick is the Resource Manager for Lake Hartwell.

Then we will address questions.

BY MR. AUSTIN:

I promise I won't be very long. I had three concerns before getting up to talk to you.

The first one was my fanny, and I presume that mine has been solved since I am standing up. What I would ask you to do, if you will do it quickly, and I will continue to talk, is stand very quietly and stretch or move around. Or if you want to stay seated, that is fine. If you stand up, it won't bother me, I promise.

My second concern in getting up here is that I haven't had an opportunity to talk to this group before, though we've been working with EPA. I am kind of reminded of a story, by the position that I'm in tonight. The story is about the old guy who used to go to town quite a bit and do some heavy drinking. Sometimes in the morning he would wake up in an unfamiliar hotel room. This particular morning, after a particularly rough binge, he woke up in jail. He couldn't remember anything but he did remember going to a hotel. He was brought quickly before the Judge and the Judge says, 'Mr. Austin, you set the hotel on fire last night.' Being a bureaucrat and quick on his feet, he said "No, sir, that bed was on fire when I got in it." Okay.

(Turning to court reporter), note "significant laughter", please.

(Genuine Laughter from audience)

BY MR. AUSTIN:

My third concern is that I think that I am beginning to understand what these people are saying and, so, I am concerned about that.

What you have seen here tonight is a culmination and milestone in a partnership between Federal and State agencies. Several other Federal agencies were involved and several State agencies involved, including two states.

The Superfund system is working, as it has been signed by our legislators. But this is a three-party partnership, I want to stress to you tonight, and you are the third partner. You are the public and we need, very much, to hear your concerns, your wishes, your desires and your wants. Please express yourself. Do it to us verbally, in writing, or any way that you see fit.

We manage Hartwell Lake from the standpoint of customer service, and we move through lots of complicated issues. We want to hear from you and it is important that we can make some quality decisions with your input. I will assure you, as your lake manager, that the Corps will listen. We have a responsibility to manage this lake and operate this lake.

If public opinion indicates substantial, as you have heard from EPA, substantial problems with these proposals, we need to hear it.

If you are in substantial agreement with this proposal, we need to hear it.

Major public concern against this alternative can turn it around.

We have talked about some of the contingencies and I want to mention that those are most important to us:

We have to think that the biological isolation will occur.

We have to meet safety requirements. Navigation must minimally be affected, or preferably not at all.

There are some other engineering requirements and some of those are approximately fifty-two percent of the entire lake flow goes through that five hundred foot area. That area has to pass a lot of water.

Floating debris is going to be a problem, wind and wave action.

We have commitments that if it does not work that at that time removal would be the case. And then it would be removed after completion if it did work.

We must be involved, because we manage the lake. We manage that lake for you as natural resource stewards. Our major concern and the reason for our involvement is regulatory authorities, the navigation systems and the responsibilities that we place on the lake, the general project operation of the lake and, of course, of utmost importance to us is public safety and customer service.

Relationships between the Corps the implementing contractor will be negotiated and/or determined after design implementation plans are developed. By that, all I mean is that we have to have -- if we put something on that lake, we have to have some responsive contractors to take care of whatever may go wrong. Public concern, fence out of place, whatever it may be. Management and operation of this lake, in our view, is service-focused and you are our customers. If you use this lake, if you live on it, if you live near it, or if you're associated with a business that is associated with the lake, you are our customers.

We can make good decisions if we hear from the third partner.

We serve people, ecology, economic development through management and conflict resolution for the protection of resources and balancing of competing needs. It seems like the more the lake is used the more conflicts that there is. The only thing that I want to stress to you tonight is to let us hear from you. You are a part of this and we can make better decisions with your input.

BY MR. ZELLER:

With that, I want to turn it over to Bernie Hayes very quickly to give you a summary on OU1 and then we will open it up to public comments.

BY MR. HAYES:

Thanks, Craig. I am a little bit surprised that Craig did not go over what we call the "Olive North alternative for OU2." He and I thought that we could hijack a B2 bomber and sell it to Hussain, get the half million for the whole hog alternative.

But -- being the government bureaucracy that we are, our boss sort of put the thumbs down on that. Anyway, it is nice once in a while to have some good news to tell you'all about. I think in OU1 that we have some good news.

As Craig said, OU1 is comprised of the source areas of PCBs for the site. The source areas is the land disposal areas consisting of places where waste was disposed of at the plant site in North Pickens and six areas scattered around the Pickens area. They are all within a few miles of the town of Pickens. The six satellite sites, as we call them, are the Brazil site, the crossroads site, the Dodgens, Nix, Trotter and Welborn sites are all areas where waste was deposited in an uncontrolled environment. Just used to fill low areas, used to dump down in ravines to get rid of it. Then, of course, there was quite a bit of waste deposited of on the plant property.

The RECLA decision, which was submitted sometime ago for OU1 called for the excavation of all that waste material from those six satellite sites; to bring it back to the plant site; and treat it there along with all the waste material that was at the plant site by a process called "low temperature thermal desorption." In very nontechnical terms, that is heating it up until the PCBs are driven off the contaminated material. It is collected and concentrated in a very highly concentrated, low volume form and disposed of properly in that low volume form.

In addition to that, there were capacitors, old capacitors and other debris that could not go through the thermal desorption but had to be hauled away.

Then there were some actual PCB filled capacitors, power plant capacitors, that will have to be disposed of probably by incineration.

In any case, the first thing that we wanted to do -- we thought the most pressing need was to get that material out of those six satellite sites, out of that uncontrolled environment, and back into a more controlled situation at the plant site. That is the first thing that we attacked.

The good news is that all six of those satellite tracts have now been excavated. All that material has been taken back to the plant site.

Four of those six sites has been tested and we feel that they have been cleaned up to the requirements of the CERCLA decision; and approval has been given by EPA to backfill those areas.

The other two, we're still awaiting some samples. On one of them they just got delayed a little bit by the wet weather, some sampling points were actually under water in the excavation.

The other site, when we first sampled the site, we got back some positive readings that indicated that they needed to take some more material out.

They've gone back in, taken that material out now and taken some more samples. We haven't gotten those analyses back, but I'm fairly confident that soon we'll be able to backfill those as well.

We are expecting here, in the next couple of weeks, the first design report for the low temperature thermal desorption, the treatment system.

We also, at three of the satellite sites, and at the plant site we have detected groundwater contamination and have designed groundwater treatment systems for those sites here also in the next couple of weeks.

So I think the process is moving ahead very expeditiously. I think that the contractors that Schlumberger -- as Craig mentioned, Schlumberger has foot the bill for all this work up to this point, under the terms of the Consent Agreement that they agreed to with EPA. I think both their consultants and their contractors have performed very commendably, in a very professional manner. We have oversight contractors on-site to keep an eye on them, and I enjoy running up there every couple weeks to keep an eye on things myself. The work has gone very well. So I think that you'll continue to see process. You will probably -- if you live in the area, they are hauling some of the debris and some of the capacitors that could not be run through the thermal treatment unit, they're actually being hauled to a permanent hazardous waste landfill in Alabama and you may see some trucks coming and going from the plant. That is what they are doing. So, in a nutshell, that is the update on OU1.

If you have any questions about it, I will be up here to answer them with Craig.

BY MR. ZELLER:

Thanks, Bernie. It's time to hear from you'all. We will be here as long as you'all have questions. Please speak up if you have concerns.

So, who goes first?

BY ATTENDEE:

I have several questions. First I will start with the technical questions. We're talking about an expenditure for a quarter of a million dollars. We're talking about a concept, not a design, nothing has been done before. I'm a retired engineer and I know what kind of costs you can run up on a program of this nature. In time, it can double in just no time at all when you come up with an idea to do something like this that has never been done before. So let's not forget that this dollar value could markedly increase and the time to complete this process could markedly increase.

The next technical question is, is this going to have some kind of a level that the boat can go over?

BY MR. ZELLER:

(Affirmative nod).

BY ATTENDEE:

That's fine. Now, what happens when the lake goes down fourteen foot like it did a couple of years ago? You're not going to get a boat in or out unless you have some kind of deal that you can remove and replace it if the lake level goes down.

BY MR. ZELLER:

I can address both of those questions. First, the first point about cost. That is a very good point. It is conceptual. The chances for cost increase are there and I would recognize that fact.

It is estimated that this fish fence, at this point in time, will cost a million dollars, in round, ballpark figures. We think that we can bring this project in with treatability, testing, what-have-you within that figure. But let's assume that we double -- let's just say that we blow our budget by a hundred percent and it costs us two million, that we run into problems. Where are you? Then we are at $5.2 Million.

But what is your next best alternative? The next best alternative is $34 Million.

So even if we have a double overrun, we are still -- what we feel -- doing something beneficial at this point in time, in relation to the other present worth values.

BY ATTENDEE:

Yes, but the other alternative is astronomical. Anybody who is thinking of that has got something wrong up here (indicating head).

I mean, this program -- your alternative, as you said, would be to drop back to 1A and 2A.

BY MR. ZELLER:

It would be 2A.

BY ATTENDEE:

Or to doing nothing, which is essentially what you are doing now. You hear all these levels of two parts per million PCBs and so forth but, good lord, how many fish do you have to eat in a year to even be close to having anything close to some level that would cause cancer?

BY MR. ZELLER:

Via the creel survey -- a lot of times risk assessments are conducted with site-specific data. As part of the creel survey, we were able to quantity meals consumed per-year from different parts of the lake. We had the lake split up into various strata, to look at. One area, they may eat ten meals a year and someone else may eat a hundred. So the arm that we are considering here, the focused arm, it is the same based on data collected on site, sixty meals a year for thirty years of 357 grams per meal. That was based on data provided to us by fishermen of that area.

BY ATTENDEE:

Who is going to get sixty meals a year for thirty years? You can't even catch that much fish! I've been fishing this lake for nine years and I might catch two fish every three or four days, if I am lucky.

Seriously, I mean it's -- the people that live on Hartwell Lake, (negative gesture). It is not a commercial fishing lake. We don't sell the fish. It's sportsmen that are fishing. There are too many boats gunning on the lake to catch anything decent in the first place, but that's another subject.

But you're not going to eat a lot of fish. How many people have gotten cancer from eating fish these first seventeen years? And now that's sixty percent of the problem? We've only got twelve more years and each year it gets less and less and less. I think what you've done is quite adequate. Let the people be responsible for themselves.

BY MR. ZELLER:

That's a very good point and things that we all considered. What we're looking at here is that, and this is the point that Mike made earlier, is that people over on the Tugaloo arm, greater than ninety percent of this lake, what they are exposed to. Now, they are definitely exposed to PCBs. Now, whether that be voluntary or involuntary, I agree that eating the fish is their business. But we are trying to do things to minimize that. We think that for this estimated one million dollars that we can do something good. We can minimize the exposure to PCB contaminants in fish.

Now, to address your idea of costs. As an engineer, you should know that if we drop off this treatability test and this thing works -- or we should know early-on if this thing is not easily solvable, which would indicate problems with the system; which may indicate to the EPA, the Corps and DHEC, that 'Hey, we think that we bit off more than we chew here. May we should go back.'

Let's talk about your second concern, what if the lake level drops fourteen feet. As Mike mentioned, the lake is approximately sixty feet deep in that area. We looked at the lowest recorded lake level in the history of lake, 642 feet above sea level. So from the bottom of that reservoir, in the vicinity of the Highway 37 bridge, it is approximately 600 feet, roughly, above sea level. So we are going to build a fixed fence or a fixed area up to about 639, which would allow -- which would allow -- which would take the 642, the lowest recorded lake level to-date, minus the 601 (phonetic) and that is your three foot draft. That is how we have designed it. So, yes, the level may fluctuate. In fact, it has recently. In the late 80's it dropped a lot. But, yes, we have considered that. And there is a lot of other data that we have to collect. Mr. Austin mentioned that there is a lot of water moving through that particular area of the lake. We are going to take some preventive measures. We're are going to have to take a look at some the debris that comes through there. Those are all very important considerations, we realize that.

BY ATTENDEE:

One more point and then I will keep my mouth shut and let somebody else talk. What you are essentially proposing is to decimate the fishing above that point. I mean, the fish aren't going to come back. They're going to go down but they aren't going to come back. This fishing is terrible in this area anyway. I used to be able to go out and get three or four fish a day, but now I'm lucky if I catch three or four fish in a week; and I'm a pretty good, serious fisherman. I mean, the fishing has degenerated and that is going to get worse. We are not going to have hybrids up there anymore. I mean, to solve a problem that really doesn't exist downstream, you're going to cause a problem upstream?

BY MR. ZELLER:

Well, our intent is not to create more problems.

BY ATTENDEE:

The risk from the PCBs is a minimal risk. We get more exposure to cancerous things sitting out in the sun all day long than you do from that.

BY MR. HAYES:

You have some very good points and these are exactly the kind of things that I think that we like to hear. In terms of the risk assessment, you're right. The risk assessment that we do as part of the Superfund program are necessarily very conservative and, necessarily, very "worst case."

So when Craig presents the figures of our risk assessment estimates, those are numbers which we are confident are the very worse that you could possibly experience.

Now, sometimes we do look at situations which may or may not be very likely or widespread. We want to make sure that, in order to protect even one or two families that might be subsistence-type fishermen at some point in this lake, that we're going to look at that as part of this risk assessment.

But I think that these are points that are very well-taken. I think the estimate of risk presented in the risk assessment, in the RI, are very much the maximum and most health-conservative numbers that we could generate under the most conservative exposure scenario.

BY MR. ZELLER:

And I would like to follow up on this. Your opinion is really quite the exception rather than the norm. I have sat in rooms like this where people say to me and to EPA, 'EPA, we want zero risk. We think that four percent is crazy. You know, if I want to put myself in voluntary risk -- to, say, drive without my seatbelt or eating something that may not be good for me, with a high cholesterol/fat content, that is my choice. But these people put these hazardous substances here and I'm a taxpaying citizen and I am not going to stand for it.'

So this is the dichotomy that we're often faced with. But your point is very well made.

BY ATTENDEE:

You don't have to eat fish.

BY MR. ZELLER:

That's true.

BY ATTENDEE:

My concern, I guess, is initially for fish fence. It would create a trash rack that I think is going to have to be maintained. As you said earlier, ten percent of the flow comes down through that arm. And I believe that it is going to be a public nuisance in that the fishermen are probably going to congregate in that area. You're probably going to have divers messing around in there too.

So that is just something that -- if it is not going to be freestanding, it will have to be structured, that would have to be engineered into it, because it is going to create an additional loading for the bridges.

The other thing that I am curious about is the fish themselves that we are talking about, weights of fish and all. You said something about a fish that is ten years old.

BY MR. ALEXANDER:

I think that the percentage of fish take that is that size is considerably small. So I can say safely that fish under three pounds would probably be the majority of what is taken, and probably not much of a risk.

BY ATTENDEE:

The thing that I am wondering is that you said that it would take thirty years of eating this kind of fish every day to get into jeopardy.

Does that thirty-year time start from the levels that exist in the lake now, henceforth, or is that thirty-years when people started back when the contamination occurred in the late -- there are not many people in this area that have been eating fish for thirty years. I've not been eating it that long myself.

BY MR. ALEXANDER:

To answer your question, as far as the low-end of the risk is the smaller fish that you eat, that is absolutely true. Absolutely. It doesn't really make much difference whether you're talking about a stripped bass that weighs forty pounds or down to a fish that weighs ten pounds. The smaller they get, the safer you are. So if you catch a lot of small fish, crappie and the twelve-inch bass, and eat them, you are a lot better off.

But as far as the levels being safe once they get small, remember that I said that -- what I presented was that largemouth bass between one-and-a-half pounds and three pounds, and those are the fish that our creel records show are what most people take home and consume. Fish within that range.

BY ATTENDEE:

We -- those up above that fish fence are -- we are still going to have to go out and put up advisories not to eat the fish.

BY MR. ALEXANDER:

That's correct. We have to allow people to do what they want to. We recommend that they not eat them because it's harmful for their health. They will do so above that fence.

But what the fence is for, the reasoning behind it is that half of the pounds of fish that come out of Hartwell could be protected if they could not get into the contaminated area and get PCBs in them. Our goal is to make it possible for people to harvest and consume fish out of Hartwell Lake at little risk. To do that, half the pounds of fish would be lower at the levels that would be a smaller risk. That would be the point.

BY ATTENDEE:

But it still would be above the baseline of ten to the negative four?

BY MR. ALEXANDER:

Yes, sir. Yes, sir, and it would be for a long time. Because like you pointed out, people that are consuming fish currently, historically, have consumed fish at high levels and would continue for a period of time. It would be the people ten years from now who started consuming fish before they would get below that ten to the four.

BY ATTENDEE:

If you started eating fish today, would it still be thirty years to get the maximum or would that go quite a ways forward?

I am saying that for a guy who just starting eating fish today, the low levels that we are today, is that really going to be any risk to him, a risk of cancer?

BY MR. ALEXANDER:

Yes, sir. The risk that we have now -- it depends on what part of the lake, it changes as you move around the lake, to some extent. In the Twelve Mile Creek embankment area, up around Clemson and up in this section of the impoundment, if you started eating fish right now and ate it for the next thirty years, even though the level drops below two parts per million, ten or twelve years from now, according to our models, you would still have a high risk of catching cancer. That's correct.

BY MR. HAYES:

Not a high risk.

BY MR. ALEXANDER:

Well, higher than not eating any. You're right.

BY ATTENDEE:

One more question. I know that you'all are having a cost-benefit study that you do for the EPA projects coming online. But is this actually a benefit that is extended to other agencies? In other words, is the taxpayer going to get the best bang for his bucks spending $4 Million for the fish fence or, say, spending it for more health care and maybe an immunization program for the schools?

BY MR. ZELLER:

This is a Superfund program. This is the Superfund. This is money that is spent for sites that are on the national priorities list. This is a program that was set up by your legislators, or my legislators, Congress.

Congress established, in 1987, that if we have problems, 'EPA, you will address them. We are setting up a trust fund called "Superfund". You will use this money to investigate and clean up hazardous waste.' This money is so-called "earmarked" this use and does not require bonds or anything else.

BY MR. HAYES:

In addition, once we reach a record of decision, whether it is this alternative or some other alternative, we are going to give the responsible party -- in this case, Schlumberger, -- the opportunity to pay for it themselves. Hopefully they will agree to do so, as they have agreed to pay for the remedial work on OU1. If they do so, then there will no costs incurred by the federal government. It would all be borne by Schlumberger. That, in fact, is what we hope will happen.

BY MR. ZELLER:

To follow up on that, let me give you an idea where you go from here. Following this meeting, we continue our public comment period.

Following the end of the public comment period, we document a record of our decision. The decision could be EPA's preferred alternative, it could be something different depending on what you'all tell us. You know, we take all of this into consideration.

Following that, we enter into a 120-day negotiation period with the responsible party; in this case, Schlumberger. During that time what we will seek, and it is no great secret, we will be seeking from them all future costs associated with EPA's remedy as well as our remedy for the investigation as well as the recovery of all past costs. As has been mentioned, the past costs of this investigation have been approximately $1.8 Million. So if EPA is successful in its negotiations with Schlumberger and Schlumberger decides that they are going to be responsible, then we wipe the slate clean and there will be absolutely zero tax dollars from U.S. citizens spent on this.

Yes, sir?

BY ATTENDEE:

You said that if you received major opposition to the fixed fence idea that you would drop back to option number 2A. Could you quantify what "major opposition" would be?

BY MR. ZELLER:

The opposition would be such as if there are questions, that there are legitimate concerns -- and it is hard without me getting these kinds of things, things that we do not address properly. I mean, what I am hearing and what I have heard in the past is that there are concerns over feasibility. 'Can you design it?'

I'm telling you right now, today, that I think this is an engineering problem that can be fixed. I may be back here later telling you that I was mistaken, that we have not been able to solve it. Another concern is that we are concerned about the debris collecting in this fence or such. So is the EPA and so is the Corps of Engineers. And we are hearing a lot of those things. These things are no surprise, they are things that we have also considered. We're hearing these type of concerns and if we feel that we can't properly address them -- all comments received will be addressed in what is called the "Responsive Summary". It will be a part attached to the record decision. All comments received here tonight, as well as formal and written comments from the public during the public comment period, will be summarized. All comments will be there, as offered by so-and-so and EPA's formal response to that. It has been done.

I mean, for instance, to use the worst case scenario, EPA has come into neighborhoods and said, 'We have looked and we saw this contamination and we are going to incinerator it.' And they say, 'No, you're not. You're not going to incinerate.' So, we weigh and balance those concerns and it is a hard -- it is a tough question to answer.

BY ATTENDEE:

During the last meeting there was a vote taken at the end and from my count it was practically unanimous that 2A is what everybody thought would be the most cost-effective option.

BY MR. ZELLER:

That's correct, and EPA thinks that it is a very integral component of Alternative 2B. We think that they are very important but we are also -- and it is coming down to this conclusion, -- think that for the money we feel that there is a lot of benefit to gain but that there is a lot of benefits there for what we are calling a small amount of money in relation to what we are looking at. We think that we can solve this problem and return ninety percent of Lake Hartwell to its highest beneficial use.

What we want to do here, and I think that you would agree with me on this, is that we want to return greater than ninety percent of Lake Hartwell to an unrestricted fish advisory. We would like to modify and then lift that advisory. We would like to downgrade that fish advisory in four to five years, and we think that we can if we can solve these engineering problems.

BY ATTENDEE:

Fifty percent of it is going to solve it by itself.

BY MR. ZELLER:

Yes, sir?

BY ATTENDEE:

Let me speak direct to that and confront you with what I take to be an intractical problem, and that is that once we have the lake ninety percent free of the fish advisories, which is pretty much at the cost of the other ten percent; namely the ten percent above the proposed site at the 37 bridge.

What I feel about that is that historically that is in the portion of the lake that has been most impacted and your solution retains that relatively unchanged during the years of improvement. It seems to me to be differentially not very just.

Why should it be the case of those people who live above that they must bear the burden of this solution for the supposed ninety percent who will benefit below? It seems to me that if you're going to have some kind of solution to the problem that you're going to have to have a way of equalizing the cost, both financial as well as other kinds of costs associated with the problem, with the PCB contamination.

What I would like to hear is the justification for why those people who live above must continue for the full period of twelve years to suffer, as far as the people who will use the lake, while the rest of the ninety percent get the benefit of a quicker return to normal conditions. I would think that the optimal solution is one that is equitable for everyone.

BY MR. ZELLER:

We do too. We looked -- I mean, you understand the alternatives that we looked at? We looked at remedies that potentially tried to address the problem in that 730 acres. Engineering fixes were either too costly or were likely going to be met with huge public opposition, and they did not solve the problem. It is turning out to be a very difficult problem to manage those sediments, while otherwise very costly and very difficult to do from the implementability standpoint.

BY ATTENDEE:

Nevertheless, those in the Twelve Mile Creek area are going to have to continue to bear the burden of that.

BY MR. HAYES:

Well, you seem to be suggesting that we should ---

BY ATTENDEE:

I have not suggested anything.

BY MR. HAYES:

The logical extension of your comments, then, is that we continue to expose the ninety percent of people in order to be equitable to those who are still upstream while ---

BY ATTENDEE:

It is nonsecular. It does not follow, sir.

BY MR. HAYES:

Well, your comment is well taken.

BY ATTENDEE:

Okay.

BY ATTENDEE:

Richard, if I may. I want to kind of build on what he just said. I think that he's got a real good point.

My parents, folks and I, live on Twelve Mile myself. We own property that joins Twelve Mile River above the Maw bridge area. I grew up right there right beside it, so I can go back thirty-five years, or thirty years, and tell you what's took place in that time period.

If I am not mistaken on this, sometime in early 1973, '73 or '74, that area, the PCB problem was identified way back then. It was known about then. And I want to ask one question that relates to your studies in 1990 or '91 in the goose neck area where you say that most of the concentration is. How deep in the sediment did you have to go to reach these levels that you are saying are high?

BY MR. ZELLER:

We had to go deep. It was below the fifty centimeters, it was below a foot easily.

BY ATTENDEE:

Below a foot?

BY MR. ZELLER:

Below a foot, easily, (affirmative nod).

BY ATTENDEE:

Okay. All right. I want to make a point here and I want everyone in here to take this point well. If you only had to go a foot and the whole entire 1970's that power house that you spoke of, the lower power house, was not in operation at all. That was in the 1980's. At one time, all of that sediment was dumped into that lake. Now, I can speak for the land that my father owns. That whole place became a mudflat, all the way across and all the way down to the Maw bridge below. And subsequent rains have pushed that right on down. I used to fish this area when I was a child and on up as a teenager, right on through, and there is three feet of settlement gathered in this goose neck area after all this took place, when they flushed that dam.

My biggest point is that, and I feel like it justified, is that ninety percent of those PCBs was contained behind that dam at that time. EPA knew that Lake Hartwell already had contamination in it, what had flowed over that dam. Now, if they knew that, was EPA not contacted or was never any consideration given to the fact that back behind that dam could have been dredged and ninety percent of the PCBs that eventually was dumped into that lake could had been removed right there. The Corps of Engineers, ---

BY MR. ZELLER:

We ---

BY ATTENDEE:

Let me finish. The Corps of Engineers, I feel like, knew that also. They went ahead and signed an agreement to let this guy -- and I have no problems with the man making money, but that is not the point. The point is that the Corps of Engineers and EPA both knew that this condition existed and knew the probable source of it in 1973. In 1984, '84 or '85, somewhere in that range, -- I am not exactly sure of the dates. But that is when that power plant was reopened and it was allowed to happen.

BY MR. ZELLER:

You are generally correct on the time. I would argue with the ninety percent figure. I think that at that point that I think it was more sixty or seventy. I believe that dam was refurbished in '83 or '85. I am just reciting that from memory. At that point in time, you had to understand that from 1955 on that plant was in operation.

BY ATTENDEE:

That's right.

BY MR. ZELLER:

So, as of 1978, PCB use had ceased at the plant. However, there were significant quantities of PCBs accumulated behind that boundary. I could dig through all the correspondence that I have, and most of it is State correspondence at that time, -- at the time period that you're talking about, in '74 and '75, the EPA program essentially consisted of water programs. There was really no Superfund in existence until 1980 when the law was passed, and then it took a year or so to get the program up and running at that point in time.

Again, most of the regulation done at that point in time was done at the State level and local authorities and EPA really did not enter into the formal investigation.

There have been some misrepresentation of facts here. EPA really did not start the initial investigation associated with placing this facility on the national priority list until the late '80s or the mid '80s, about '85 or '86 when they started doing what they called a preliminary site inspection.

And there were some people that picked up on that. I know that there was a professor over at Clemson that is sitting back right now saying, 'I told you so.'

And I will tell you that the interesting thing in our data which suggests that what we saw in the course, especially in that area that you're talking about in that goose neck bend area, we saw a pattern. As you move down, we saw 'nothing', 'nothing', 'nothing', 'blip', 'nothing', 'nothing', 'nothing', 'blip', 'nothing', 'nothing', 'da-da-da', 'nothing', 'nothing'.

So this would suggest basically 1980 and then also 1985 and then 'okay' and then 'nothing', 'nothing',

'nothing' and then all of a sudden Sangamo days. Now, the Sangamo days blip is far better than that release. How we interpreted, and is just a 'best guess', we interpret that it was a release of that sediment, this being the sediment from that impoundment.

BY ATTENDEE:

The agency, though you said that they didn't know about it during the '84 release of it, knew that it existed there; correct?

BY MR. ZELLER:

I believe that at that point in time, and this again is from memory, I have not gone back in on those files, that -- it was pre my existence, pre-existence to most of the people in this room. As far as working for the EPA, I believe that the approval was looking for them to state, 'Look, we are building this. Can we flush this?' There was never approval granted by DHEC, to my knowledge. And I think, I believe that that material was flushed without any approval whatsoever, albeit from DHEC or the EPA. You've got to appreciate that ---

BY MR. HAYES:

Let me add to that that there were no regulations in existence that would have required them to get that approval at that point in time and, as far as I know, even perhaps even still. A dam is not a permitted discharger. A dam on a body of water, it is a discharge from one body of water of the United States to another body of water of the United States. Permits are only required into bodies of water of the United States and not between them. So I am not sure that at that time, or even perhaps to this day, that any permit would be required or that any formal approval would have been required at that time for them to discharge.

BY MR. ZELLER:

Let me add to that, and is exactly right, that dams currently are regulated by the Federal Energy Regulatory Commission, FERC. I believe those facilities are classified as one of the river facilities, meaning that there really is no approval required. It is almost 'flush as you will.' EPA does not manage those things. DHEC is concerned with the water quality aspects associated with flushing. It was flushing large quantities of sediment, granted, but based on that, that is -- that seems to be the problem right there.

BY ATTENDEE:

I don't -- you know, I know all that is hindsight. I know that it is all something that we can't do anything about now. I just was concerned, my dad was concerned, and I am sure that other people up and down the lake are. But, you know, if -- if in '73 we knew that PCBs existed and then in '84 we were -- it was just allowed to happen, without any intervention from anyone, I just think that just seems a little bit benevolent on somebody's part not to pay it any attention.

I don't -- you know, I am not here to have a cure or a fix, I just want to point that the majority of this contamination -- I know that it was not ninety percent of it, I exaggerated that to make a point. But a great majority of that contamination had to come in at that time.

And you said that it passed by and was at the level of highest concentration.

BY MR. ZELLER:

There is a lot of contamination ---

BY ATTENDEE:

I know how much it came up. I did not come in here twenty years later and study it, I saw it. Okay? I saw it take place. So I don't -- the first release that they had at that dam, the picture that you have showing that release, ---

BY MR. ZELLER:

That was in September of '93.

BY ATTENDEE:

Whenever it was. In '84, the water came all the way to the bottom of that steel bridge that you took the picture of, Maw bridge. It almost came -- the water was right to the bottom of the steel bridge; and we're talking no rocks showing, nothing. And it was twice as deep, the sand was, the sedimentation. So what you showed there was nothing compared to that release. I mean, it is just minor.

BY MR. ZELLER:

Yes, Jean?

BY ATTENDEE:

I have two questions. One is, are there any families that you would be able to identify in your survey who are dependent upon the fish that come from the lake?

BY MR. ZELLER:

There was -- I don't believe names were part of the questionnaire.

BY ATTENDEE:

No, not names but just people who said that they were dependent on ---

BY MR. ZELLER:

I do know that in that arm, that in that area, that there were several fishermen, or fisherwomen, if you will, that were interviewed more than once. What that suggests to us, and you can make your own conclusions, but what we took that to mean is that these people frequented these areas and they fished it quite regularly. Now, whether you want to call that subsistence fishermen or not, I don't know.

BY ATTENDEE:

My second question is, EPA is also required to have an assessment, in addition to a risk assessment, that is health ---

BY MR. HAYES:

That is connected with the Superfund.

BY ATTENDEE:

That is mandated as a "must", and that's been conducted?

BY MR. ZELLER:

It is mandated, yes.

BY ATTENDEE:

Could you just briefly summarize what the findings of that were as it relates to the impact on the health population in this area, specifically taking it to the known effects?

BY MR. ZELLER:

You know, I haven't -- it's been a while, quite frankly, since I have read that and all the conclusions are not real fresh in that mind.

BY ATTENDEE:

Are you not required to take that into account?

BY MR. ZELLER:

Yes, we take that into account.

BY ATTENDEE:

How do you take it into account?

BY MR. ZELLER:

Well, we look and see what we came up with and what the risk assessor came up with and -- and I did compare that back then, and there was no major differences. We looked for what I looked for -- and what I looked for personally. We disagree with another agency who likely knows more about fish migration than EPA does. So these people look at the differences and we did look to see if there was something that we missed. But to the best of my knowledge, they did not disagree with large amounts. They were fairly consistent in their conclusions.

BY MR. HAYES:

The only thing that I might add to that, Jean, is that South Carolina is one of the states that has a cooperative agreement with EPA to prepare the health assessments. The Department of Health & Environmental Control actually prepared it instead of the ASTR. If you have specific questions about it, you might call over to -- I guess Lovis Howell would be the contact or Dr. Moreno with Health & Environmental Control, whose office is responsible for preparing health assessments in the state of South Carolina under a cooperative agreement with ATS.

BY ATTENDEE:

I guess my point is that there are other known health effects besides cancer.

BY MR. ZELLER:

Oh, yes, there are.

BY ATTENDEE:

Could you briefly -- just in terms that people in this room can understand, can you maybe just describe what those known health effects are?

BY MR. ZELLER:

It is reproductive.

BY ATTENDEE:

Such as?

BY MR. ZELLER:

It's not something that I can just jump into. I do know that it involves inability to reproduce. I am not a toxicologist by any means, and I don't claim to be, but I would be happy to follow up on that question.

BY ATTENDEE:

Thank you.

BY MR. ZELLER:

Yes, sir?

BY ATTENDEE:

First of all, I want to tell you that I commend you for an outstanding study, very thorough, and I appreciate you presenting it as you have.

From my perspective, it appears as though 2A is a very logical approach. The fish fence, though commendable, may have some very inherent major problems in maintaining it, so I would personally set that aside.

But I would recommend that 2A be amended slightly to make it a little more interpretable for the layperson. For the layperson, so that when they go to the boat launch and see the advisory on the lake that it doesn't say 'Don't Eat the Fish' but that it would say 'Do Not Consume Over X-Number of

Pounds of Fish Per Year, Per Individual.' Then as you exercise 2A, with the future studies and the sediment decrease and the impact, that number could be altered on all postings. It may begin at don't eat more than forty pounds per person per year and then become fifty pounds and, then, you know, 'go wild, eat all you want to.'

BY MR. ZELLER:

That is a very good comment. In fact, a neighboring state, Georgia, has adopted that. They adopted the risk assessment type program with a fish advisory. They have, I believe, all different categories ranging from unrestricted to 'eat as many fish as you want to', to 'do not eat even one single fish.' We have -- Mike Alexander is probably the more appropriate person to address this, but I understand that -- we have talked to people with the state and we have asked them, 'Do you anticipate changing your fish advisory?' And they said, 'not at this time.' They didn't say, 'No, we are never going to.' That is a comment that is very good.

I like the more informative-type of advisories, such as the ones that we are going to. Something that we could bring up with the state and suggest

to the state. I am sure that the state is very
responsive, it is their advisory.

BY MR. HAYES:

I am Richard Haynes with the State DHEC. We are looking into changing those advisories. We are waiting more to see what comes out of this, what the problems with the remediation are going to be, before we make any changes. But that is a concern, that it is vague.

BY ATTENDEE:

We recognize that the problem will diminish as the years go on, whether there is a fence or not.

BY MR. HAYES:

Right. We will update that, as need be. That is our goal, to remove the advisories from the lake.

BY MR. ZELLER:

Back over here (indicating attendee).

BY ATTENDEE:

What assurance do we have that -- (inaudible) -- the fish fence will be removed after the five years or the limit increase -- (inaudible).

BY MR. ZELLER:

Right. Richard, do you want to address the first part of the question?

BY MR. HAYES:

I guess you're talking about whether there is an FDA limit or where we set a level lower than the FDA limit?

BY ATTENDEE:

Right.

BY MR. HAYES:

That is an issue that DHEC is discussing right now, namely because it was one of the outcomes of the study in the ATSR study. It shows that there is a risk level associated even with the FDA limit, is a risk too. We haven't decided yet whether we would release or remove the advisories if it reaches the FDA limit; and there is a good possibility that we probably wouldn't, as it stands right now.

BY MR. ZELLER:

And to address the second part of your question, yes, it is going to be a semi-permanent structure. We have every intention of doing that.

BY ATTENDEE:

Do you anticipate this fish fence to be inplace for approximately five years?

BY MR. ZELLER:

We are looking at ten or twelve. That is our best guess. But we would say -- but that is something that we can change. That is why when we install this fish fence, or if we install this fish fence, we're going to continue monitoring the fish at the six locations, including the sediment. When we have notable changes at consistent decreases that stay below this number that we have chosen to call protective -- if they stay there for three, four, five years, until we -- then, yes, we are going to pull that thing out.

See, the thing that is interesting in this, if you go back -- the gentleman over here sitting against the wall is right. There have been fish studies conducted out there as early as 1976. When Mike was putting together his work plan, he summarized all that, from '76 to where we are now. There has been no obvious trends in PCB concentration in fish. They went down, they went up. They went down, they went up a little bit, they leveled out, -- you can look at the graph. So we are not entirely convinced that if we just walk away today that these fish are just going to automatically -- or automatically assume that they will continue to improve. We expect that they will.

But monitoring is the best method that we have to verify what is going on.

Yes, sir.

BY ATTENDEE:

I too would like to commend you for your presentation. I received your mail, answered it and mailed it to you.

BY MR. ZELLER:

Thank you.

BY ATTENDEE:

My concern is up the river at the plant site. I am continually hearing of events that are occurring up at the plant site and today I think I heard the most unusual one of all. Schlumberger called in the media today and announced they are closing the plant.

BY MR. ZELLER:

I had not heard that.

BY ATTENDEE:

They are going to build a different plant in another locale.

What would priorities be for the OU1, et cetera, et cetera, and the effect on OU2, which this gentlemen here says is still coming out of the soil and land into the water?

I did mail back my comments and I voted for 2B, because of this.

BY MR. ZELLER:

Our investigation, OU2, determined that the satellite sites are isolated. We looked at the tributaries that are located -- I mean it is a very complex watershed.

You will get all of those tributaries into Twelve Mile Creek, they are located near a dump site. We found no sediment contamination in these tributaries and no PCB contamination in the floating biota; which is fairly normal. There were some of those areas that tended to be somewhat impacted, probably due to erosion.

The continuing source that they're talking about is that there is some existing water -- what they call an NPDES Permit, National Pollution Discharge Elimination System, that allows the current industry to discharge water to Permit level of the state and EPA.

The discharge up there in Town Creek is continuing, from two Permits, as I understand it. One from Cornell with the lease of that property from Schlumberger and there is a discharge associated with the old outfall. Okay?

Schlumberger had an old wastewater treatment plant in operation there during their heyday. They had, it is my understanding -- and, Bernie, tell me if I make a mistake here -- a wastewater treatment lagoon to collect wastewater from those discharges. Schlumberger had applied for and has received a permit from DHEC to build a brand new, state-of-the-art treatment plant, decommissioned that lagoon and take appropriate mediation, as necessary, for the sludge in that lagoon. That Permit has been issued by DHEC just recently and the facilities shall be built by January '95.

<u>BY ATTENDEE:</u>

On the plant site?

<u>BY MR. ZELLER:</u>

On the plant site. Is that correct?

<u>BY MR. HAYES:</u>

Let's back up a little bit here. Schlumberger is the RP for the site because they acquired the property after any release of PCBs through an outfall occurred or after any PCBs were used at the plant. Okay, let's make that clear.

Sangamo operated the plant during the time when the releases occurred that caused all these problems. Schlumberger acquired the plant and acquired the Superfund liability later.

Now, Craig is exactly right. There are two NPDES Permit discharges at the plant, ongoing. Last year sometime there were some measured releases of PCBs at very low levels in those discharges that violated the Permits. The State has responded to that and has them under enforcement in order to rectify that situation. The new construction that Craig has mentioned is, I am sure, in partial response to that.

The idea that that plant is closing is news to us. We have no knowledge.

BY ATTENDEE:

It just occurred today.

BY MR. HAYES:

The only thing I will say in response to that is that it doesn't matter if the plant is opened or closed, the remediation of this site, whatever remediation that is done under OU2, will go on regardless.

BY MR. ZELLER:

Now, would you like to say something?

BY ATTENDEE:

As a matter of fact, it is a coincidence that Cornell announced today that their business is up, their employment is up, and they are in a four-year-old building and they are going to be building a new plant. So as of -- they're planning on by the end of the year having a new plant up and running that is two miles away from that current plant. But it had to do with the fact that their business is up. Cornell has nothing to do with the cleanup.

BY MR. HAYES:

That sounds to me like it is actually good news rather than bad. If you have a company in the area that is improving their physical plant and continuing to provide employment and all that sort of thing. But that's not EPA's concern.

EPA's concern is that the existing site at that plant site will be cleaned up regardless of whether that plant is open, closed, torn down, expanded. Whatever happens there, the remediation at the plant site will continue just the same, and that's the important thing.

BY ATTENDEE:

I hope that will be the attitude.

BY MR. HAYES:

The only obligation is to Schlumberger. So the closure or the moving of the plant to another locality will not have anything to do with Schlumberger. They are just two completely different independent things.

BY ATTENDEE:

I personally am in favor of 2A but I had a couple of other questions. It seems strange to me -- the biggest question is hybrid bass, -- and I am not in favor of stocking hybrid bass. However, did anybody ever give consideration, since it is the major problem and since we stock hundreds of thousands of them every year, at a considerable expense, that we would not stop the stocking of the bass if that is the biggest problem and possibly enhance the population of another species that does not cause this problem? It wouldn't cost a lot of money.

BY MR. ALEXANDER:

Yes, we did give that consideration. We did discuss it with the South Carolina Wildlife & Marine Resources Department, Georgia Department of Natural Resources. And basically hybrid bass, like I pointed out to you, not only it is a problem because it makes up half the fishery in the lake, it is also a tremendous asset because it make up half the fishery in the impoundment.

I don't know what any of you'all realize about the economic value of a fishery like that in this impoundment is. But it far exceeds a million dollars, I will flat tell you that. If you can walk into any Wal-Mart store or any K-Mart store and walk back to the sporting goods department and look around, you can see that the community in these areas, all the people come in and the guides that take those people out and all that, it is a tremendous asset around this lake. And they do not feel like, since you could put an advisory on the fish, requesting people not to eat them, although there is 120,000 pounds of them being harvested, the things that we might do, they supported the 2B option because they saw that as an investment of a million dollars spread out over a period of time. It's not like a million dollars a year, it is a million dollars spread out over time, that would help them conserve the sport fishery that was worth many times that to the local community. That's why they selected that option.

<u>BY ATTENDEE:</u>

And my second question. The fish fence wouldn't prevent forage fish from passing through it?

<u>BY MR. ALEXANDER:</u>

No, sir. Probably not. We would be looking at the hydraulic loading on how small we could make the openings, as to what size fish we could exclude. I wouldn't expect to be able to make the opening small enough to exclude little tiny fish, you know. Most of the -- the smaller the fish, the less PCB concentration, in general; you know, and stuff. So we're not quite as concerned. And then, in addition, our forage fish samples that we collected up there mimic the same as largemouth, catfish, crappie; stuff that we've collected over time. It is not like forage fish move up in that area, get highly contaminated, and then moved down to spread it to the other fish as much. I am not saying that it doesn't ever happen. But if it did, then the largemouth, catfish and the other fish that feed on the downstream would also have levels like the hybrid bass. We feel like the hybrid bass actually move up into that arm of the lake and get contaminated.

BY ATTENDEE:

Isn't it possible that -- I always thought that herring, shad moved quite a bit and that's why the hybrids and strippers moved.

BY MR. ALEXANDER:

Uh, -- (pause).

BY ATTENDEE:

Is it not possible that if you construct a fish fence and all the forage fish move up into the area that is already bad, that those fishermen won't have any hybrids to catch anymore. They'll be catching largemouth bass and everything and it could have a significantly higher level of PCBs because of the abundance of forage fish up there and they are not feeding with the hybrids any longer.

BY MR. ALEXANDER:

No, I don't think that would occur. Basically -- the forage species -- any species of fish that's out there, you know, they're -- some of the forage species do move quite a bit. Shad and the blueback herring do. Gizzard shad, particularly the larger ones, tend not to move quite as much. As they age, they change their feeding habits and begin to feed along the bottom and stuff rather than -- and, of course bluegills is another one, and it stays very close to where it was originally. Those two do move around some. But even if they could move by this barrier, I don't think that that would particularly keep them in the area or increase the abundance tremendously in a particular area.

Normally there is natural movement throughout the lake but there is only so much of an area of the lake that will support so much -- it reaches that point, you know, and then it adjusts itself somehow. Like when we sampled up there, you know, up in that part of the lake, we sampled for them consistently. We get about two hundred pounds of fish per acre and, you know, you couldn't sudden cram four hundred pounds of fish per acre in there and have them survive, for periods of time. It just won't support that kind of concept.

<u>BY ATTENDEE:</u>

One other question. There is a lot of traffic, from fishermen and residents, whatever, up the Keowee River arm of the lake. At several other meetings that I have attended, I have asked why haven't you tested up there because there's all the water flushing out of Keowee Dam, which would flush that area out. Nothing, to my knowledge, has ever been done. If you're spending all this money, could you not expand testing into the Keowee River arm?

<u>BY MR. ALEXANDER:</u>

To be honest, I can't answer that question good myself. I will let Craig answer it.

I can tell you from my perspective, of collecting fish, that when you collect fish from certain sections of the lake that we do see differences.

But once you get up into the Twelve Mile Creek arm and the Keowee arm, right there, I don't know that I could feel comfortable in saying that we collected fish, unless you collected something that was real sedentary, like bluegill. You might be able to collect them and say, 'Yeah, I believe that they live most of their life over here.' But the largemouth and things like that, I don't believe between those two arms, that close together, that I could do it collecting fish. I could certainly do it putting out corbicula baskets and perhaps we should incorporate another station upstream of there and do something like that to see if there's any contamination as it comes down there. But as far as sediments, I don't think that I could do that.

BY MR. ZELLER:

That's a possibility, and maybe we could do that fairly inexpensively.

BY ATTENDEE:

Personally, I would like to see the numbers. And my last question is, why not construct a fish fence just at the mouth of Twelve Mile Creek? That would eliminate the majority of the flow, that fifty-two percent, as it comes down the Keowee River, from the discharge from Lake Keowee. And it would probably reduce that number from ten percent to about two percent and affect far fewer people and have far less costs associated with it. Because, I can't imagine keeping that thing clean enough where that -- that you could construct it. But, you know, the way that the Corps manages the lake and all the debris every time that the lake level changes, it is going to clog that thing up. I just don't see it working.

BY MR. ZELLER:

I can answer that. We are taking into consideration the natural constrictor at the bridge with the expanse of 500 feet. It is a very good place, engineering-wise, to place it.

Secondly, as you go up -- you can trace it. If you go up from Twelve Mile Creek on, right there where it meets the Keowee River, it is approximately 1,600 feet in width and it's very difficult there because there's nothing to affix onto. It would be very expensive.

If you go on further, the next big bridge is 133. The 133 bridge happens to be upgradient of the SD107, which is Mike Alexander's so-called source area of biological samples. If you place it at 133, you'd accomplish zip. Does that make any sense to you? You'd accomplish absolutely nothing. Plus by placing it at 133, you always have some contamination there below 133 that, on the average, is 1 ppm and the fish would still be getting exposed to those.

So based on engineering considerations and also that 37 bridge, for all practical purposes it represents the southernmost boundary of that site.

BY ATTENDEE:

There is another restricted area just above that, Twelve Mile boat ramp. I can't imagine that it would cost a whole lot more if it is going to be constructed primarily of chain-link fence.

BY MR. ZELLER:

The Twelve Mile Creek boat ramp, that is where Mike actually put his boat in to go out and sample.

BY ATTENDEE:

Thank you.

BY MR. ZELLER:

Yes, sir?

BY ATTENDEE:

I would first like to say that I endorse 2A as the best possible solution, but not as you have formulated it in the fact sheets. I think that there is a better way of conceiving 2A, the institutional control solution, which is really aggressive. But I think that you are just pouring money down a sinkhole with this. I will address that in a second.

To develop the truly aggressive educational campaign that would benefit the population in a far more comprehensive way than with this narrowly conceived and, to my mind, very nit-picking discussion, about percentages and that type of thing, I think that you would get a much greater public benefit by using the $4 Million to address the issue of educating the population about the nature of the problems.

After all, with cigarettes and alcohol and the various other things, it seems to me to be the easiest route, and I think the most effective.

So I would really urge you to think very, very carefully about an aggressive educational campaign. A far wider benefit that just putting up some kind of structure for the 37 bridge.

About that, and if you will forgive me if I say that I think there should be some safeguards because, we have already established, that this is never far from the engineers excitement to try it out; because it is a great challenge to design capacity. But I think that the social and health problem is a different kind of problem that should not be addressed by one's interest in whether we could do this 'new thing' or 'wouldn't it be fun if it works?' I think that there are social consequences that far exceed that benefit. I would just like to address that to you now by way of another consideration of 'Why choose this at all?' When one of the things that I can imagine might very play a somewhat unconscious role is that it is a damn interesting challenge for an engineer, but does it address the problem?

BY MR. ZELLER:

We feel that it does.

BY ATTENDEE:

I, myself, am rather skeptical about it. Furthermore, it is going to take a year to build the thing and I suspect that during that year that there will be no boat access through that passageway.

BY MR. ZELLER:

That is not true. The last comment, at the very bottom, we could build -- (reading): "in the design, installation and removal of this fish fence, we will minimize to the extent possible any disruption of normal everyday lake usage." That is from the Corps of Engineers. At their request, we put that in there.

BY ATTENDEE:

I understand once the fence is established, but including installation, design and all the time to do that.

BY MR. ZELLER:

We would be met with major opposition if we told the Corps of Engineers, 'Hey, look, for a year, EPA, you can't come in there and we're not going to allow any boating.' We're not out to displease anybody. I hope that you realize that. We're here to receive your input. We are not here to make the Corps upset with us, by restricting access to that arm of the lake.

This is something that Mr. Austin mentioned earlier, that it has been quite -- at this point in time -- quite an endeavor. It's been quite a harmonious relationship between numerous government agencies that normally don't get along very well, et cetera, et cetera. But this seems to be a case where everybody seems to be on the same wavelength here. Numerous government agencies, both sides, think that this is the prime alternative, the best alternative of the ones that there are. And there are a lot of Game & Fish that have managed fish resources for their entire career who think that this can be done.

To address your concern about some of your thinking that some engineers think that this is going to be his career vault by designing this fish fence, (negative gesture).

Superfund has been around -- yes, Superfund has made mistakes since 1980. But when Superfund was first founded, we had no earthly idea how to treat -- how are you going to treat contaminated soil, that's contaminated with PCBs or other hazardous substances? If we had said, 'Oh, boy, that's pretty tough. We can't go any further. We might as well just quit. We don't want to challenge our engineers.' Where would we be now? We would be out of business, it'd be at ground zero. We've learned a lot. We've made mistakes and we've stumbled but we didn't fall completely down on our face and quit.

I mean, this is like -- I fervently believe that this is an engineering problem. If it turns out to be a problem that we cannot actually solve, we will not do it.

BY MR. HAYES:

Let me also say that I am not a young engineer, that I am an old engineer. And I am not very anxious about accepting new challenges that may or may not work.

I understand your point. I think that it is a point well-taken. I also think that your point about examining the use of funds for an extended or an innovative educational campaign is exactly the kind of input that we came here to get. I think that that is a very positive suggestion and I think that we need to go back and think about that as a potential new alternative -- well, maybe not a "new" alternative, but as an alternative that some of you'all have talked about. That's exactly the kind of thing that we came here to hear. I want to say that that strikes me as a very positive, very constructive suggestion and I think that it is something that we need to look at and think about.

BY MR. ZELLER:

Yes, sir?

BY ATTENDEE:

I just want to give my opinion. I think that Alternative 2A would be money very wisely spent, especially if you do make it more aggressive and incorporate some of these idea. Even get specific like this lady was talking about, that if there is any identified health risk that should be outlined, like the reproductive risk, cancer risk, in brochures. And that these brochures should be put around to all the bait stores and should be made widely available.

I have a lot of concerns about this fish fence idea. Let's just assume -- I will assume that it will work perfectly. Even if it works perfectly, I am very concerned about the safety issues. I don't know -- you know, I have been a recreational boater on Lake Hartwell since 1985. In the real world of recreational boating, you get all kinds of different people driving these highspeed, very powerful boats, on the lake. That is one of the most congested areas on all of Lake Hartwell. If you restrict boat passages between two of those bridge abutments, whatever they are called, columns, then you're going to have people congested on either side of that bridge waiting to get through. And you're going to have people that have had a few too many beers and they are going to be jockeying for position to pass under that very restricted area. I see that as a major, major safety concern. Even if it does work perfectly in keeping the fish out, then also with what you're saying with some debris collecting on that fence, that a boat with a draft deeper than three feet, and there are boats on the lake that have a draft deeper than three feet, then you're going to have problems getting through there.

BY MR. ALEXANDER:

Then those boats that have drafts deeper than three feet can't cross under that bridge. That's a very small bridge. Sailboats and things that are down the lake can't cross under that bridge. I mean, it is just such a small area.

And the other thing, about it being congested, you're right. I believe that it would make it more congested and stuff, and that is a concern. We certainly would not want to make it to where it was a hazard.

BY ATTENDEE:

That is my point. I don't see how to avoid it being a hazard if it is going between two of those columns.

BY MR. ALEXANDER:

Well, it might be and it might not. I have never sat up there and counted the boats that went under it. But I do know that it is such a narrow restricted place, with the land coming out on the ends, that it slows boats down as they come into it. But I am not sure that -- people can sort themselves out better than you might imagine.

And we certainly intend to build the top line of it like a buoy line, to where if someone actually ran into it that it would have give. But as far as the top of it itself, it would be floating up and down to where, you know, someone could run into it without -- I am not saying that they might not put a scratch on the boat, but it would not be a solid structure that would kill them or anything like that.

<u>BY ATTENDEE:</u>

To expand on this, I have a concern as this gentleman does because I go there once in awhile and I see the way some of the guys go tearing way up through there.

However, the other problem that is going to cause congestion, once you have those fish fence and the fish try to migrate upstream, now they're not going to get up there. They are going to congregate at the fish fence. Now, where am I going to fish? Just like everybody else, I am going to fish right there. And you're going to get all kinds of people fishing there, in addition to the people coming through.

BY ATTENDEE:

That will create a lot of hot tempers.

BY ATTENDEE:

I mean, it is something that you need to consider.

BY MR. HAYES:

It is good to hear that you'all are thinking along these lines because, frankly, we were up there today and we were talking about very much the same things.

Even though this gentleman might look at it as us playing games with design, I want to say that there is something of a challenge there. That if we do proceed with this alternative -- and at this point it is only proposed, -- then that will in fact be the challenge, to see if we can design something that not only will not be a safety hazard but won't cause these kinds of problems or things.

We talked about the same things up there today.

So, you know, we're -- it's good to hear that we're not making problems up for ourselves but that those are real problems and real concerns that you'all perceive as well. We will see whether or not we can address them.

BY ATTENDEE:

I have a question for Mike. It is a two-part question and I will ask the second part as the first question.

If the fish fence goes in, what happens to the fish that is trapped upstream over the next twelve years?

BY MR. ALEXANDER:

Basically, in any candidness, I don't foresee the fish fence as trapping the fish upstream as much as preventing the fish from downstream moving up. That is basically because I think that the design of it, like a fish weir, will guide the fish away and in a downstream direction.

And I don't know that -- I don't know that you could do that upstream, because the water coming down. Because, you know, the top part would have to be loose and able to give. You could do that in the downstream direction. But the upstream would be much more difficult. But the fish that are upstream, you know, whether it did trap some of them up there -- and according to our model -- (pause).

And let me say too, about these models. These models are based on the information that we've collected historically. They were put into mathematical models to say that the sediment loading coming into the reservoir for the past seventeen years has been so-and-so. Let's say that the loading is based on hydrology. How much rainfall we've had in the basin, based on land use up the creek, things of that nature. The contaminants in the fish and in the other biota that the fish fed on as it moved up. We put those kinds of things in the models, and that's based on historic samples.

Now, if the hydrology is not the same in the next twelve years, on average, or if the land use is not the same over the next twelve years as it has been, then some of these parameters change, you know.

So part of the reason that the fish fence was even considered beyond this 2A in the first place is that it would be a semi-permanent structure that you could put in and if it was not successful it still would provide those benefits.

But those fish upstream, that twelve years that we predicted, they would be continually contaminated with PCBs at levels above two parts per million for the twelve years, or perhaps longer.

BY ATTENDEE:

That was my next question. If you're doing this to limit the PCBs in the other ninety percent of the lake, it only stands to reason that they are going to increase in that ten percent or whatever that percentage turns out to be. If those fish die and those PCBs are released, there are water supplies taken out of that part of the lake and that could be a real problem for increasing the PCBs in the Central-Easley Water System.

BY MR. ALEXANDER:

No, sir, not in the least because there is nothing that we are doing, nothing that relates to the fish or anything that would be done in Hartwell Lake that would relate to the water system.

(SEVERAL PEOPLE TALKING AT ONCE)

BY COURT REPORTER:

One at a time, please. One at a time.

BY ATTENDEE:

I am just asking. If you're going to limit the PCBs in the water in one part of the lake, it only stands to reason that there's got to be an increase.

BY MR. ZELLER:

Under the No Action scenario, even with this barrier in there, you are having an existing sedimentation. We are not stopping that. The stuff is being buried. Our sediment concentration is going to decrease.

Now, above the fence, for the twelve years it is increasing in concentration.

Below the fence, we are predicting an accelerated decline.

The problem with the Easley-Central Water is completely unrelated. You are all the way up the Twelve Mile Creek drainage. As Mike was saying, actually separated by three small impoundments. You have got the Twelve Mile Creek drainage, and then the other two impoundments. There is no way, based on current samples of that area of sediments mentioned in the Easley-Central area, that we could not find any contamination in the fish and it is just not -- the damage is not at the Easley-Central Water District. There are no appreciable quantities of PCBs entering into that system.

BY ATTENDEE:

It is in the distribution system leaving the plant.

BY ATTENDEE:

(Inaudible).

BY MR. HAYES:

I see what your question is. Let me say that if you -- right now, if our theories are correct, there are fish in the Twelve Mile Creek arm that are becoming contaminated and will move out into the rest of the lake. That's what we are talking about. But it is possible that what you are perceiving may occur. Not that there would be an increase in the contaminate levels of fish but that the high levels would persist for a longer time; because you don't have any PCBs transferring out of the Twelve Mile arm in the fish flesh, as you would have if it were not there. That is possible. This fish fence there will bring it down. You might have higher concentrations but ---

BY MR. ZELLER:

I would ---

BY ATTENDEE:

That's fine, I will take your word on that. I have just been trying to find out, because it looks to me that we're stuck here with the higher levels for a longer period of time, that they then might get higher.

BY MR. ZELLER:

No, it won't be any worse than it is anyway. Let's get back to the question that this gentleman asked before. What we're proposing is that for people upstream of the fish fence that the situation for those people would be much better.

BY ATTENDEE:

All the more reason for that massive educational campaign. I can't claim the statistical -- but from the observations that I have made in the area of the lake that we live, there are lots and lots of people fishing off bridges and from embankments; frankly, African-American peoples by and large, from my observations. And it is part of our responsibility, given the facts of the matter, the usage of the fish from the lake, to, uh, engage in a massive educational campaign to help them be able to protect themselves from exposure to this. I am sure that people aren't eating the fish because they happen to like it, but because it's important to them in their daily, uh, ---

BY MR. ZELLER:

That is what we have to find out as a part of this ---

BY ATTENDEE:

I find that ---

BY MR. ALEXANDER:

For those of you who may not have heard the data or heard the stories about the Easley-Central, over the past few years there has been sampling in the

Easley-Central Water System that at times has shown very low levels of PCB contamination.

Sampling during the same period doesn't show any contamination in the water treatment plant or, in fact, even leaving the water treatment plant in the water itself. But then if you go out somewhere within the system and take a sample, sometimes you then get low level positive results.

As Jeannie indicated, that means that somewhere in the distribution system the drinking water is picking up PCBs.

At this point in time there has never been a result, a positive result at a tap, a drinking water tap, or at some point of use that exceeds the Safe Drinking Water Act, drinking water standard.

There have been a few at fire hydrants, when they go to the hydrants and flush them real vigorously and then took a sample there has been occasional results in that situation that were higher than the drinking water standard. But there's never been a sample, at least in the period of sampling that we have, that was higher than the drinking water standard at a point of use.

So what we have done is we have asked Schlumberger, and they have agreed to do this, to pay for continued monitoring of the Easley-Central Water System and some of the other water systems that are connected to that system in order to make sure that those levels of exposure don't go up. And I believe that that program of monitoring is already underway.

BY ATTENDEE:

Yes, sir.

BY MR. ALEXANDER:

They are working with the Easley-Central to pick a sampling point and have a quarterly program sampling, and those results will be made available to DHEC and to EPA. We're just trying to make sure that what we've seen in the past few years, which is very low levels below the drinking water standard at points of use don't get any higher and that they go lower as time goes on. So those systems are being monitored on a regular basis.

We didn't take an Enforcement action on it, although we would have been prepared to if the monitoring hadn't been taken up by somebody. Schlumberger agreed, voluntarily, to do that monitoring; in fact, it is ongoing.

BY ATTENDEE:

You mentioned -- well, I think that you have answered my question. The fishing is going to deteriorate markedly. Have you ever given a thought about stocking us some fish up there then? I will take my chances, because PCBs, it's a ridiculous problem in the first place.

BY COURT REPORTER:

It is a what?

BY ATTENDEE:

It's a very exaggerated problem that has gotten totally out of hand and is being handled by a bunch of hysterical people. Over nothing! You could eat that fish every day of your life and you're not going to get hurt. But you're -- for attempting to help other people, you're going to -- the fishing is going to deteriorate.

I would like to propose a recommendation that you consider stocking that part of the lake.

BY MR. ZELLER:

We will give that every consideration.

Yes, sir?

BY ATTENDEE:

The question that I -- I assume that they stock the hybrids and strippers as fingerlings.

BY MR. ALEXANDER:

Yes, sir.

BY ATTENDEE:

And they're starting to migrate at some point in time and they will continue -- well, I guess they migrate at an early enough age to go through the fence unless -- I am curious as to what size fence you're going to end up trying to keep -- what size fish are you going to try to keep out, three pounds, ten pounds or ---

BY MR. ALEXANDER:

We would hope -- I would think that a structure inplace -- you know, that's not too difficult to go up there and figure out. You know, we can go up there and take a velocity measurement and figure what kind of holes that you have to have to ---

BY ATTENDEE:

What size fish is permissible to be up there as far as hybrids? I assume that these hybrids are predatory and they are kind of a popular food chain in the lake.

BY MR. ALEXANDER:

That's true.

BY ATTENDEE:

And these predators go up there, and they probably eat each other too. So the little ones go up there and get loaded up and bring them back down the lake anyway.

BY MR. ALEXANDER:

No, sir. We would probably try to exclude fish that are up in the range of twelve inches long, which would be hybrids in their first full year of life; you know, after they are a year old. That would be the range of fish that we would try to exclude. Fish less than, say, ten or twelve inches long, probably we could construct a barrier to keep them from migrating back and forth through the barrier itself, you know.

When fish are that small, they tend not to pile up concentrations of PCBs at nearly the same rate. You know, just collecting fish that are ten inches long and then fifteen inches and twenty inches, so forth, it tends to increase in both size and time that they spend in a body of water and consume things that are contaminated with it, you know. So when those fingerlings are stocked, and certainly they would not stock them above that fish area. They would stock them lower than that in the impoundment. You know, some of them might go through there and some of them might make it back out of there that same year. Then hopefully the next year they would be excluded from then on, you know.

BY ATTENDEE:

So you're saying probably a three-inch square opening or something like that to stop a twelve-inch fish that -- I mean, I am just trying to get an idea of how it would ---

BY MR. ALEXANDER:

When you start getting into twelve-inch fish, some of the studies indicate that they try to build it in elongated fashion, about two inches wide by six inches tall, to get more opening this way, so that you don't have as much space.

Now, if we built one, I don't know that we would particularly take that approach, because it would be more expensive to actually construct something like that than to buy material that is already available and is just made, you know.

It might have something in the form of a two-inch opening, yes.

BY ATTENDEE:

In the risk assessment, have you considered occupational injuries that might be associated with the construction and maintenance of that fish fence, including maybe traffic.

BY MR. ZELLER:

We looked at -- the construction effectiveness criteria evaluates the potential impact for, say, community, harm to workers, whatever it may be. That -- as far as post-graduation, as far as risk assessment, the -- it is my personal opinion that the very time that we go ahead and injure somebody or perhaps kill them because of something that we put on the lake it's an immediate failure. There's no doubt about it. You know, we are -- we are going to design this thing so that we hope that that doesn't happen. And we think that we can. The very last, absolutely last thing that we want to happen is for us to be meddling around, as some people might call, -- for EPA to be "meddling" around with the design and you've injured somebody.

BY ATTENDEE:

Post construction?

BY MR. ZELLER:

Post construction.

BY ATTENDEE:

How about during construction, has that been considered much?

BY MR. ZELLER:

About during construction?

BY ATTENDEE:

Yes.

BY MR. ZELLER:

Yeah, we've looked at that. That is part of criteria as far as, you know,relative performance, worker effectiveness, which takes into effect workers, uses of the lake during the construction process and that type of thing. Say during the one-year type thing.

And relative performance during the construction of this thing, those are problems that we can handle as far as ---

BY ATTENDEE:

I have one other question.

BY MR. ZELLER:

Okay.

BY ATTENDEE:

Considering that there are fish advisories for other parts of the state, are there other things perhaps that we can do, something ---

BY MR. ZELLER:

In this lake, yes, there has been. Part of the initial investigation that Mike conducted, there was -- he mentioned it earlier in his presentation. There was a priority pollutants done at the six stations and we looked at 144 things that EPA calls environmental pollutants, inorganic, organic, semivolatiles and all that; and PCB was the sole one.

BY ATTENDEE:

Thank you.

BY MR. ZELLER:

Yes, sir?

BY ATTENDEE:

I am here to present the findings of the Technical Committee of the Lake Hartwell Association. I think you've seen some of our newsletters and articles that we've produced and distributed, in the last year substantially.

Our Technical Committee has diligently reviewed the several volumes of the administrative record and chewed over each of the other publications that have come out. I can tell from some of the questions tonight that a lot of people have not taken that opportunity, because a lot of the questions are answered in that administrative record.

Our Committee reviewed all the alternatives and felt that both ends of the spectrum were probably not going to be what was appropriate. We spent a lot of time agonizing between 2A and 2B ourselves. We shared a number of the concerns and questions that have been raised. In the interest of time, I won't go back through them. You know, will the engineering work? Will it be too much hydrology? Will there be too much garbage? How are we going to dispose of that garbage, and at what cost? Things of that sort that have already been chewed over. So we concluded and our recommendation was 2A; and it's apparent that a lot of people have come to that same conclusion for that reason. Mike, if your engineers feel confident about it, I don't think that our people would object; but we think it is evident that 2A was imminently do-able. In the area of the continued sampling and educational program that would be funded under 2A, we would like to see sampling go on to not just use the whole place and prepare them the way that they have been but to use some of the advisory information on further removal of the belly flap and skin, vein along the side and all. Some of the stuff that has been over the last twenty-five years in the Great Lakes, where it was a problem more in the lakes than it is here. And we would like to see some of the cooking techniques applied in the sampling program, so that some of these results that have been reported elsewhere -- and they have published some literature and I've got some here -- where proper preparation will reduce the overall concentration anywhere from forty to ninety percent. Then another forty to eighty percent of that can be removed by cooking. So we're talking about being able to take stuff at the two part level and possible get it down in the range of the .05 to.1 range for what we eat. We'd like to see that kind of stuff included in there as well.

We had requested and thought it possible to get what we consider very meaningful to the average citizen and that's comparative risk information, but that's not within the charter for the Superfund program. It is encouraging to note that there is a comparative risk project somewhere within EPA now that we've recently become aware of. We've tried to get more information on that.

There will be an EPA seminar in Philadelphia in May that is on this subject of Risk Management for Hazardous Chemicals, an international conference. We've spoken with Craig about that. We're all interested in what those folks have got to say. This gentleman has led the charge for downplaying PCB risk. There is a lot of sentiment in the scientific community that the risk is being stated very conservatively. And it's not a mean risk by any stretch of the imagination. That it is a mean risk plus a safety factor, and we're out here on the edge of the safety factor. It is sort of like -- well, in Georgia we have a 55 mile an hour speed limit but you don't get arrested until you exceed 65. That's the uncertainty factor or that buffer factor that they're going to give you. I have not yet found out what the magnitude of that buffer is. Some numbers have been suggested to me but they're like -- until we have something a little more firm information I would rather not mention numbers.

I think that the program is on the right track. The 2A or the 2B, if it works, would be suitable for an acceptable remedy.

And we have members all the way around the lake, about 2,500 members. We're the largest lake association in either South Carolina or Georgia.

So I'll sit down in the interest of time.

BY MR. ZELLER:

Thank you, Ed.

Yes, sir, back ---

BY ATTENDEE:

I have a question and a suggestion. The question is, in all your studies how many documented individual cases do you have that you can prove that people consume more than the sixty pounds of fish per year, say prior to 1985 and since 1985?

BY MR. ZELLER:

We have answers to the creel survey.

BY ATTENDEE:

No, I'm talking about documented cases where people swear, 'I have eaten sixty-five pounds of fish last year.' Do you have any of those?

BY MR. ZELLER:

We don't have any of that. But we have answers to, say, 'How many meals a year do you eat from this reservoir' and then they tell us. Now, we took them at their word and I don't think that we're prepared to call anybody a liar.

BY ATTENDEE:

No, I'm not trying to call you a liar. I am just saying that that's a pretty wideopen, canned survey that you're doing there when you go out and ask people, 'How many fish have you caught and how many do you eat a year' and all that. How many of us even know how many we've caught?

BY MR. ZELLER:

We have all those records.

BY ATTENDEE:

And since 1985 when you started doing publicity, are you still getting a large number of people that are consuming high levels of fish?

BY MR. ZELLER:

Since 1992, we've had -- that data is all there, for the numbers that we have cited here tonight.

BY ATTENDEE:

In other words, what you're saying is that your publicity campaign has been no good?

BY MR. ZELLER:

Well, we found -- I will tell you what we did find, that a large majority of the people weren't aware of the advisory. I think one of the questions was, 'Are you aware that there is a fish advisory on this lake?' A majority of them, greater than seventy-five percent, did not.

BY ATTENDEE:

All right.

BY MR. ZELLER:

'Well, do you still eat fish?' And about fifty percent said not.

Then another question was, 'What would it take for you to stop eating fish?' There were some very interesting answers. Like, 'Well, see my buddy that I am fishing with here? When he falls out of the boat dead from PCBs, I'll stop eating fish.'

BY ATTENDEE:

All right. Well, let me go on to my suggestion then. I have found over the years that the most effective way to stop somebody from doing something is to pay them not to do it. Certainly with $4 Million, we can buy a awful lot of fish up here. And it would be a way to get the fish out of the lake. You could buy fish that is only over three pounds, over five pounds. You pay them so much a pound for the fish when you get it. Then if it turns out to be a fish with a high level of PCBs in it, then you can pay them an extra bonus because they caught one of the high-risk fish.

BY MR. ZELLER:

Well, ---

BY ATTENDEE:

You could get your fish out of the lake and wouldn't have to worry about your fence. You take all the hazards out and people could enjoy fishing too because they'd get paid for it.

The people that depend on it to eat, you could give them two-for-one pounds of fish. They give you the fish and you can give them two pounds of salmon in exchange. I think that you would find out that people would respond to that program.

BY MR. ZELLER:

Ironically, that was an alternative that was brought up by Schlumberger. You could call it a fish finding ---

BY ATTENDEE:

People do respond to money. If you don't believe it, ask the businesses and everything else. You put money and bonuses on the table and people respond.

BY MR. ZELLER:

It's an alternative to look at, as I mentioned earlier that is one of the things put on the table during the draft stages, fish commissions. They scratched their head and said that's an idea, but they came up with what they thought were a lot of insurmountable problems with that. That program on a lakewide basis is a monumental effort, and I am sure you understand that.

BY MR. ALEXANDER:

As a matter of fact, when I discussed this with South Carolina Wildlife & Human Resources Department, they pointed out to me very quickly that it was illegal to buy sport fishing in the state of South Carolina for any reason. That if we adopted something like that, that that could not be done within their agency, that that would have to go to the Legislature of the State of South Carolina ---

BY ATTENDEE:

We can take it to the Legislature, that's no problem.

BY MR. ALEXANDER:

Well, I'm telling you that that is what they said, that it is not a simple fact that they could say, 'That sounds like a good idea, we'll do it.' That this would have to go to the Legislature and change the regulations on how things are done.

And they did not see that in the best interest of the fishing management program.

BY ATTENDEE:

I wasn't speaking of the whole lake. Your fish net is only going to affect everything north of where you put the fence up.

BY MR. ALEXANDER:

I understand ---

BY ATTENDEE:

Only the fish caught above that level. Now, I realize that people might catch fish down below and bring it back up here to the check station, but it would be out of their way and -- I think that that would be the exception rather than the rule, of anyone doing that. Then also put in there that you randomly test the fish for PCBs and you give a bonus when they have the PCBs. Then you'd also have some idea of how many people are bringing fish in from other places and trying to sell them to you.

BY MR. ALEXANDER:

I understand. And, like I say, they didn't see that to be in the best interest of the fishery management program. Particularly they didn't want to start any precedents of buying and selling fish like that out of the lakes. They didn't want people going down the lake or somewhere else and catching fish, you know, and bringing them in there and selling them.

BY ATTENDEE:

Then change it. You're not buying the fish, you're buying the PCBs and only pay on PCBs.

BY MR. ALEXANDER:

I understand.

BY ATTENDEE:

Earlier you said that the last day for comment was May 11th unless requested for an extension. How do you request an extension of the comment period?

BY MR. ZELLER:

You can request an extension right now, if you like.

BY ATTENDEE:

So requested.

BY ATTENDEE:

So requested.

BY MR. ZELLER:

Request granted. The comment period will go until June 11th.

BY ATTENDEE:

How do we totally prevent anything but an advisory from coming out?

BY MR. ZELLER:

Excuse me? One more time?

BY ATTENDEE:

How do we prevent 2B from becoming effective? I mean, we give comments but you guys make the final judgment, as you said yourself. You can look at the comment and say, 'Yeah, that's a pretty good comment, we thought about that.' Then you put it aside because you've already thought about it and you've already made up your mind that you wanted to go "B", so that gets set aside.

Then somebody else has another comment and, 'Oh, yes, we thought about that too' and then it gets set aside.

Pretty soon, all the comments are over here (indicating hand gesture away to side) because you thought about them and your august opinion is that you still want 2B; so our comments don't mean anything.

BY MR. ZELLER:

Write me a letter, submit it to -- my address is in here (indicating fact sheet). State your reasons for your preference or your major opposition to this recommendations. I will tell you right now that if we get -- we hear all too often, 'EPA, guys, you don't have a clue what is going on.'

If you're got something to add, write me a letter and tell me. If you have got something good to say, please write me as well. I like to hear good things as well as bad things. We will take all the comments into consideration. We will take a look at all these things.

It is intuitively obvious that no one in this area wants this fish fence.

I'll talk to Mike, I will talk to Dick Austin, 'what do you guys think?'

We welcome your ideas, believe me.

BY ATTENDEE:

Are these the only two alternatives that you're looking at now, or are you looking at 3 or ---

BY MR. ZELLER:

Well, we're looking at 2A and ---

BY ATTENDEE:

2A or 2B?

BY MR. ZELLER:

Our preferred alternative is 2B, as the preferred option on the way to go here. 2B is the most aggressive alternative that would be implemented.

BY ATTENDEE:

Okay.

BY MR. ZELLER:

Thank you. That's it. Appreciate you guys coming out.

(CONCLUDED)

State of South Carolina)
County of Greenville)

This is to certify that the within Public Hearing was held April 19, 1994;

That the foregoing is an accurate transcript of the presentation, complete with question-and-answer session;

That no exhibits were entered herein or attached hereto as part of this record;

That the undersigned court reporter, a Notary Public for the State of South Carolina, is not an employee or relative of any of the parties, counsel or witness and is not in any manner interested in the outcome of this action;

IN WITNESS WHEREOF, I have hereunto set my Hand and Seal at Greenville, South Carolina this 10th day of May, 1994.

COPY

____

Commission expires: 1-10-2001

(SEAL)

ATTACHMENT 2

5 9 0284

5 9 0285 **USE THIS SPACE TO WRITE YOUR COMMENTS**

Your input on the Proposed Plan for the Sangamo Superfund Site - OU2 is important in helping EPA select a final remedy for the site. You may use the space below to write your comments, then fold and mail. A response to your comment will be included in the Responsiveness Summary.

April 15th [redacted]

Mr. Craig Zeller

In the matter of Operable Unit # 2

I vote for the "Alternative 3B Sediment Control Structure

In view of the length of time "PCB" in the ground and

amount of "PCB" in the water, I fear we will not do enough

using Alternative 2B Fisheries Isolation. (think of the future)

Frank D. Cartee

Frank D. Cartee

REQUEST TO BE PLACED ON THE SANGAMO WESTON, INC./TWELVE MILE CREEK/LAKE HARTWELL SITE MAILING LIST

If you would like to be placed on the mailing list for the Sangamo Site, please complete this form and return to: Cynthia Peurifoy, Community Relations Coordinator, EPA-Region IV, North Superfund Remedial Branch, 345 Courtland Street, Atlanta, Georgia 30365, or call 1-800-435-9233.

NAME: ______

ADDRESS: ______

______

TELEPHONE: ______

AFFILIATION: ______

May 4, 1994

Mr. Craig Zeller
Remedial Project Manager
US EPA, Region IV
North Superfund Remedial Branch
345 Courtland Street, N.E.
Atlanta, GA 30365

Dear Mr. Zeller:

I attended the open meeting of Monday, March 28, 1994, at the Strom Thurmond Institute at Clemson University where you explained the various options the EPA has been studying for remediation of the PCB problems in the Twelve–Mile Creek arm of Lake Hartwell. I found the meeting to be very informative and useful. I have read the literature which was distributed at that meeting, but not the formal report issued later by the EPA referred to in the May 3, 1994, issue of the Anderson, SC, Independent–Mail.

Based on your discussion and what I have read regarding the available options and their associated costs, I feel that the plan of action selected by the EPA, namely, the "fish fence," is not the best choice.

I believe that continued public education regarding the hazards associated with the PCB contamination represents the best option. The overwhelming support for this option demonstrated by the straw vote taken at the March 28 meeting would seem to indicate that many would agree with me. I have several reasons for favoring this plan:

- The hazards associated with the PCBs are largely avoidable. Cessation of the consumption of large fish from Lake Hartwell drastically reduces the health risks associated with the presence of the PCBs.
- Removal of the contaminated sediment is not necessary or financially feasible. Per EPA's estimates, natural burial of the contaminated sediments will reduce the health risks associated with consumption of fish from Lake Hartwell to acceptable levels within roughly twelve years. Construction of the fish fence would not be expected to affect this.
- Public education needs for those who choose to fish the Twelve–Mile Creek arm of Lake Hartwell will be unaffected by the construction of the fish fence.

I feel that continued public education represents the best solution to the PCB problem that exists on Twelve–Mile Creek. I do not feel that the benefits associated with construction of the proposed fish fence justify the associated costs.

Thank you,

Paul A. Work
[redacted]

5 9 0288

5/8/94

[redacted]

Dear Mr. Zeller:

Re. Fish Fence Across Hartwell

I am totally against spending any money let alone 4.2 MM to put a fish fence across lake Hartwell. It is a waste of money and totally unnecessary. If we were dependent on the fish for a major part of our food source then I would say yes. However, the major use of fish for from Hartwell is for sport and that has nothing to do with eating or not eating.

If I remember correctly, other articles said it would take 2-4 lbs of fish/day to be eaten by a person to be harmfull. No one eats that much fish out of Hartwell.

Money should be spent to educate people on the possible effects.

The solution to the problem is simple. Just don't eat the fish.

Sincerely yours,

Edmund L. Brockelbank

5 9 0289

Fran Moseley
[redacted]

Dear Mr. Zeller,

I feel the need to express my concern in spending $4.2 million on a "fish fence" in Lake Hartwell as a control for the PCB problem. Since nearly $2 million has already been spent on studies of the PCB problem, only to determine that one must eat 60 fish dinners a year for 30 years to see an appreciable risk in cancer, I can hardly see the justification in spending a minimum of $4.2 million more. This is a tremendous expense for a questionable solution to a problem that, with no action, will become acceptable in 12 years. It seems to me that this same money could be well spent elsewhere. If one is that concerned about getting cancer, then just Don't Eat The Fish!

Please look at this with an objective mind and realize that the "fish fence" is a huge and inconvenient and expensive mistake.

a concerned citizen,

Fran Moseley

5 9 0290

Please File as A protest comment against A Fish Fence!

The Pickens
Sentinel
Favorite Newspaper Of Pickens County

Page 2 A - Wednesday, May 4, 1994

"Well I'll Declare.."

by jerry alexander

Closing The Barn Door After The Mule Is Gone

I noticed the federal government's Environmental Protection Agency (EPA) is considering spending millions of dollars on the Twelve Mile River arm of Lake Hartwell to clean up the PCBs they say are lurking there that may cause cancer. They have recently held a public meeting at which several different proposals were aired, and people in our area are certainly concerned and interested.

But among the proposals they are considering is one to build a giant fish net across the lake that would allow water through but contain the larger fish.

Putting a net across Twelve Mile River ~~25~~ 40 years after PCBs have been deposited there? That is like closing the barn door a quarter century after the mule got out.

Besides, I thought the general information for these many years has been that the PCBs have been deposited in the sediment at the bottom of the lake and now they have been covered of other sediment as the years went by.

And what about the millions of fish who migrate Hartwell, GA area of the lake over the past five ye they be netted?

We have been told for years not to eat the fish Twelve Mile but if we do, it would take a huge am eaten almost daily to cause humans any problems. the way I understood their rhetoric. Now we appar contain these older fish, and that brings me to the

Why now!

Could it be that instead of dying down, the prob worse? In other words, after so many years, why ar getting around to talking about spending millions c

Of course we appreciate anything the governme can do to clean up our environment, and certainly efforts along the entire Twelve Mile River drainage seems a bit late at this point to talk about buildin dredging the lake bottom and hauling it away.

Seems like that should have been done many ye first found out about the pollutants.

Now, Let's Move On

Well, it looks like Pickens County's School Dis superintendent. He is Dr. W.D. "Duke" Hucks o accepted the new job Tuesday afternoon. He will

While the search to fill the position being vaca

...Office. ... in donating ... The yard sale can call 898-5508 between the hours of 8:30-4:30 for more information.

Distric... superintende... schools effectiv...

5 9 0291

S. W. Poser
[redacted]

May - 12 - 94

Mr. Craig Zeller
Remedial Project Manager
U.S. EPA Region IV
Superfund Remedial Branch
Courtland Street N.E.
Atlanta GA 30365

Ref. Lake Hartwell Cleanup

Dear Mr. Zeller,

I have followed closely EPA's effort over the years to deal with the PCB contamination of lake Hartwell and I generally support and appreciate EPA's mission and goals to obtain and maintain a better and cleaner environment for all of us.

It is my opinion however that we should spend our scarce financial resources on projects that pose serious dangers to our environment. The solution proposed by EPA certainly does not fall into this category, since the statistical risk of cancer is minimal, the problem will diminish and go away over the next twelve years, and the present situation will be concentrated in the area north of the proposed fence.

I understand, that there are still unsolved engineering problems to build the fence which certainly means that the completion time will be delayed, shortening the time span before the PCB levels will drop to a safe level anyway. Experience also shows, that the completion of any project takes longer and costs more than originally estimated, which will further diminish the cost - effect ratio.

Under the given circumstances, the proposal to intensify the education of the public with warnings not to eat the fish from the contaminated areas and continue the monitoring of the PCB levels should be sufficient to provide the desired level of public safety and free up funds for more dangerous contamination problems.

Sincerely

S. Poser

5 9 0292

W M Mosele[y]

[redacted]

Mr. Zeller,

I'm writing concerning the EPA's propose "Fish Fence" at Cherry Crossing on Seneca River Lake Hartwell. For me the proposed remedy for the PCB problem is completely out of line with common sense. The EPA's own numbers don't make a strong case for this so called Super Fund clean up. Building a fence on the lake may control fish movement but would have little or no effect on fish consumption. If you feel you must spend some federal tax dollars, I would suggest radio or television ads to simply advise the people taking the fis[h]. This is simply one more example of what the federal government can't do well. It can't live people's lives and care for their every need. People are responsible for their own actions. Four and a half million dollars for a fish fence on Lake Hartwell. Be Real!

W M Moseley

5 9 0293

College of Commerce and Industry
DEPARTMENT OF LEGAL STUDIES

CLEMSON UNIVERSITY

May 13, 1994

John Hankinson, Regional Administrator
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Re: Sangamo Weston/...PCB Contamination Superfund Site
Pickens County, South Carolina

Dear Mr. Hankinson:

I am writing somewhat belatedly to formally thank U.S. EPA, Region IV, for its extraordinary handling of the public relations/ due process aspect of the above mentioned Superfund matter.

I refer in part to a three-year series of exceptionally well managed (officially scheduled) public meetings, required by law under the Superfund program. I also refer to a special "Public Information Session" held at Clemson University on March 28, 1994, in response to Clemson's request for speakers on a case-in-progress of local interest with multidisciplinary educational potential.

As an alumna of some four years' service with the Office of Regional Counsel, U.S. EPA Region II, I began to follow the development of the Sangamo case with some interest when I relocated to South Carolina to live near family in 1990. It soon became apparent that a Remedial Investigation was being conducted by a blue ribbon team of scientists who also had exceptional public speaking skills. Over three years, I watched a frustrated and suspicious public become sophisticated in Superfund issues. With increasing information and skillful explanations by the Project Manager, Craig Zeller, attendees at public meetings asked increasingly to-the-point questions. Suspicion and hostility were gradually replaced by a dialogue that had more academic overtones.

When Clemson's Students for Environmental Awareness asked about EPA contacts, Cynthia Peurifoy, EPA's Community Relations Coordinator, was easy to reach and very receptive to an invitation to visit Clemson. She explained that EPA was in fact looking for an opportunity to experiment with a new concept -- public interaction above and beyond the due process requirements of the Superfund statute and the NCP. On short notice, the March 28 meeting was arranged. On a cold rainy night, about 150 members of the community arrived at the Strom Thurmond Institute on campus to hear what EPA would say at a point in the administrative process that was near the end of the Remedial Investigation, but before the officially scheduled Public Meeting during the Public Comment Period. As the enclosed memo from my Department Group Coordinator indicates, Clemson's educational community was very pleased with the meeting. As the quality of the dialogue and the informed nature of the public comments at the subsequent official Public Meeting indicated, an informed public differed with EPA about the proposed remedy selection, but the differences of opinion were, for the most part, respectfully stated. The respectful tone of the dialogue owed much to the tremendously well prepared presentations by EPA's Project Manager and the team of scientists from EPA and other agencies. It also owed much to the skill of the Community Relations Coordinator, who had managed to get the message across to the Sangamo site neighborhood that EPA would indeed listen to their concerns.

At the close of the Public Comment Period, I would not be surprised to see a record that reflected an absence of public fears about the health consequences of this contamination at this site that is not usual in Superfund cases. This absence of fear arises from the successful communication of the information gained during the Remedial Investigation.

The Sangamo site may well be a newsworthy case for the following reason: after hearing the results of the Feasibility Study, based on an understanding of the science in the study and based on a community concern with the cost-effectiveness element, the public comments may well urge the EPA to revise its recommendation and downgrade its planned response and expenditures on the remedy. This unusual dialogue takes place in a case with an extraordinary history of education and communication with the public. I hope that, as Regional Administrator, you will give appropriate recognition to the years of good professional work by the EPA team assigned to this case that have produced such a result.

Sincerely,

Margaret L. Thompson

Margaret L. Thompson

Enclosure

cc: ✓Craig Zeller, Sangamo Project Manager (OU2)
Cynthia Peurifoy, Region IV Community Relations Coordinator
Alan Elzerman, Clemson University
Faculty Advisor, Students for Environmental Awaremess
T. Bruce Yandle, Group Coordinator
Legal Studies

5 9 0295

College of Commerce and Industry

DEPARTMENT OF LEGAL STUDIES

March 29, 1994

Note for Margaret Thompson

Margaret--

Thanks so much for inspiring the EPA session. Last night's event was a roaring success for all concerned. A wonderful learning experience for our students, and us.

Let's do something else along these lines.

BRUCE YANDLE

[redacted]

5 9 0296

May 15, 1994

Craig Zeller
U.S. EPA Region IV
North Superfund Remedial Branch
345 Courtland Street N.E.
Atlanta, Georgia 30365

Dear Mr. Zeller,

The proposed fish fence intended to mitigate damages from PCB contamination in Lake Hartwell doesn't make sense. Its expensive, its experimental, it will not contribute to a reduction in the quantity of PCB's, and it is unnecessary. I would prefer that the EPA use its limited resources--manpower, money and public goodwill--on more immediate and serious problems. Enough money has been spent assessing the magnitude of this problem. The evidence indicates a reasonable solution is simply to allow nature to continue gradually healing itself.

I recommend that the fish fence proposal be shelved. I also suggest that a campaign to further warn the public of contamination is unnecessary. Additional study beyond routine water quality monitoring is simply not needed.

Thank you for considering my opinion.

Herman Senter

Herman Senter

[redacted]

[redacted]

5 9 0297

MAY 15, 1994

DEAR MR: CRAIG ZELLER,

PLEASE ADD THIS LETTER TO THE MANY OTHERS THAT OPPOSE THE UNTRIED FISH NET OR ANY OTHER METHOD THAT WOULD REQUIRE THE DISTURBANCE OF THE BOTTOM OF LAKE HARTWELL TO CORRECT THE PCB ACTIVITY.

MY WIFE AND TWO SONS HAVE LIVED ON THE SHO[RE] OF LAKE HARTWELL ON THE 12 MILE RIVER BRANCH OF THE LAKE FOR 28 YEARS. WE HAVE WITNESSED THE IMPROVEMENT OF THE WATER QUALITY AND THE AQUATIC LIFE QUALITY THAT IS NOW TAKING PLACE.

WE DO NOT WANT TO SEE THIS STEADY IMPROVEMEN[T] NEGATED IN ANY WAY.

WE ARE IN FAVOR OF THE FEDERAL GOVERNMENT SPENDING OUR TAXES ON THE DEVELOPMENT O[F] AN EDUCATIONAL PROGRAM THAT WOULD INFOR[M] THE PUBLIC ON HOW TO PREPARE THE FISH FOR EATING WITHOUT HARMING THE CONSUMER.

THANK YOU FOR ALLOWING US THIS OPORTUNITY TO MAKE OUR FEELING KNOWN.

S. G. Nicholas

S. G. NICHOLAS

5 9 0298

Carole McCullough
C.A.T.S
The P.C.B. Connection
5-17-94

To
Craig Zeller
Thank you for keeping me on your mailing list even though I haven't been active in this issue for 2 years due to the precarious health of my retarded son and myself
I received 3 packets. to Carole Whitfield Carole McCullough and C.A.T.S. all three are me so you can save postage by sending packet information to: (I'm divorced again)
Carole McCullough
C.A.T.S
The PCB Connection
[redacted]
I just had Carpul tunnel Surgery on my only hand and couldn't write before now I do have a commentary
I hope your comment Period isn't over
It was proven in Fed. Court that Sangamo dumped 100 lbs PCB waste liquid into town Creek for 30 yrs. 56-96 thats a lot higher than your figures. I have a report from DHEC in the late 70's or early 80's that show checking points from town Creek to 500 yds Behind the hartwell dam which at that point shows 935 parts per million P.C.B in sediment

And I sit here today writing you and looking back in hind sight I wish some one 30 or 34 years ago would have put up signs about PCBs and their danger's so that I could have made my own decision about eating fish swimming or playing in the sand. I'm a smart person I wouldn't have put my self or my 3 children in that danger as my mother kept me out of Reedy River when it was posted because they said it caused Polio.

Maybe then I wouldn't be sitting here today with a sick 33 yr old Man child.

I pray that my actions in the past 10 yrs have one child some where in Pickens County from suffering like my Pearce I never tried to force my beliefs on other people I only told them the truth and let them decide what they would do.

So today I plead please post more explicit signs from town creek to all of Hartwell lake and let the people + vistors of S.C. make their own choices. In the years since the 1st signs so many people have quit eating the fish they say I fish but I throw them back.

Enclosed is a sample sign I would like to see up starting at the spot on Town Creek where Sangamo started dumping.

Could you please answer a question for me? A few weeks ago on Sunday I was watching T.V. I always watch programs about birth defects so as I ran the chanels on the discovery channel I found a program about Mexico and children, retared no brains, cancer, spina bifita etc as the program continued I discovered it was about an capasitor plant called Kermet of South Carolina and there were 350,000 parts per million PCBs in the river. Is Kemet of South Carolina Sangamo / Schlumberger of Pickens SC they moved to Mexico

In closing I once again remind you in case you've forgot Schlumberger is the seventh wealtest Company in the world.
act according

Thank you
Sincerely
Carole McCullough

the sample sign uses your own words from the last packet
Please dont play down the Risk of swimming I have seen 100's of people at 12 mile Landing out deep the water was green but it was red muddy on the shore where the people swim

Please excuse my writing
I'm losing the use of my right hand too and my vision is going

5 9 0302

Attention OR Caution

FROM 1955 to 1987 SANGAMO/ Weston operated A plant in Pickens S.C. ~~on Town Creek~~ They used PCBs Polychlorinated Biphenheny/ in their transformers And CAPASitos, Their Liquid wastes were dumped ~~in To Town Creek~~ From the plant to Town Creek by use of A cement drain ditch then thru waste water treatment ponds It is estimated that over 4,000,000 lbs of PCB's were Released into the Town Creek, 12 mile River Lake Hartwell untill the use of PCBs were ~~banned~~ ~~were~~ discontinued prior to AN EPA ban in Jan 1978

PCB's CAN CAUSE CANCER AND Birth Defects in Humans It Also causes A severe skin diease called Chloracne

They Are in the Fish in the sediement and have been Found in the water Anything that Distives the sediement can ~~CAus~~ CAUSE the P.C.B.S to return to the water. There is no swimming aduisory but there is A Fish aduisory And it is As Follows (You Decide whether to swimm in the water or play in the sand)

The [illegible] · E.P.A

5 9 0303

LAKE HARTWELL ASSOCIATION, INC.

[redacted]

May 25, 1994

Mr. Craig Zeller
Remedial Project Manager
USEPA Region 4, North Superfund Remedial Branch
345 Courtland Street, NE
Atlanta, GA 30365

Dear Mr. Zeller:

Thank you for the opportunity of attending and participating in your Public Meeting at Clemson on April 19.

The Lake Hartwell Association, Inc., an organization of nearly 2500 members who are property owners, businesses, vacationers, day users, and just about any description that evidences an interest in the future of Lake Hartwell, has been studying and participating in the development of this Remediation Project since its inception.

The Lake Hartwell Association, Inc. wishes to go on record in favor of Alternative Remedy 2A. This had been the recommendation of our Technical Committee prior to the April 19 meeting. After the meeting, we reconsidered the choice, taking into account the presentations and discussion at the meeting, and reaffirmed that recommendation, which was ratified by our Board at its May 10, 1994 meeting.

The only difference between 2A and your selection of 2B is the matter of the Fish Fence. Our Technical Committee did not see how the Fish Fence would be practical, since more than 50% of the flow through Lake Hartwell would pass through it. To handle the hydraulic loading, the openings would have to be so large as to allow too much fish passage, and the collection and disposal of debris that would be intercepted would be overwhelming, in our opinion. We would urge abandonment of the Fish Fence notion without further consideration. With that, we are in agreement with the balance of the Remedy.

We are requesting that the educational programs move away from advisories against eating the fish, as much as possible, other than in the immediate vicinity of the 12 Mile Arm, and instead focus on how do reduce the PCB concentration by fish preparation and cooking techniques. We request that fish sampling and testing activity include equal sampling and testing of these forms of the fish, not just the raw, as caught, whole fish or whole fillets.

As part of this submittal, we are including published information on these approaches to the issue. These reprints identify techniques of preparing the fish fillets to achieve 25 to 64% reduction of PCB (depending on species), with two species of bass showing 60 and 64% reduction by trimming. Following that, the recommended cooking techniques can further reduce the PCB levels another sizeable increment. We would also like to see both the risks and the benefits expressed in perspective, and the risks explained not just numerically, but comparatively, to other risks inherent in our lives and our diets. This should include both the so-called "involuntary" risks as well as those considered "voluntary". We strongly suspect that calculation of equivalent risks would show less risk to human life and health from eating the fish than there is in falling out of the boat and drowning, or in driving to and from the lake. The list of questions below which was presented a year ago still applies, and we would hope they would be answered in preparing the educational material.

> Everything in life poses a risk. Please state the PCB risk associated with eating Lake Hartwell fish in comparison to other everyday voluntary risks. Is 30 years of eating the fish once a week more or less likely to cause harm than, say smoking one carton of cigarettes over the same period? Or is the risk of drowning by falling out of the boat the greater risk?
>
> What is the average American's normal annual dietary intake of PCB's from all food sources? How much of an incremental amount would be represented by eating 3/4 pound of fish from Lake Hartwell weekly? Would this PCB risk be greater than or less than the risk imposed by eating beef instead of the fish, since beef increases other health risks? What other dietary chemical exposures have equivalent risks? A pound of this fish, for example, is the equivalent risk of how many peanut butter sandwiches, or how much bacon, or how much wine?
>
> Please give us some idea of how many deaths and various illnesses attributable to the PCB's, if any, would be expected over a 30 year period as a result of this exposure. If you plugged in the projected natural decrease of PCB's that you presented, what would happen to those morbidity and mortality projections?
>
> What would the average concentrations and/or risks be across the entire lake excluding the 12 Mile Creek arm?

We would like to continue to work cooperatively with EPA toward better public education in this area, and toward the goal of eventually lifting the advisories. The Lake Hartwell Association, through its Technical Committee is willing to help in this public education mission. We have highly qualified, educated, and experienced volunteers who can conduct or participate in meetings and workshops, and we can disseminate information through our newsletters and our twice-a-year public meetings.

Sincerely,
The Lake Hartwell Association, Inc.

William D Rolsten

William D. Rolsten
President

ERS/wp
encl.

5 9 0306

THIS FORM IS PROVIDED TO ENCOURAGE YOUR PARTICIPATION IN THE COMMENT PROCESS.

Mail to:

Mr. Craig Zeller
Remedial Project Manager
US EPA
345 Courtland St., NE
Atlanta, Georgia 30365

Name (Optional) W. Ray Carter

Address (Optional) [redacted]

How do you use Lake Hartwell (e.g., boating, fishing, swimming)?

Property owner

Please provide your comments on:

The proposed fish fence at the State Route 37 (Cherry Rd.) Bridge

I wish to oppose the proposed fish fence. Few people consume fish from Lake Hartwell even fewer consume large quantities no one consumes the quantity stated by E.P.A. to be hazardous. Don't let a few fanatics start a project that can do more harm than good.

Institutional Controls (e.g., continued health advisory on eating fish, expanded education campaign on the risks associated with eating fish):

Continue health advisories place signs at launching ramps state correct figures of danger and quantity of fish that must be consumed to be at risk.
Consider ending any commercial fishing for food until PCB levels drop.

Everyone has an opinion here is mine.
Work to stop the flucation of lake level which creates currents it fish life cycle and natural sediment cure the problem.

This newsletter is published by
Schlumberger Environmental Services, Inc.
1-800-962-5848

The small amount of electricity generated by the Core Hydro plant should not be of concern if we want to stop the spread of PCB's

5 9 0307

May 16, 1994

Dear Mr. Zeller:

I am writing to you about the proposed fish fence on Lake Hartwell. Five of my friends and I fish the upper Seneca River branch of Lake Hartwell frequently and enjoy it very much.

A fish baricade at the Martin Creek area will make most of the fishing at the upper end non-existant since many of the fish such as hybrid bass and stripers migrate from the lower end at certain times of the year.

We do not live on Lake Hartwell but know people that live in the Bayshore area. Their property values will suffer greatly if the fish fence is erected!

We urge you not to proceed. Let nature take its course. We know of no one that is eating excessive fish quantities from the upper end of Lake Hartwell. In twelve years or less the PCB's will be totally covered by silt and I think it will be less time than that.

Sincerely,

Ken Van Laeke

Ken Van Laeke
Bob Dancy
Hugh Kittle
Dave Finch
Lou D vidson
Fred ..ofmann

5 9 0308

May 23, 1994

Royal E. Lappin
[redacted]

Mr. Craig Zeller
Remedial Project Manager
U.S. EPA, Region IV
North Superfund Remedial Branch
345 Courtland St., NE
Atlanta, GA 30365

Dear Mr. Zeller,

Having been a member of the Management Team of Sangamo Electric Company from 1969 to 1977, I am very familiar with the PCB problem and the tens of millions of dollars spent then, now, and probably in the future. Hardly a week has gone by that the media has not written an article about PCB's and Sangamo; some of which were constructive but most repeating over and over the few facts available to them.

The fact that not one person has ever died from exposure to PCB's should put most of our fears to rest, but, for some unknown reason the EPA continues to demonstrate major concerns about something that may never be a problem. Let's look at the facts:

1. The production of PCB's ceased many years ago.
2. Major cleanups have been accomplished by users during the past 20 years.
3. During this cleanup period no new major evidence has been found that would increase potential problems for people. A case in point is that 700 to 1500 employees at Sangamo had been directly exposed to PCB's for years with no known health problems that were caused by the suspected carcinogen.

In my opinion, the continued cost of this "witch hunt" serves no purpose what so ever and the money and manpower could be used for many other constructive activities.

Again, please look at the facts, a person would have to eat 60 fish dinners a year for 30 years to see any appreciable increase in the risk of cancer. How many other things do we do that increases the risk of cancer 1000 fold?

I am very opposed to doing anything on Lake Hartwell because the problem, if one exists, has greatly diminished over the past 20 years with no additional deposits going into the lake.

Let's all use some good old "common sense" over this matter.

Yours very truly,

Royal E Lappin

Royal E. Lappin

5 9 0309

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Sangamo Superfund Site - OU2 is important in helping EPA select a final remedy for the site. You may use the space below to write your comments, then fold and mail. A response to your comment will be included in the Responsiveness Summary.

I attended your meeting @ the Ramada Inn & it served to re enforce my belief that there is no problem so don't spend tax payers money to fix something thats not broken.
The attached list comprizes many citizens who agree

Robert Schilling (ROBERT SCHILLING)

[redacted]

REQUEST TO BE PLACED ON THE SANGAMO WESTON, INC./TWELVE MILE CREEK/LAKE HARTWELL SITE MAILING LIST

If you would like to be placed on the mailing list for the Sangamo Site, please complete this form and return to: Cynthia Peurifoy, Community Relations Coordinator, EPA-Region IV, North Superfund Remedial Branch, 345 Courtland Street, Atlanta, Georgia 30365, or call 1-800-435-9233.

NAME: ______________________

ADDRESS: ______________________

____

TELEPHONE: ______________________

AFFILIATION: ______________________

Doris Fillmore [redacted]

Joanne C Prescott [redacted]

Richard [illegible] [redacted]

PROPOSED PLAN FOR THE SANGAMO SUPERFUND SITE- OU2

[illegible] + Betty Schroder [redacted]

Since there have been no reported cases of anyone contracting cancer from eating fish from Hartwell Lake in the 17 years that have passed since PCB's were last dumped into the lake and since the levels of PCB's have decreased in that time frame and are continuing to decrease to the point that the level of PCB's will be below the acceptable 2 ppm by 2005 (11 yrs.) and since it is obvious that the fish adversaries have been successful, the underesigned strongly recommends that the Environmental Protection Agency proceed with Alternative 2A.

Mary + George Laib

[redacted]

NAME	ADDRESS
[illegible]	[redacted]
Mr & Mrs [illegible]	5 9 0310
L. C. [illegible]	
Fay Myatt	
[illegible] Ricketts	
[illegible] Sievert	
Mary Ann Sievert	
Allie Lewis	
[illegible] E. Lewis	
HEYWARD DOUGLASS	
Carolyn C. Douglass	
[illegible]	
CATHY GODFREY	
[illegible] Howle	
David Howle	
[illegible]	

NAME	ADDRESS
Alfred F. Newton	5 9 C311
[illegible] F Jones	
[illegible] Jones	
Betty [illegible]	
Carolyn Brown / W. P. Brown	
Diana Brown	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
Kathy Clark	
[illegible]	
Hoke S. Hill, Jr.	
[illegible]	
[illegible]	
Lynda M. Overcamp	
Thomas J. Overcamp	
Mary C. Birchmough	
[illegible]	
[illegible]	
[illegible]	

5 9 0312

Douglas Massingill
[redacted]

5/19/94
Craig Zeller remedial project manager
EPA Region IV
North Superfund Remedial Branch
345 Courtland Street, NE
Atlanta, GA. 30365

Dear Mr. Zellar:

Please accept the following comments regarding the Twelve Mile River. I am a resident of the area and a user of the lake for recreational purposes. Based on the information regarding the PCB contamination, it seems that the money could be used much more effectively at other locations. The amount of fish that has to be eaten, over a long period of time in order to pose even a slight human threat shows this.

The best solution for the river is to allow it to correct itself. Of course it should be monitored. Please do what you can to see that this money is not wasted on a so called fish net. Thank you.

Sincerely,

Doug Massingill

Doug Massingill

DOM/ibl

5 9 0313

[redacted]
May 24, 1994

Craig Zeller
Remedial Project Manager
EPA Region IV
North Superfund Remedial Branch
345 Courtland St NE
Atlanta, Ga. 30365

I am writing on the matter of PCBs in the Twelve-Mile River and the proposal to control spread of contamination by placing a fish net across the river near Clemson.

It sounds as if the Twelve-Mile PCBs have been well studied and I understand the conclusion is that the problem will naturally correct itself within twelve years. I also understand that to reach levels likely to cause health effects, one must consume large amounts of fish regularly for many years.

As a native of the area and landowner on the waters of the river, let me urge EPA not to overreact. I'm no marine biologist, but the net fix doesn't sound like a particularly environmentally friendly situation either. What about the disruption of the usual fish movement patterns? And, will it really do the job of blocking those movements?

I, like you, am a public servant, an employee of another government agency. I realize there is much pressure to act on these matters. But, as a concerned citizen, I ask that EPA thoughtfully do the right thing. And, I believe that the right thing is to let nature take its course while ensuring that further pollution is not allowed.

SFMassingill
S. F. Massingill

5 9 0314

[redacted]

May 24, 1994

Mr. Craig Zeller
Remedial Project Manager
US EPA Region IV
North Superfund Remedial Branch
348 Courtland St., NE
Atlanta, GA 30365

Dear Mr. Zeller:

We were pleased to attend and participate in the April 19, 1994 public meeting on the above subject in Clemson, SC. The data presented by both the EPA representatives and the U.S. Army Corps of Engineers was very informative and well done. This information helped us understand and respond herewith. The alternatives given clarified an otherwise complex remedial course of action.

The Alternative 2B (Fisheries Isolation) as proposed has merit, however, we do not believe it is the proper one for this PCB contamination situation. The key points which make this unacceptable are:

1. Little or no actual experience with a fishfence of such a size.

2. The cost to build, maintain and remove the fence.

3. The devaluation of properties upstream of the fence.

4. The fact that fish consumption of massive proportions for 30 years would have to occur to expose humans to a token increase in the risk of cancer. This is especially minimized by the fact that the lake will self-clear in 12 years, which is 18 years before the baseline exposure could be attained.

Alternative 2A (Institutional Controls) is by far the best overall solution as it retains public awareness as well as monitoring the lake for unexpected changes in sediment and fish. We strongly recommend that the public awareness signs at lake boat launches be rewritten to "plain English" such as "Warning, do not eat more than 40 lbs. of fish per year per person from this lake." In the years to follow, the warnings should be altered based on the monitoring results until the lake and fish are deemed substantially safe for the general public.

5 9 0315

Thank you again for your interest and fine work.

Very truly yours,

Herman L. Spitzer

Carol W. Spitzer

Herman L. Spitzer

Carol W. Spitzer

[redacted]

cc: U.S. Army Corps of Engineers

5 9 0316

Evergreen Landscape Maintenance

[redacted]

Jimmy Howell, Owner

5-27-94

MR. ZEller,

THE PROPOSED FISH BARRIER/SCREEN PROPOSED for LAKE HARTWELL will NOT HElp THE people who LIVE on HARTWELL, fish in LAKE HARTWELL, OR USE THE LAKE for ANY RECREATIONAL ACTIVITY. People who fish ARE GOING TO fish! MANY fishermen NEVER EAT THEIR CATCH, but RATHER USE CATCH + RELEASE principles.

THE proposed BARRIER will only CREATE A VERY NEGATIVE ATTITUDE toward THE RECREATIONAL ACTIVITIES on LAKE HARTWELL. How ABOUT THE fish on THE "GOOD" SIDE OF THE BARRIER? ARE THEY O.K. TO EAT?

LEAVE THE lake Alone + LET NATURE TAKE it's course TO RID itself of THE pollution. IT would be MUCH preferred to TELL THE public WHAT THE EPA KNOWS And LET THE public decide for THEMSELVES How MANY FISH TO EAT. NO FISH BARRIER!

Jimmy Howell

Jimmy Howell

5 9 0317 [redacted]

May 25, 1994

Craig Zeller, Remedial Project Manager
U.S. EPA, Region IV North Superfund Remedial Branch
345 Courtland ST., NE, Atlanta, Ga. 30365

Dear Sir:

I am writing about the proposed "fish fence" suggested for the 12-mile section of the lake. It seems to me that a "fence" of any kind would hold back more than fish and would be harmful to the attractive 12-mile section of the lake.

We owned a small attractive house on that section of the lake and it was delightful. We had running water (by gravity) and a little waterfall from the spring above. It was like a mountain stream. That house is gone now, but other houses have been built.

It has been many years since the PCB's were discovered and I think it is too late to do anything so drastic as to build a fish net. People ate the fish without even knowing about the PCB's for many years. A fence would hold back more than fish and would make that section of the lake unattractive. We thought it was delightful. We no longer own property there but I thought I should make these comments.

Please don't ... [illegible] !

Mary C. Stevenson

5 9 0318

May 24 '94

A brief note to express my great displeasure in the lake Hartwell "PCB" fish fence project. I feel nature will do the correct project & such a waste of government monies is an example of extravagant government waste.

I feel a reconsideration of this project is in order.

Sincerely

Wallace [illegible]

5 9 0319

Lane D. Parker
[redacted]

May 27, 1994

Mr. Craig Zeller
U.S. EPA-Region IV
North Superfund Remedial Branch
345 Courtland Street, NE
Atlanta, GA 30365

Dear Mr. Zeller,

I recently attended a meeting on April 19, 1994 concerning the clean up for operable unit two of Sangamo-Western.

For the record, I totally disagree with the EPA's selection of alternative 2B, as the solution of cleaning up Twelve Mile Creek.

To eradicate the problem you first eliminate the source of the contaminated sediment in Twelve Mile Creek. Allowing this contamination to continue to lie there unabated and uncontrolled only makes the problem worse.

High levels of run off causes shifting of this contaminated sediment closer to Lake Hartwell.

Once this contamination reached Lake Hartwell the original contaminated area will become pale in comparison.

It is my opinion that the only way to alleviate this problem is to use alternative A3 or A4 as the proper solution. Anything less would only act to prolong this serious consequence and increase liability.

I am confident that this will assist you in the record of decision that is forthcoming. If I can be of any assistance to you, please do not hesitate to contact me.

Sincerely,

Lane D. Parker

Lane D. Parker
Hazmat Director
I.U.O.E. Local 470

LDP/jc

5 9 0320

May 27, 1994

Craig Zeller, Remedial Project Mgr.
U.S. EPA, Region IV
North Superfund Remedial Branch
234 Courtland St. NE
Atlanta, GA 30365

Dear Mr. Zeller:

We oppose in the strongest possible way the proposed fish fence on Lake Hartwell, or any other solution to the PCBs except that of waiting the required period for them to abate. If our nation is to avoid financial ruin, all expenditures must be weighed against the possible benefit or danger. It seems ludicrous that after contaminating the fish for all these years and warning the public with danger signs, anyone would consider spending this kind of money when we have only twelve more years to wait! Add to that the fact that very few, if any, would eat fish taken from the lake in the amounts required to harm them, and it becomes obvious that this construction would be unconscionable for those entrusted with public funds.

Sincerely,

B. W. Blanton

Gail Blanton

[redacted]

5 9 0321

THIS FORM IS PROVIDED TO ENCOURAGE YOUR PARTICIPATION IN THE COMMENT PROCESS.

Mail to:

Mr. Craig Zeller
Remedial Project Manager
US EPA
345 Courtland St., NE
Atlanta, Georgia 30365

Name (Optional) Judy Ingram [redacted]

Address (Optional) [redacted]

How do you use Lake Hartwell (e.g., boating, fishing, swimming)?

boating, fishing, swimming all water recreations

Please provide your comments on:

The proposed fish fence at the State Route 37 (Cherry Rd.) Bridge fish & sediments

this talks about PCB contamination. I would like to know exactly what this is, and it's effects on humans being in the water. The fish fence does not really concern me. I know it has to do with nuclear power in S.C. & radioactive water

Institutional Controls (e.g., continued health advisory on eating fish, expanded education campaign on the risks associated with eating fish):

being released up stream of the lake. We have owned property on this lake sinse 1963 & have spent every summer their. This has happend before 10 to 15 years ago. We have always came to hartwell because of the water quality compared to Lake lanier and it is only 15 minutes away where hartwell is 1 hr. Our property is on the Tugaloo River near Rock Springs Boat Launch. Please send me a response on my questions. I have a 5yr old son & this concerns me.

Judy Ingram

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Schlumberger Environmental Services, Inc.
1-800-962-5848

5 9 0322

[redacted]

May 30, 1994

Mr. Craig Zeller
US EPA Region IV
North Superfund Remedial Branch
345 Courtland St. NE
Atlanta GA 30365

Dear Mr. Zeller:

I'm writing you regarding the PCB contamination in Lake Hartwell. It makes little sense to spend millions of dollars on a "fish fence" (which is not by any means a sure cure) when the situation will clear up naturally within another few years. My wife and I are much opposed to putting in such a measure.

Sincerely yours,

[signature]

5 9 0323

JUNE 6, 1994
LARRY DENMARK
[redacted]

CRAIG ZELLER
EPA - SUPERFUND
ATLANTA, GA.

DEAR MR. ZELLER:

CONCERNING THE PCB PROBLEM IN THE NORTHERN PART OF LAKE HARTWELL, MY SUGGESTION IS TO TAKE NO FURTHER ACTION. NO FENCE FOR FISH. NO DREDGING. KEEP MONITORING, BUT TAKE NO ACTION.

THANK YOU,
Larry Denmark

June 09, 1994 5 9 0324

Mr. Craig Zeller, Remedial Project Manager
U. S. EPA, Region IV, North Superfund Remedial Branch
345 Courtland Street, N. E.
Atlanta, GA 30365

RE: Alternative for cleanup of 12 Mile Creek, Site OU2

Dear Mr. Zeller,

I am writing to urge that you abandon plans for a fish fence and adopt your Alternative 2A: Institutional Controls.

The PVC problem existed before we bought our home on 12 Mile Creek in 1989 but, at that time, conditions did not warrant more than monitoring and public education. The situation has improved since that time and will, as you have said, correct itself within about 12 years. Logic should dictate continuing with the original plan.

Your decision can be very costly to homeowners so it must not be made lightly. Already real estate people are saying the fish fence discussion has affected property prices on 12 Mile Creek. You apparently surmise the fish fence will do some good but you must not be too convinced of its importance because you've been quoted as saying EPA will dispense with the fence if it proves impractical or too costly to build. Please don't pursue a course so nonessential that EPA can be blamed for property owner losses and the public's inconveniences.

It is apparent that most people will benefit and no one will be endangered by EPA's adoption of Alternative 2A. Please take the courageous step of announcing Alternative 2A, not 2B, as your final choice.

Sincerely,

H W Bracken

Mr. and Mrs. H. W. Bracken
[redacted]

June 10

5 9 0325

Craig Zeller
Remedial Project Manager
U.S. EPA Region IV
North Superfund Remedial Branch
345 Courtland ST NE
Atlanta GA 30365

Dear Mr. Zeller,

As new residents of Clemson (2 1/2 years), I am not aware of all the happenings before our arrival in regard to the lake and PCB pollution

But, I ask that the proposed project not be implemented. The cost does not jusify itself! In my opinion a wiser use of the funds could be found, and nature could play a part in the solution rather than a fence.

Sincerely,

Lee Churchfield

[redacted] 5 9 0326

June 8, 1994

Mr. Craig Zeller, Remedial Project Manager
U.S.EPA Region IV, North Superfund Remedial Branch
345 Courtland Street, N.E.
Atlanta, GA 30365

RE: Comments on Lake Hartwell PCB Remedy Proposals

Dear Mr. Zeller:

From my experience as environmental affairs coordinator in risk management at Clemson University, and as a permanent resident bordering Lake Hartwell a short distance south of the U.S. 123 bridge in Clemson, I am commenting on the above captioned matter.

I support "Alternative 1 with Process Option: Institutional Controls (i.e. fish advisory) Currently In Place". In casual discussion with friends, neighbors and other concerned parties, I find supporting consensus adequate to present a petition if necessary.

Upon review of available documents on PCBs danger and the investigative reports on Lake Hartwell contamination, I conclude that threat to humanity exists only to fishing addicts with extremely good luck and insatiable appetites, who flagrantly disregard obvious warnings that are totally comprehensible to anyone with a fifth grade literary capacity. In applying risk management philosophy to any circumstance with similar potential, the resolve would be to do exactly what already has been done in this case: post warnings and conduct appropriate monitoring.

From the environmental impact consideration, Alternative 1 in your report is kindest. Every other alternative is fraught with impacts to the community, to remediation workers, and to lake users. The chance of personal injury during remedial action, and during the life of any engineered action, is magnitudes beyond the probability of harm from "no action" and allowing nature to take its course over the years.

If you desire additional input from a person very close at hand to the situation, please contact me. I am a very frequent user and observer who only wants the best for a wonderful lake and a fine community.

Sincerely,

Walter E. Berry

Walter E. Berry

5 9 0327

MEMO From Marty Koldyke

Re: Lake Hartwell

Sangamo Elect

PCB Clean-Up -

Forget The Fence

Continue Education,

Testing, etc. (I have

Property on 18 Mi creek -

Seneca River)

5 9 0328

Bobby G. Wixson, Ph.D.

[redacted]

June 7, 1994

Mr. Craig Zeller
Remedial Project Manager
U.S. EPA, Region IV
North Superfund Remedial
Branch, 345 Courtland St., N.E.
Atlanta, GA 30365

Dear Mr. Zeller:

I appreciate the opportunity to comment on the experimental fish fence proposed for Lake Hartwell as a control measure for PCB contamination in fish from the upper reaches of the Seneca River arm that has been impacted by contaminated sediments from Twelve Mile Creek. Based on my professional experience in dealing with a similar proposed control strategy to screen out fish from turbine pump back operations at Harry S. Truman Reservoir near Warsaw, Missouri, I have major concerns with the proposed remedial action. At the time of the research study, I was Professor of Environmental Health in the Civil Engineering Department at the University of Missouri, Rolla which was funded by the Corps of Engineers to study ways to prevent fish from getting into the plunge pools below the hydroelectric turbines and then be sucked into the pump back operations. A fish fence was proposed but no suitable fence material was found that would withstand current pressures and debris generated by the pump back operations. The final solution was to cease pump back operations since excessive numbers of fish were killed and ground up during the pump back operations.

Presently, we live on Lake Hartwell near the Holiday Inn in Clemson and spend a great deal of time boating on Lake Hartwell. I have become keenly aware of the lake current and tremendous flow volume funneled by the neck of the lake down through the proposed site near the Stevens plant on Highway 37. During flood control release from Lake Keowee or storm runoff, the large number of logs and other debris washed down stream would collect on and destroy any type of fence proposed for this particular location.

Secondly, effective remedial projects draw on successful case studies using the most effective technology. To the best of my knowledge, the proposed fish fence would be an experimental design (at significant expense) that does not represent a proven remedial technology.

Give the time related detoxification characteristics of PCB's and the best risk management approach to this situation, I feel that the educational program presently used for advising fisherman not to eat fish from the affected area remains to be the best available technology that is cost effective and protective of the specific population at risk. You may wish consider increasing the public awareness program by adding additional warning signs at strategic locations coupled with other media coverage, handouts, and public information programs.

Thanks for allowing me to comment on the proposed remedial action plan. Please call on me if I may furnish any additional information.

Sincerely,

Bobby G. Wixson

Bobby G. Wixson, Ph.D.
Dean, College of Sciences
Clemson University

5 9 0330

THIS FORM IS PROVIDED TO ENCOURAGE YOUR PARTICIPATION IN THE COMMENT PROCESS.

Mail to:

Mr. Craig Zeller
Remedial Project Manager
US EPA
345 Courtland St., NE
Atlanta, Georgia 30365

6/7/94

Name (Optional) Ron Hanby

Address (Optional) [redacted]

How do you use Lake Hartwell (e.g., boating, fishing, swimming)?

RECREATIONAL PURPOSES - BOATING, FISHING, SWIMMING, CAMPING

Please provide your comments on:

$4.2 million

The proposed fish fence at the State Route 37 (Cherry Rd.) Bridge

I AM OPPOSED TO THE PROPOSED FISH FENCE. THE EXPENSE AND UNPROVED RESULTS POSE A GREATER HINDRANCE THAN THE 12YR ESTIMATE OF A REDUCTION OF P.C.B. CONCENTRATIONS IN FISH.

2 ppm

ENTIRE PROJECT SEEMS TO BE A WASTE OF MONEY & TIME.

Institutional Controls (e.g., continued health advisory on eating fish, expanded education campaign on the risks associated with eating fish):

CONTINUE THE INSTITUTIONAL CONTROLS

[signature]

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Schlumberger Environmental Services, Inc.
1-800-962-5848

A

5 9 0331

[redacted]

June 4, 1994

Mr. Craig Zeller, Project Manager
U.S. E.P.A., Region [illegible]
North Superfund Remedial Branch
345 Courtland Street N.E.
Atlanta, Georgia 30365

Dear Mr. Zeller

The "fish fence" proposal, the dredging of a large arm of Lake Hartwell or any other of the proposed approaches to solving the PCB problem seem totally out of line with the nature of the problem.

We have been living with this PCB problem since the fifties--forty years of watching the problem slowly subside from the initial scare propaganda to the present level of possibly a [illegible] increase in risk to those who might ignore the years of notification and insist on gorging themselves on pounds of Hartwell fish per week.

Spending several million dollars on projects that might prove more nuisance than help would seem to be very unwise. I think that occasional notification of the problem in local news media is the best solution.

Sincerely yours,

Bingham M. Cool

Bingham M. Cool

5 9 0332

June 10, 1994

Mr. Craig Zeller, Remedial Project Manager
U.S. EPA, Region IV
North Superfund Remedial branch
345 Courtland Street, N.E.
Atlanta, GA 30368

RE: Sangamo Weston/Twelve Mile Creek/Lake Hartwell
PCB Contamination Superfund Site

Dear Mr. Zeller,

I am writing this letter to express my opposition to the Agency's proposed remediation plan for the referenced site.

I believe the expense (in excess of $12 million for construction and maintenance) associated with this long standing issue far out weighs any returned value. The risk analysis showed that large quantities of fish would have to be eaten over a 50 year period to cause a slight increase in the cancer risk (1 in 1,000,000 if I recall). The Agency itself has stated the problem will "go away" in approximately twelve years and as such would not allow enough time for this risk to manifest itself.

Signs have been posted for many years warning the public of the potential dangers. This method seems to have been successful to date. The construction of a "fish net" will not aid those people who have in the past chosen to ignore the warning , nor will it prevent people from ignoring it in the future. In fact just the opposite may happen. People will now know where the "big ones" are: they're behind the "fish net".

I believe the monies can be more constructively spent on other sites which do pose a current and long term threat to the public health and environment. Although the news articles have said that superfund monies would be recovered, I suspect you will negotiate with PRP's for a partial recovery. With respect to the PRP's I would prefer their dollars be spent in the community in the form of capital investment to assure continued jobs in our economy.

Considering the current risks associated with this site, the costs involved, and the predicted short time period for natural attenuation, I am in support of the "do nothing" option.

Thank you for your consideration.

Sincerely,

Frederick W. Kindervater

Frederick W. Kindervater
[redacted]

5 9 0333

Appendix C

Proposed Plan Fact Sheet

5 9 0335

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SUPERFUND PROPOSED PLAN FACT SHEET

SANGAMO WESTON/TWELVE MILE CREEK/LAKE HARTWELL PCB CONTAMINATION SUPERFUND SITE - *OPERABLE UNIT TWO*

Pickens County, South Carolina **APRIL 1994**

A number of terms specific to the Superfund process (printed in bold print) are defined in the glossary at the end of this publication.

INTRODUCTION

The Region IV office of the United States Environmental Protection Agency has developed this Proposed Plan Fact Sheet for the Sangamo Weston/Twelvemile Creek/Lake Hartwell **Polychlorinated Biphenyl (PCB)** Contamination Superfund Site - Operable Unit Two ("Sangamo OU2 Site") in Pickens County, South Carolina. This Proposed Plan is issued to present the alternatives that EPA has considered to address PCB contamination in the sediments and aquatic biota of the Sangamo OU2 Site. More specifically, the purpose of this Proposed Plan is to:

- Identify the preferred alternative for remedial action at the Site and explain the rationale for that preference;
- Describe the other remedial options considered in detail in the Final Feasibility Study Report;
- Solicit public review of and comment on all of the alternatives described; and
- Provide information on how the public can be involved in the remedy selection process at the Sangamo OU2 Site.

PROPOSED PLAN PUBLIC MEETING
for the
SANGAMO-WESTON
SUPERFUND SITE, OU2
Tuesday, April 19, 1994
7:00 P.M.
RAMADA INN
U.S. 76 & HWY. 123
Clemson, South Carolina

EPA, in consultation with the Savannah District of the U.S. Army Corps of Engineers (COE) and the South Carolina Department of Health and Environmental Control (SCDHEC), will select a final remedy for the Sangamo OU2 Site after the public comment period has ended and the information submitted during this time has been reviewed and evaluated. The public is encouraged to submit comments on all the alternatives, and on the information that supports these alternatives to the EPA Remedial Project Manager listed at the end of this publication. The final remedy, as presented in a **Record of Decision (ROD),** could differ from the Proposed Plan, depending upon new information or input EPA receives during the formal public comment period.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act** (CERCLA, more commonly known as Superfund). This fact sheet summarizes information that can be found in greater detail in the **Remedial Investigation/Feasibility Study (RI/FS)** Reports and other site-related documents contained in the **Administrative Record**, located at the established **information repositories.** The reader is referred to the information repositories listed at the end of this publication for a more detailed account of this subject matter.

SITE BACKGROUND

From 1955 to 1987, Sangamo Weston, Inc. owned and operated a capacitor manufacturing plant in Pickens, South Carolina, near the headwaters of Lake Hartwell. In its manufacturing processes, Sangamo used several varieties of dielectric fluids which contained PCBs. Waste disposal practices from the Sangamo Plant included land burial of off-specification capacitors and wastewater treatment sludges on the plant site and at six satellite disposal areas. PCBs were discharged with untreated effluent directly into Town Creek, which is a tributary of Twelvemile Creek. Twelvemile Creek is a major tributary of Lake Hartwell. It is estimated that over 400,000 lbs. of PCBs were released into the Twelvemile Creek system until the use of PCBs were discontinued prior to an EPA ban in January 1978. Schlumberger Industries, Inc. (SII) is the current owner of the plant site, as a result of a merger with Sangamo Weston in December 1989.

Historical sampling events conducted by SCDHEC, COE, and EPA documented the presence of widespread PCB contamination of the sediments, surface water and aquatic biota from the Sangamo Weston outfall on Town Creek, through Twelvemile Creek, and well into the Twelvemile Creek Arm of Lake Hartwell. During these sampling events, it was discovered that fish from certain areas of Lake Hartwell contained PCBs which exceeded the recommended limit established by the U.S. Food and Drug Administration (U.S. FDA). Subsequent to these findings, a fish consumption advisory was initially issued in 1976 and later modified by SCDHEC in 1985 as a conservative measure to reduce human exposure. The advisory states: 1) All fish taken from the Seneca River Arm of Lake Hartwell north of SC Highway 24 and Twelvemile Creek should be released and not eaten; and 2) All fish larger than 3 lbs. from the remainder of Lake Hartwell should be released and not eaten. This advisory remains in effect and warning signs against eating fish have been posted at the majority of the public boat launch and recreation areas since 1987.

In 1987, based upon the EPA **Hazard Ranking System**, SCDHEC monitoring programs and accompanying concerns of citizens in the area, the Sangamo Site was proposed for inclusion on the **National Priorities List** (NPL). The Sangamo Site was finalized on the NPL in February 1990. A **Remedial Investigation**, consisting of separate sediment and biological components, was then initiated to define the nature and extent of PCB contamination in the Sangamo OU2 study area. The OU2 study area extends from the Sangamo Weston Plant's discharge point on Town Creek, through the Twelvemile Creek watershed, and finally into the upper portion of Lake Hartwell. Figure 1 at the end of this publication provides a general illustration of Lake Hartwell and the surrounding area. Figure 2 provides a more focused description of the OU2 study area.

Field sampling and analysis for the sediment component of the OU2 RI was performed in July and August 1991 (Phase I) and April and May 1992 (Phase II). The sediment investigation included the collection and analysis of over 1,100 sediment cores and grab samples to adequately characterize the horizontal and vertical distribution of PCB contamination in the sediments of the study area. The sediment investigation determined that most of the PCB-contaminated sediment lies within the upper portion of Lake Hartwell, specifically the Twelvemile Creek Arm. PCB concentrations of surficial sediments (i.e. grab samples) were typically less than 5 **parts per million (ppm)**, but higher concentrations up to 61 ppm were detected in the deeper sediments (i.e. core samples). Figure 3 illustrates average sediment PCB concentrations for an approximate 10 mile reach extending from Maw Bridge (Rt. 337)to the Rt. 37 Bridge at the southernmost boundary of the focused OU2 study area.

Field sampling and analysis for the biological component of the OU2 RI was conducted in the Spring of 1991 and 1992. Largemouth bass, catfish, and hybrid bass were collected and analyzed from 6 stations in Lake Hartwell. These stations are illustrated on Figure 4. The biological investigation determined that fish in the Twelvemile Creek drainage and Lake Hartwell are contaminated with PCBs, often at levels that exceed FDA's safe tolerance level of 2 ppm. Furthermore, caged fresh water clams and forage fish (small, young fish) accumulated PCBs over a relatively short period of time which confirmed the presence of food chain and respiratory transport mechanisms. PCB concentrations in sedentary fish (i.e. largemouth bass, catfish) are highest in the Twelvemile Creek Arm and decrease with increasing distance downstream, similar to the gradient of sediment contamination. Migratory fish species (i.e. hybrid bass) have PCB concentrations that are similar throughout the entire reservoir with concentrations frequently exceeding FDA's safe tolerance level. PCB concentrations for largemouth bass and hybrid bass collected from the six stations, years 1990-1993, are shown on Figures 5 and 6, respectively.

SCOPE OF THE PROPOSED ACTION

The Sangamo Site consists of two Operable Units. Operable Unit One (OU1) consists of the land-based source areas which include the Sangamo Weston Plant Site and the six satellite disposal areas located within a 3-mile radius of Pickens. Schlumberger Industries, under the oversight of EPA, initiated cleanup activities for OU1 in November 1993. On-going remedial actions consist of excavation of waste and contaminated soils from the six satellite disposal areas and transportation of the excavated materials to temporary storage facilities at the former Sangamo Plant Site. The excavated material will remain in these storage facilities until such time as a treatment system can be built at the plant site, at which time the contaminated materials will be treated by means of low temperature thermal desorption.

This publication was specifically developed to present the preferred remedial alternative for Operable Unit Two (OU2). OU2 addresses the sediment and biological migration routes downstream from the OU1 land-based source areas. OU2 represents the final response action EPA expects to implement as part of its overall strategy in remediating the Sangamo Site.

SUMMARY OF SITE RISKS

CERCLA directs EPA to protect human health and the environment from current and potential exposure to hazardous substances at the Site. A Baseline Risk Assessment was conducted to evaluate the potential current and future human health and ecological impacts associated with exposure to PCBs in sediment and fish. The human exposure pathways which were quantitatively evaluated under current and future land-use conditions included: 1) Ingestion and dermal absorption of PCBs in the shallow sediment by a child and an adult; and 2) Ingestion of PCB-contaminated fish by a recreational fisherman. PCBs were not detected in the surface water during the RI and therefore this medium was not evaluated in the risk assessment.

EPA evaluated PCBs according to their potential to produce either cancer and/or noncancer health effects. The carcinogenic risk range EPA has set for Superfund cleanups to be protective of human health is 1 X 10^{-4} to 1 X 10^{-6}. For example, a cancer risk of 1 X 10^{-6} indicates that an individual has a 1 in 1,000,000 (or 1 in 10,000 for 1 X 10^{-4}) incremental chance of developing cancer as a result of site-related exposure to a carcinogen over a 70 year lifetime under the specific exposure conditions at the Site. EPA generally uses the cumulative benchmark risk level of 1 X 10^{-4} for all exposures relating to a particular medium to trigger action for that medium. Noncancer exposure estimates were developed using EPA reference doses to calculate a Hazard Quotient (HQ). A HQ greater than 1 indicates that PCBs are present at concentrations that could produce harmful effects.

Human Risk

The risks associated with the ingestion of fish were calculated for all of the sampling stations in Twelvemile Creek and Lake Hartwell (Figure 4). Risks were evaluated separately by fish species and also for all species combined to account for both individuals who may eat one specie exclusively and individuals who consume all types of fish. Exposures associated with ingestion of fish caught from all sampling stations resulted in unacceptable risks ranging from 10^{-2} to 10^{-4} and HQs greater than 1. The highest cancer risk of 4 X 10^{-2} was calculated for anglers exclusively consuming largemouth bass caught in the Twelvemile Creek watershed. The highest cancer risk for ingestion of all species combined, 1 X 10^{-2}, was calculated for the Twelvemile Creek Arm. The lake-wide risk associated with ingestion of all species combined was 5 X 10^{-3}. Adverse human health risks resulting from direct contact or incidental ingestion with the sediment are unlikely to occur, however, sediments are a continuing source of contamination in the aquatic biota of the study area.

Ecological Risk

An ecological risk assessment was conducted to evaluate the impact PCBs may be having on the aquatic receptors of the study area. The biological investigations clearly document PCB contamination in all levels of the aquatic food web. However, although PCBs appear to be impacting the fish and macroinvertebrate communities in Twelvemile Creek, habitat degradation from man's influence is likely causing greater adverse impacts at the population and community levels. The health of fish in Lake Hartwell does not appear to be effected at the population level for fish that have PCB concentrations around 5 ppm. However, there is evidence that as concentrations increase to greater than 20 ppm, fish health can be effected.

Based upon the results of the Baseline Risk Assessment, it was concluded that actual or threatened releases of hazardous substances from this Site, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential imminent and/or substantial endangerment to public health, welfare, or the environment.

SUMMARY OF ALTERNATIVES

Thorough development and evaluation of feasible remedial alternatives for the Sangamo OU2 Site required the derivation of cleanup goals for the media of concern: sediment and fish. Cleanup goals were not developed for surface water since PCBs were not detected in any sample collected during the RI above the detection limits of 1.2 to 1.3 ppb. Cleanup goals were also necessary to identify areas to be addressed by EPA's preferred alternative. The final cleanup goals are discussed below.

Final Sediment Cleanup Goal - Concentration of 1 ppm was selected based upon technical feasibility. Remediation goal of 1 ppm identified the entire Twelvemile Creek Arm, extending from the headwaters of the lake downstream to the confluence with the Keowee Arm, as an area to be remediated. This area covers approximately 730 acres with a total estimated volume of 4,722,000 cubic yards of contaminated sediment.

Final Fish Cleanup Goal - The U.S. FDA safe tolerance level of 2 ppm was selected based upon technical feasibility. A carcinogenic risk-based approach was evaluated by determining the concentration levels in largemouth bass that would result in acceptable risk to anglers through ingestion of fish. Utilizing EPA risk assessment methods, a fish tissue concentration of 0.036 ppm is associated with a 10^{-4} risk. The risk-based fish cleanup goal of 0.036 ppm was determined to be technically impracticable.

In a similar fact sheet dated February 1994 and in the Final FS Report, EPA identified the range of remedial alternatives that were under consideration for the Site. These alternatives are briefly summarized below. All alternative cost estimates are expressed in 1993 dollars and are based upon conceptual engineering and design. Capital cost consists of direct (construction) and indirect (non-construction) costs incurred in the first year of operation. Operation and maintenance (O&M) cost refers to long-term, postconstruction items necessary to ensure continued effectiveness of a remedial action. Total present worth cost represents that sum of money, if invested in the base year and disbursed as needed, would be sufficient to cover all costs of a remedy over its planned life.

Alternative 1: No Action

As required by CERCLA, a no further action alternative was evaluated to serve as the basis for comparison with other active cleanup alternatives. Under this alternative, no further remedial actions for the contaminated sediment or fish at the Site would be conducted. The existing fishing advisory would continue and 5-year reviews would be conducted to assess sediment/fish PCB concentrations and associated risks to human health and the environment.

Due to the complex, dynamic nature of the Lake Hartwell system, significant changes in the nature and extent of contamination are expected over time even under the no-action scenario. A comprehensive modeling effort consisting of sediment transport, water quality and contaminant transport, and food-chain bioaccumulation was conducted during the RI to predict the future fate and transport of PCBs in sediments and aquatic biota of the study area. The predicted results of this modeling exercise are important considerations when evaluating the no-action alternative. For this reason, the predicted results of the baseline modeling activities are summarized below.

Future Sedimentation

The objective of sediment modeling was to determine the rates at which presently contaminated sediments would be buried by relatively clean sediments from tributary drainages over the next 30 years. Average sediment burial rates for the 30 year simulation are presented in Figure 7. Substantial rates of sediment deposition are predicted from Maw Bridge (Rt. 337) to just above the Hwy 133 Bridge. All of the sand and most of the silt coming into the reservoir from the Twelvemile Creek drainage are deposited in this reach with a predicted 30-year accumulation of nearly 10 feet of sediment in some areas. This deposition pattern is favorable since PCB concentrations have historically been higher in sediments from this portion of the study area.

Sediment Quality Trends

The objective of sediment quality modeling was to predict the fate and transport of PCBs in the surface and bottom sediments in the Twelvemile Creek/Lake Hartwell system over the next 30 years. Surface and bottom sediments upstream of the Hwy 133 Bridge are predicted to decrease to near zero levels within 5 years. Sediments between the Hwy 133 Bridge and the Hwy 93 Bridge are predicted to fall below the 1 ppm cleanup goal in approximately 10 years. Surface and bottom sediments lying between the Hwy 93 Bridge and the Hwy 37 Bridge are predicted to increase and remain over the 1 ppm cleanup goal after 30 years. This predicted increase is attributed to the settling of the finer, clay sized particles caused by the constriction of the channel at the Hwy 37 embankment.

Bioaccumulation and Future
Fish Concentrations

Aquatic bioaccumulation modeling was conducted to assess: 1) How PCB levels in fish would change over the next 30 years if the contaminated sediments were left unmanaged, and 2) How long it would take for levels to drop below the 2 ppm cleanup goal. A representative food web was developed to evaluate the uptake of PCBs into fish via respiration and consumption of contaminated food. Largemouth bass was selected as the top predator, gizzard shad/bluegill sunfish as the forage fish, while plankton and benthos composed the lower levels of the food web. Initial and predicted PCB concentrations for the selected food web are presented in Figure 8. The bioaccumulation model predicts PCB concentrations to decrease in all levels of the food web during the 30-year simulation.

PCB concentrations in older largemouth bass are predicted to fall below the 2 ppm cleanup goal by 2005.

Capital Cost = $7,000
Total O&M Cost = $123,000
Total Present Worth Cost = $130,000

Alternative 2A: Institutional Controls

This alternative is a limited action alternative that relies on a series of institutional controls to prevent or minimize ingestion of contaminated fish tissue, which was identified as the primary exposure pathway of concern for the Site. Generally, these institutional controls consist of the following:

- Public Education Program - A program would be initiated to inform the public on available methods for reducing the intake of PCBs through fish consumption. Specific preparation, handling, and cooking techniques can reduce the quantity of contamination consumed. Information of this type would be disseminated to the public through a series of local public meetings and distribution of an informational pamphlet.

- Fish and Sediment Monitoring - In addition to maintaining the current fish advisory, annual monitoring of PCB levels in fish and sediment of Twelvemile Creek and Lake Hartwell would be conducted. Results from this monitoring program would be utilized to support modifications to the fish advisory and to monitor concentrations of PCBs in sediment and fish over time. Results of this program would be made available to the public.

- Regulation of Twelvemile Creek Impoundments - A routine schedule would be developed for flushing of sediment accumulated behind the 3 small impoundments located on Twelvemile Creek. Periodic flushing (most recently in September 1993) of a large load of sediment over a short period of time has been documented to have an adverse impact on the water quality and aquatic biota of the upper portion of the Twelvemile Creek Arm. These adverse impacts are attributed to elevated levels of suspended sediment and not PCBs. A routine flushing schedule would minimize impacts to the ecosystem while enhancing burial of more contaminated sediments with cleaner sediments from the Twelvemile Creek drainage.

Capital Cost = $366,000
Total O&M Cost = $2,842,000
Total Present Worth Cost = $3,208,000

Alternative 2B: Fisheries Isolation

Alternative 2B is a more aggressive approach consisting of management of the fisheries resource within the lake to minimize ingestion of PCB-contaminated fish. The primary control measure includes construction of a barrier, or fish fence, to prevent the movement of migratory fish (i.e. striped bass, hybrid bass, and walleye) into or out of the most contaminated portions of the reservoir. These migratory species represent approximately 50% of the fish harvested by weight from Lake Hartwell. The fish isolation barrier would be located in the vicinity of the Hwy 37 Bridge, and designed/constructed to meet the following performance standards:

- Minimize safety hazards for boaters and other users of the lake (i.e. waterskiers);
- Maximize effectiveness to prevent passage of migratory game fish through the barrier;
- Allow boats to pass unimpeded to minimize disruptions of boating traffic on the lake (i.e. no gate);
- Construct a semi-permanent structure that could be removed once PCB levels decline to health-based levels;
- Incorporate value engineering principles to minimize cost for design and construction; and
- Minimize operations and maintenance requirements and costs.

Lake use restrictions, such as no-wake zones and warning signs would be implemented to prevent damage to the fence and for boating safety. Alternative 2B also includes the institutional controls described for Alternative 2A.

Capital Cost = $1,232,000
Total O&M Cost = $3,012,000
Total Present Worth Cost = $4,244,000

Alternative 3A: Capping

Under this alternative, an 18 inch clean sediment cap would be placed over the entire Twelvemile Creek Arm to eliminate the further downstream migration of contaminated sediment and the transfer of PCBs from sediment to aquatic biota. The cap would extend from just upstream of the Maw Bridge (Rt. 337) to the confluence with the Keowee River, just upstream of Hwy 123. The cap would cover an area of 730 acres and would require approximately 1,800,000 yd^3 of sand to construct the cap. Alternative 3A also consists of lake usage restrictions to minimize erosion of the cap once it is placed and other institutional controls described under Alternative 2A.

Capital Cost = $48,296,000
Total O&M Cost = $2,843,000
Total Present Worth Cost = $51,139,000

Alternative 3B: Sediment Control Structure

Alternative 3B would consist of constructing a 1,600-ft. long fixed-crest weir at the mouth of the Twelvemile Creek Arm, just above the confluence with the Keowee River. Construction of the sediment control structure would physically isolate the Twelvemile Creek Arm from the remainder of Lake Hartwell resulting in reductions in downstream migration of contaminated sediment and movement of fish to/from the areas with highest sediment PCB levels. Fishing restrictions in the isolated area, as well as institutional controls under Alternative 2A, would be implemented to limit consumption of contaminated fish until protective levels were achieved.

Capital Cost = $51,226,000
Total O&M Cost = $2,365,000
Total Present Worth Cost = $53,591,000

Alternative 3C: Optimal Capping/ Sediment Control Structure

Alternative 3C utilized value engineering techniques to optimize both the area to be capped and location of the fixed crest weir. The weir would be constructed at an upstream location near the Hwy 133 Bridge, resulting in the physical isolation of a much smaller area than Alternative 3B. A similar clean sediment cap as described under Alternative 3A would be placed below the weir and extend downstream to the mouth of the Twelvemile Creek Arm. The area to be capped under this alternative is approximately 285 acres. Institutional controls under Alternative 2A and fishing restrictions for the isolated area would be implemented until protective levels in the fish were achieved.

Capital Cost = $31,684,000
Total O&M Cost = $2,365,000
Total Present Worth Cost = $34,049,000

Alternative 4: Confined Disposal Facility

Alternative 4 involves a much more rigorous remediation approach than any of the alternatives discussed above. Under this alternative, contaminated sediments from the Twelvemile Creek Arm with PCB concentrations greater than 1 ppm would be removed by hydraulic dredging. All dredged sediments would be placed in a near-shore confined disposal facility (CDF) located in the "goose neck" bend area between the Maw (Rt. 337) and Madden (Rt. 15) Bridges. Twelvemile Creek would then be diverted around the CDF via a physically rerouted channel. Institutional controls would be used to limit consumption of contaminated fish until protective levels were achieved.

Capital Cost = $43,422,000
Total O&M Cost = $3,487,000
Total Present Worth Cost = $46,909,000

Alternative 5: Stabilization

Alternative 5 is a very complex and costly alternative that involves removal of contaminated sediments with PCB concentrations greater than 1 ppm via a combination of shallow water excavation and hydraulic dredging. Contaminated sediments in the middle and lower portions of Twelvemile Creek Arm would be dredged while the upper portion is dewatered and excavated. The dredged/excavated sediments would be treated by stabilization with cement and placed in a CDF as described under Alternative 4. Fish and other biota in the upstream segment would be collected and destroyed as part of the dewatering operations. Institutional controls would be used to limit consumption of contaminated fish until protective levels are achieved.

Capital Cost = $581,957,000
Total O&M Cost = $3,486,000
Total Present Worth Cost = $585,443,000

EVALUATION OF ALTERNATIVES

EPA has established criteria for use in comparing the advantages/disadvantages of each alternative under consideration. The alternatives discussed above were evaluated against one another by using the nine criteria specified in the **National Contingency Plan** 40 CFR 300.430(e)(9). These nine evaluation criteria are:

1) Overall Protection of Human Health and the Environment
2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3) Long-term Effectiveness and Permanence
4) Reduction of Toxicity, Mobility, or Volume
5) Short-term Effectiveness
6) Implementability
7) Cost
8) State Acceptance
9) Community Acceptance

The first two criteria are referred to as threshold criteria and must be met for an alternative to be eligible for selection. The next five criteria are referred to as balancing criteria and are used to weigh major trade-offs among alternatives. The final two criteria, state and community acceptance, are referred to as modifying criteria and are addressed during the Proposed Plan comment period. The following discussion briefly evaluates the relative performance of each alternative to the evaluation criteria.

Overall Protection of Human Health and the Environment - It is important to note that complexities related to cycling of PCBs in the biota of Lake Hartwell cause the residual risk levels to remain above EPA's threshold of 1×10^{-4} regardless of which remedial alternative is implemented. A reduction in sediment PCB concentrations does not result in an immediate reduction in PCB concentrations in fish. High PCB concentrations in fish during the initial years of the 30-year exposure duration result in average risk estimates exceeding acceptable levels. Therefore, the most effective measures to minimize exposures to PCB-contaminated fish tissue are institutional controls (i.e. public education, continuation of fish advisory).

However, the most protective alternatives rely principally on engineering rather than institutional controls to reduce or eliminate exposures, given the uncertainty regarding the performance/reliability of institutional controls. Alternatives 3A and 3C involve capping actions that would permanently isolate the contaminated sediment in all or a major portion of the Twelvemile Creek Arm. The more aggressive alternatives 4 and 5 provide an even higher level of protectiveness, as the contaminated material is removed from the lake and isolated in an engineered disposal facility.

Compliance with ARARs - This criterion assesses the overall compliance with Federal/State requirements. All the alternatives rely on natural fate and transport processes to reduce PCB concentrations in Lake Hartwell fish to the FDA safe tolerance level of 2 ppm. Alternatives that involve capping and isolation (Alternatives 2B/3A/3B/3C) achieve FDA levels in fish quicker in the main body of the lake. Alternatives 3A, 4 and 5 would best achieve the cleanup goal of 1 ppm in sediment. However, Alternatives 4 and 5 would likely trigger a large number of Federal/State requirements associated with water quality, dredging, and disposal.

Long-term Effectiveness and Permanence - With the exception of the No-Action Alternative, all alternatives rely on institutional controls to prevent exposure to contaminated fish. The performance and reliability of these controls is dependent on site-specific factors and therefore difficult to predict. The fish fence (Alternative 2B) would require pre-design treatability testing to demonstrate effectiveness for the scale of application at Sangamo OU2. Capping (Alternatives 3A/3C) is a proven technology but is dependent on an extensive program of monitoring and maintenance to ensure cap integrity and long-term effectiveness. Sediment control structures (weirs) are also widely used and are less dependent on maintenance. Further technology evaluation and treatability studies would be needed prior to implementation of Alternatives 4 and 5 to obtain design and operating data for the dredging, CDF, and treatment activities.

Reduction of Toxicity, Mobility, or Volume - Alternative 5 would accomplish the most significant reduction in the mobility of PCBs through a stabilization treatment process followed by disposal in a CDF. The capping alternatives (Alternatives 3A/3C) also accomplish a reduction in contaminant mobility, but the effect is contingent upon proper maintenance of the cap. The sediment control structures (Alternatives 3B/3C) and fish fence (Alternative 2B) would be the most effective in limiting contaminant mobility related to the migration of fish into and out of the areas with the highest sediment contamination.

Short-term Effectiveness - Implementation of Alternatives 1 (No-Action) and 2A (Institutional Controls) would have the least impact on the community, workers, and the environment; Alternative 2B has only a slightly greater impact. Alternatives 3A/3B/3C have greater impacts on the local community due to construction of sediment control structures and excessive truck traffic associated with transportation of capping material. The greatest impacts (and least short-term effectiveness) are the more aggressive alternatives that entail dredging, re-channeling and construction of the CDF (Alternatives 4/5).

Table 1 at the end of this publication summarizes the estimated schedule for each alternative, presenting the time required to implement, time required for fish PCB concentrations to decline to the FDA safe tolerance level, and total time to achieve protectiveness. This information is presented for the focused Sangamo OU2 study area (Twelvemile Creek/Seneca River Arm) as well as the main portion of Lake Hartwell. The table shows that most of the alternatives rely on natural fate and transport processes within the reservoir to return conditions to protective levels (12 years). In the Twelvemile Creek Arm, the more aggressive alternatives involving capping, sediment control structures, or dredging, achieve protectiveness (in most cases) in 5 to 10 years. Alternative 2B - Fisheries Isolation achieves protectiveness in the main body of Lake Hartwell (representing 90% of the total lake area) in a shorter amount of time (4 to 5 years) than the other more aggressive and costly alternatives.

Implementability - Alternatives 1 and 2A would be the most readily implementable. Alternatives 2B/3A/3B/3C would require close coordination with the COE, SCDHEC, and other agencies; however, the administrative and technical issues associated with these alternatives are considered manageable. The most difficult alternatives to implement, in terms of both administrative and technical feasibility, would be Alternatives 4/5.

Cost - Costs for each alternative were provided under the Summary of Alternatives section of this publication.

State Acceptance - The State of South Carolina is currently reviewing this Proposed Plan. The State feels that at a minimum, Alternative 2A - Institutional Controls should be selected. The State will make a final selection of a preferred alternative after the public comment period is over. The State will rely on public comment for the selection of the preferred alternative.

Community Acceptance - The purpose of this Proposed Plan and the comment period is to encourage input from the public during the remedy selection process. Community acceptance of the preferred alternative will be evaluated after the public comment period and will be described in the Record of Decision for the Site.

EPA'S PREFERRED ALTERNATIVE

In summary, based upon the information available at this time, EPA is proposing Alternative 2B - Fisheries Isolation, which also includes those activities described under Alternative 2A. Placement of the fish fence in the vicinity of the Hwy 37 Bridge would result in isolation of the Twelvemile Creek, Keowee River and upper Seneca River Arms, which represent less than 10 percent of the total area of Lake Hartwell. Isolation of these upstream areas is expected to result in an accelerated decline in migratory fish PCB concentrations in the downstream portions of the reservoir (i.e. the remaining 90+ percent of the lake). Migratory species represent approximately 50% of the fish harvested by weight from Lake Hartwell. Reduction of fish PCB levels would allow for rescinding of the existing fish advisories in these areas, returning the majority of lake areas to normal use. This approach is consistent in the COE's Best Management Practices for Lake Hartwell, designed to achieve the maximum beneficial uses for the reservoir, which include fish and wildlife management and recreational use.

Alternative 2B - Fisheries Isolation represents the best balance among the criteria used to evaluate the other alternatives. Alternative 2B is believed to be protective of human health and the environment, would attain ARARs, would be cost effective and would utilize permanent solutions and resource technologies to the maximum extent practicable. The selected remedy does not satisfy the preference for treatment as a principal element due to the excessive costs. Based upon comments received from the public during the comment period, EPA, in close consultation with the COE and SCDHEC, may later modify the preferred alternative or select another remedial alternative presented in this Proposed Plan.

COMMUNITY PARTICIPATION

Concurrent with the release of this Proposed Plan, EPA has initiated a 30-day public comment period from April 11, 1994 through May 11, 1994 for submission of written and oral comments on the Proposed Plan and all supporting documentation located in the information repositories listed below. All comments, written or oral, should be directed to Craig Zeller, EPA Remedial Project Manager for the Sangamo OU2 Site, at the address and telephone number listed below. Upon timely request, EPA will extend the public comment period by 30 additional days. EPA will hold a public meeting at 7:00 PM on April 19, 1994 to present the information contained in the RI/FS Reports and to explain the rationale behind the preference for Alternative 2B - Fisheries Isolation. The meeting will be held at the Ramada Inn located at the intersection of U.S. 76 and Hwy 123 in Clemson, South Carolina. Representatives from EPA, the U.S. Army Corps of Engineers, and the South Carolina Department of Health and Environmental Control will be available to answer any questions the public may have regarding future activities at the Sangamo OU2 Site.

GLOSSARY

Administrative Record - A file which contains all information used by the EPA to make its decision on the selection of a response action under CERCLA. This file is required to be available for public review and a copy is to be established at or near the site, usually at the information repository. A duplicate file is maintained in a central location such as a regional EPA and/or state office.

Baseline Risk Assessment - An assessment which provides an evaluation of the potential risk to human health and the environment in the absence of remedial action.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) - A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The Act created a trust fund, known as Superfund to investigate and clean up abandoned or uncontrolled hazardous waste sites.

Hazard Ranking System - A scoring system used by EPA to evaluate relative risks to public health and the environment. A score is calculated based on actual or potential release of hazardous substances through all media present (i.e. the air, soils, surface water, sediments, groundwater). If a site scores above 28.5, the site is proposed for inclusion of the National Priorities List.

Information Repository - Materials on Superfund and a specific site located conveniently for local residents.

Macroinvertebrates - Small animals lacking backbones found in sediments of water bodies.

National Contingency Plan - The Federal regulation that guides the Superfund program.

National Priorities List (NPL) - EPA's list of uncontrolled or abandoned hazardous wastes sites eligible for long-term cleanup under the Superfund Remedial Program.

Parts Per Billion (ppb)/Parts Per Million (ppm) - Units commonly used to express low concentrations of contaminants. For example, 1 ounce of PCBs in 1 million ounces of water is 1 ppm. If one drop of PCB's are mixed in a competition sized swimming pool, the water will contain about 1 ppm PCB.

Polychlorinated Biphenyls (PCBs) - A family of organic compounds used since 1926 in electric transformers as insulators and coolants, in lubricants, carbonless copy paper, adhesives and caulking compounds. Also produced in certain combustion processes. PCBs are extremely persistent in the environment because they do not easily break down. PCBs are stored in the fatty tissues of humans and animals through the biaccumulation process. EPA banned the use of PCBs in 1978. In general, PCBs are not as toxic as some other chemicals, although acute and chronic exposure can cause liver damage. PCBs also have caused cancer in laboratory animals.

Remedial Investigation/Feasibility Study (RI/FS) - Two distinct but related studies, normally conducted together, intended to define the nature and extent of contamination at a site and to evaluate appropriate, site-specific remedies.

Record of Decision - A public document that explains which cleanup alternative will be used at a National Priorities List site and the reasons for choosing the cleanup alternative over other possibilities.

Superfund Amendments and Reauthorization Act (SARA) - Modifications to CERCLA enacted on October 17, 1986.

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FOR MORE INFORMATION CONTACT:

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North Superfund Remedial Branch
345 Courtland Street, N.E., Atlanta, GA 30365
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South Carolina Department of Health & Environmental Control
2600 Bull Street, Columbia, South Carolina 29201
(803) 734-5487

INFORMATION REPOSITORIES

The Administrative Record for the Sangamo Site is available for review at the following information repositories:

The Village Library
Main Street
Pickens, SC 29671
(803) 859-9679

Pickens County Public Library
Easley Branch
110 West First Avenue
Easley, SC 29640
(803) 859-9679

R. M. Cooper Library
Clemson University
Clemson, SC 29634-3001
(803) 656-5174

Hart County Library
Benson Street
Hartwell, GA 30643
(706) 376-4655

U. S. Army Corps of Engineers
Lake Hartwell Natural Resources Management Center
Hartwell, Georgia
(706)376-4788

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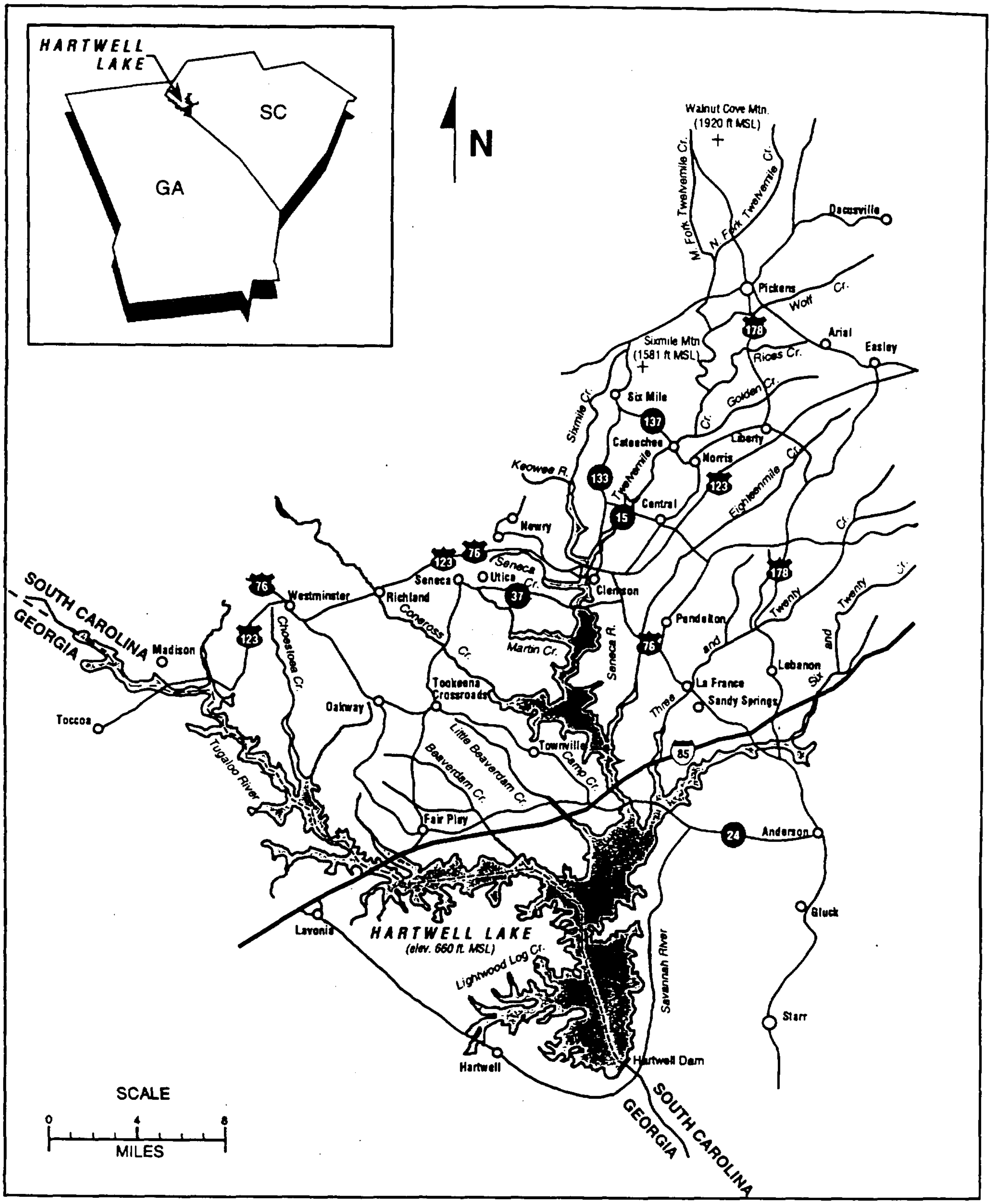

Figure 1
Lake Hartwell and Watershed
Sangamo OU2

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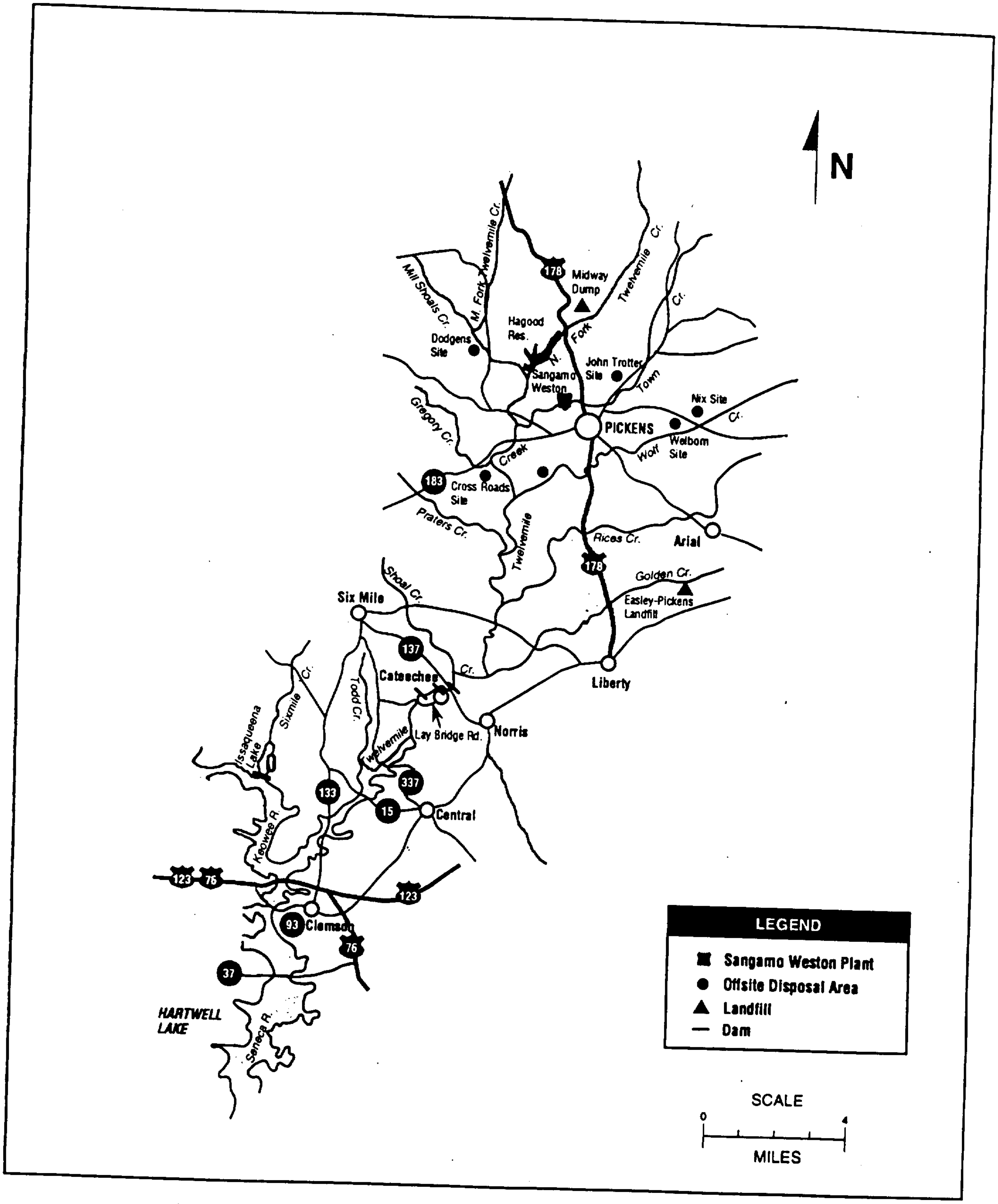
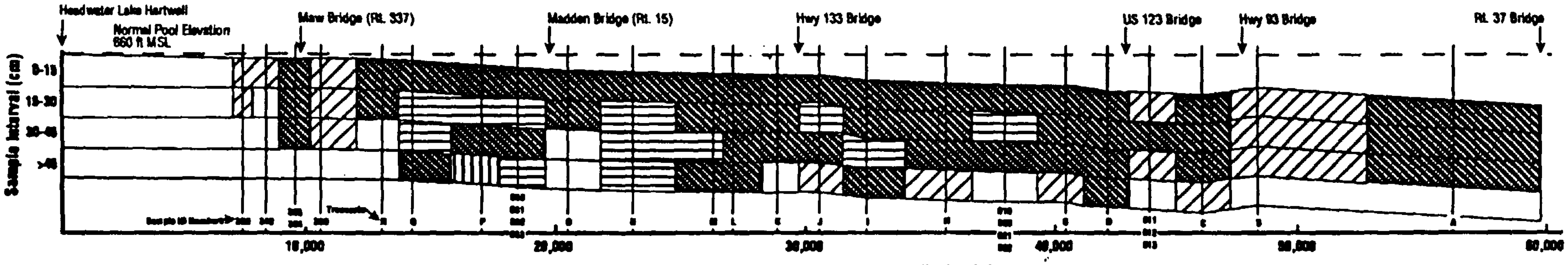


Figure 2
Sangamo OU2 Study Area

Mean PCB Concentration per Transect Interval



NOTE: Mean PCB concentrations were determined by averaging all results for a given sample depth interval for all coring stations along a given transect.

No samples for given interval

PCB Concentration <1 mg/kg

PCB Concentration ≥1< 5 mg/kg

PCB Concentration ≥5<10 mg/kg

PCB Concentration ≥ 10 mg/kg

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Figure 3
Mean Vertical Distribution of PCBs in Sediments
Twelvemile Creek Arm of Hartwell Lake
Sangamo OU-2 FS

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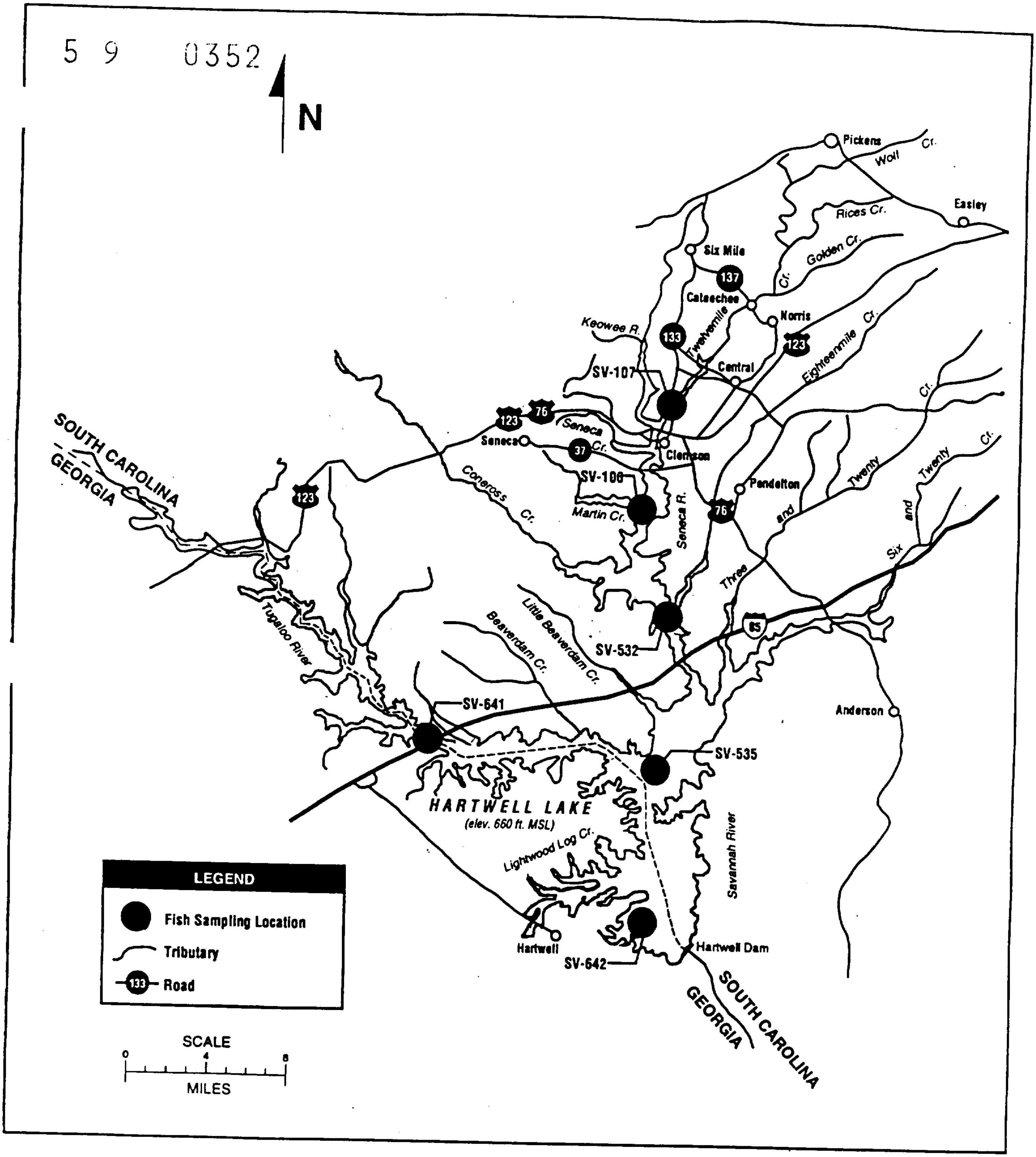

Figure 4
Fish Tissue Sample Stations
Lake Hartwell

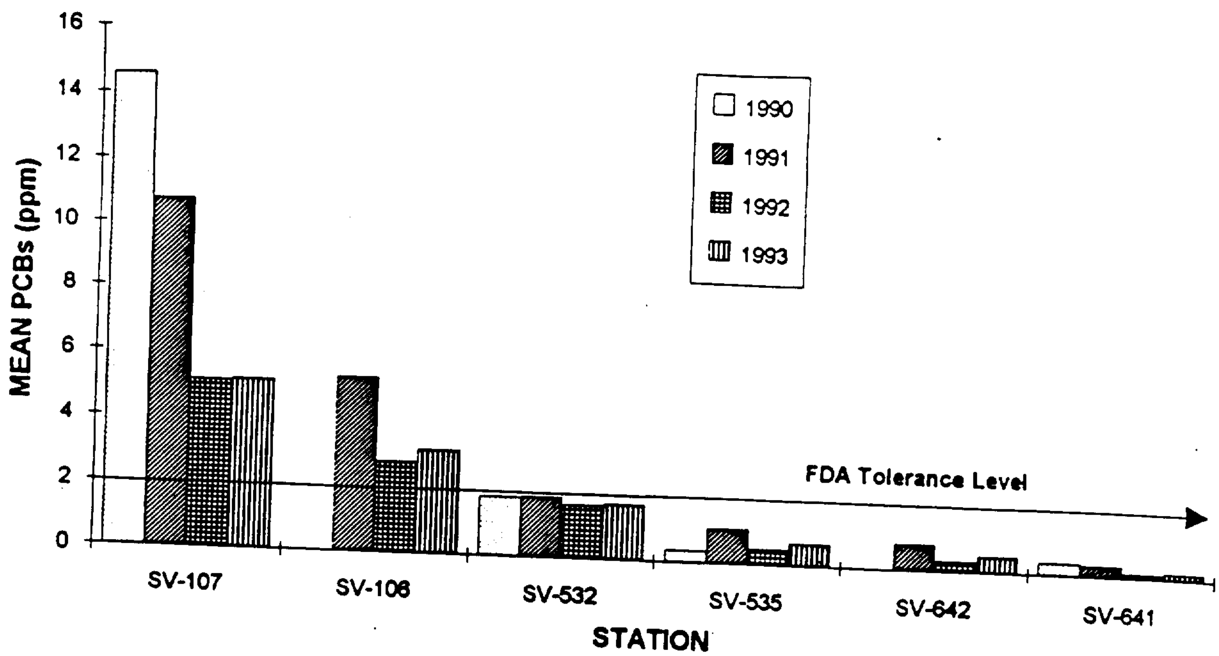

Figure 5: PCB concentrations in largemouth bass fillets collected from six stations in Lake Hartwell, 1990-1993.

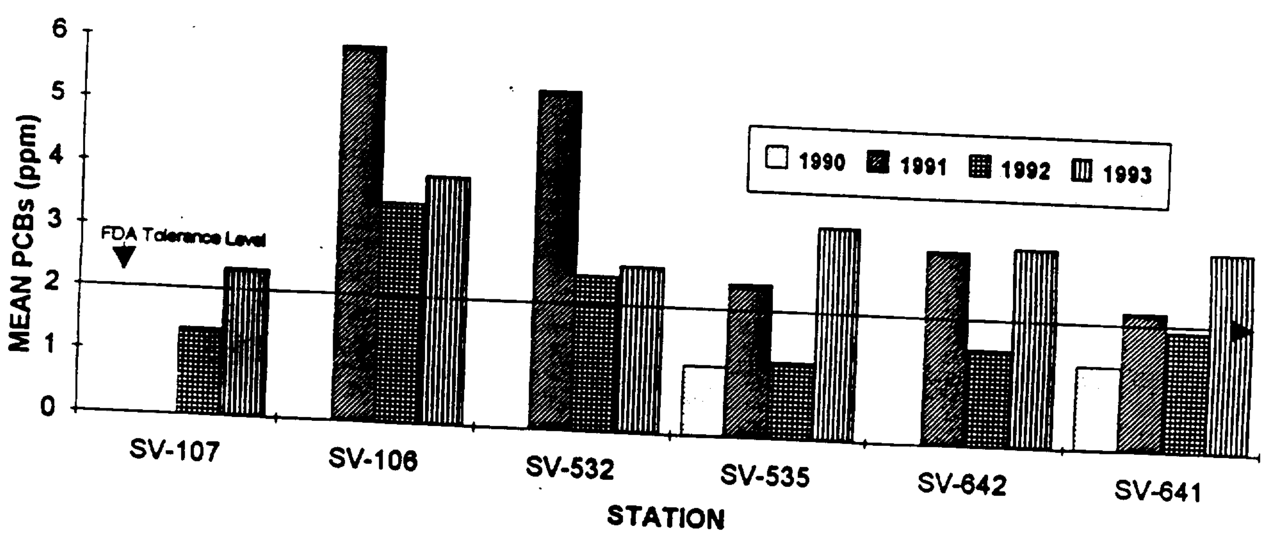

Figure 6: PCB concentrations in hybrid bass fillets collected from six stations in Lake Hartwell, 1990-1993.

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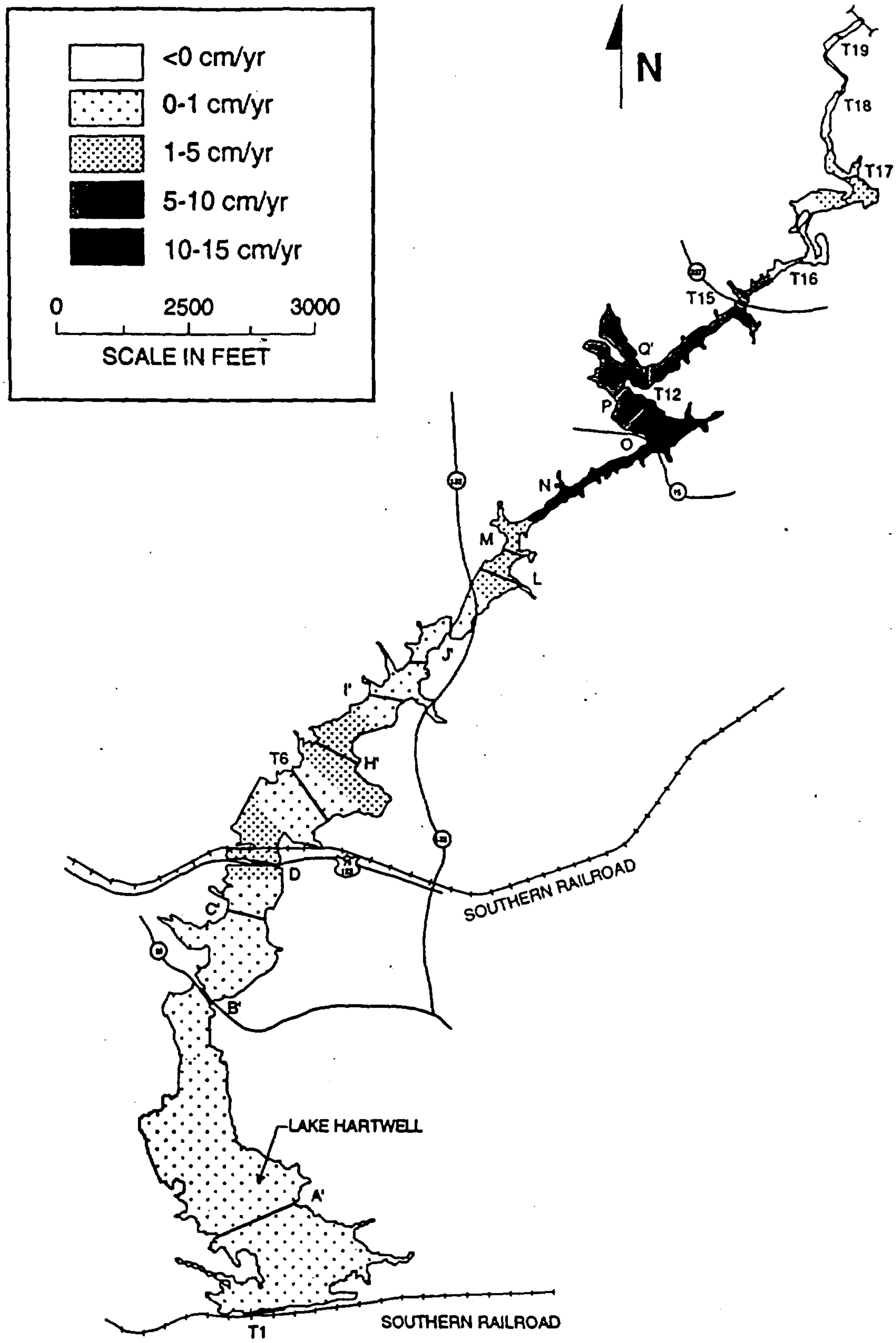
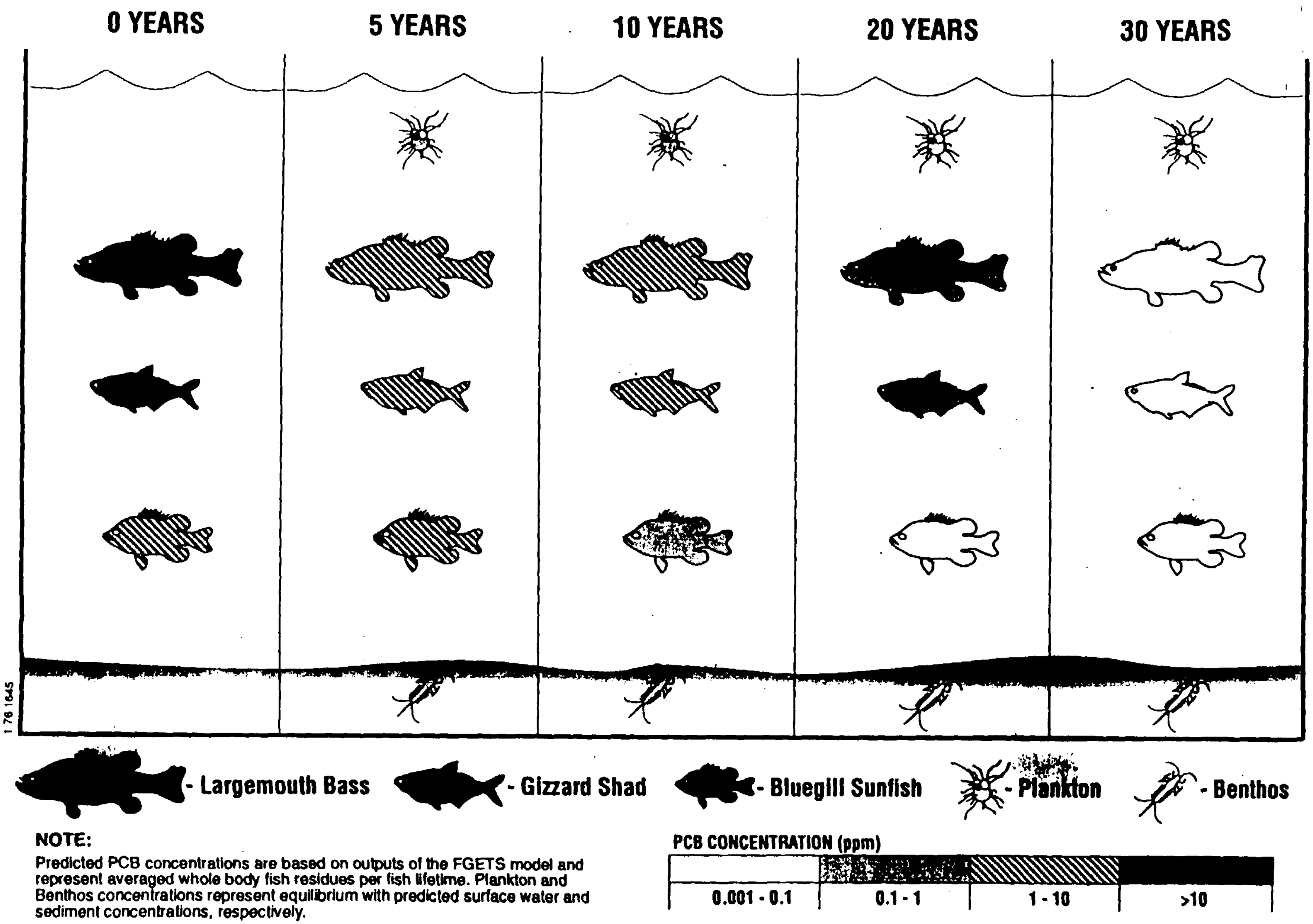


Figure 7
Predicted Average Sediment Burial Rates
Sangamo OU2



NOTE:
Predicted PCB concentrations are based on outputs of the FGETS model and represent averaged whole body fish residues per fish lifetime. Plankton and Benthos concentrations represent equilibrium with predicted surface water and sediment concentrations, respectively.

Figure 8
Initial and Predicted PCB ›ncentrations for Food Web
Lake Hartweŀ - Sangamo OU2

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Table 1
Estimated Time Required to Achieve Protectiveness
Sangamo OU-2 FS

ALT. NO.	DESCRIPTION	TIME TO IMPLEMENT[1] (yrs)	TIME FOR FISH TO ATTAIN FDA LEVEL (yrs)		TIME TO ACHIEVE PROTECTIVENESS[4] (yrs)	
			TWELVEMILE CREEK/SENECA RIVER[2] ARM	MAIN BODY OF HARTWELL LAKE[3]	TWELVEMILE CREEK/SENECA RIVER ARM	MAIN BODY OF HARTWELL LAKE
1	No action	0	12	12	12	12
2A	Institutional Controls	0.5	12	12	12	12
2B	Fisheries Isolation	1	12	3-4	12	4-5
3A	Capping	2	3-4	3-4	5-6	5-6
3B	Sediment Control Structure	2	12	3-4	12	5-6
3C	Optimal Capping/Sediment Control Structure	2-3	3-4 (downstream) 12 (upstream)	3-4	5-7 (downstream) 12 (upstream)	5-7
4	Confined Disposal Facility	3-4	5-6	5-6	8-10	8-10
5	Stabilization	4-5	5-6	5-6	9-11	9-11

NOTE:
(1) Includes time needed for pre-design studies, design, procurement, and construction, but does not include time between Proposed Plan/Record of Decision and initiation of Remedial Design.

(2) Twelvemile Creek Arm only; FGETS modeling results indicate that fish will decline to FDA tolerance level (2 mg/kg) in approximately 12 years under baseline conditions; none of the alternatives will extend the period required for this to occur (i.e., none of the alternatives can have a period to achieve protectiveness of greater than 12 yrs).

(3) Downgradient of the Twelvemile Creek Arm (i.e., main body of Hartwell Lake), PCB concentrations will decline more rapidly for actions involving isolation, capping or removal of contaminated sediment (Alternatives 2B, 3A-C, 4 and 5). It was assumed that this rate of decline would be comparable to that observed in the Twelvemile Creek Arm for Alternatives involving capping (3-4 yrs) or removal of the sediment (5-6 yrs); further modeling is needed to verify this estimate.

(4) Duration only; based on estimated time to implement remedy and duration thereafter needed for fish PCB levels to decline to FDA level, based on the FGETS modeling results presented in Section 3.3 and assumptions regarding migratory fish PCB concentrations trends.

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USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Sangamo Superfund Site - OU2 is important in helping EPA select a final remedy for the site. You may use the space below to write your comments, then fold and mail. A response to your comment will be included in the Responsiveness Summary.

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REQUEST TO BE PLACED ON THE SANGAMO WESTON, INC./TWELVE MILE CREEK/LAKE HARTWELL SITE MAILING LIST

If you would like to be placed on the mailing list for the Sangamo Site, please complete this form and return to: Cynthia Peurifoy, Community Relations Coordinator, EPA-Region IV, North Superfund Remedial Branch, 345 Courtland Street, Atlanta, Georgia 30365, or call 1-800-435-9233.

NAME: ____

ADDRESS: ____

____

TELEPHONE: ____

AFFILIATION: ____