FINAL REPORT
May 2003
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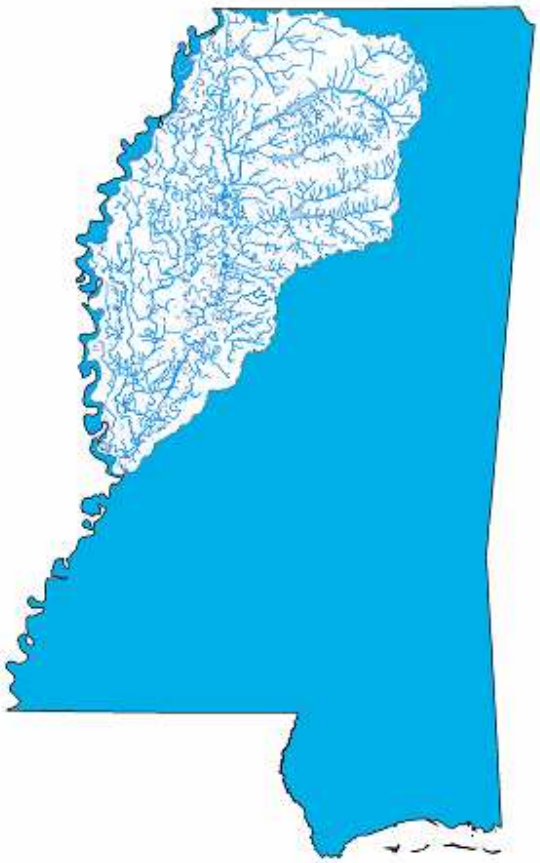
Total Maximum Daily Loads For The Legacy Pesticides DDT and Toxaphene In The Yazoo River Basin

Prepared by
Mississippi Department of Environmental Quality
Office of Pollution Control



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Foreword

This report has been prepared in accordance with the schedule contained within the federal consent decree dated December 22, 1998. The report contains one or more Total Maximum Daily Loads (TMDLs) for waterbody segments found on Mississippi's 1996 Section 303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Prefixes for fractions and multiples of SI units

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^{2}	hecto	h
10^{-3}	milli	m	10^{3}	kilo	k
10^{-6}	micro	μ	10^{6}	mega	M
10^{-9}	nano	n	10^{9}	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
Acres	Sq. miles	0.0015625	Days	Seconds	86400
Cubic feet	Cu. Meter	0.028316847	Feet	Meters	0.3048
Cubic feet	Gallons	7.4805195	Gallons	Cu feet	0.133680555
Cubic feet	Liters	28.316847	Hectares	Acres	2.4710538
cfs	Gal/min	448.83117	Miles	Meters	1609.344
cfs	MGD	.6463168	Mg/l	ppm	1
Cubic meters	Gallons	264.17205	μg/l * cfs	Gm/day	2.45

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Original Listing

Mississippi conducted a survey of district conservationists (DC) in 1988 and 1989 to find candidate watersheds for future Section 319 funding opportunities. Questionnaires were mailed to each county requesting each DC identify the impaired watersheds in the county in part based on land use. Numerous DCs responded to the survey and Mississippi's Section 319 list was created based on these surveys.

In 1992, MDEQ compiled a Section 303(d) list based, in part, on the Section 319 listed watersheds that were a concern. It is important to remember that these listings are based on speculation and not water quality monitoring. At the time, MDEQ considered the evaluated listings from the Section 319 survey as a placeholder for future monitoring to determine if there were indeed impairment in the watershed.

The questionnaires asked for the presence of agriculture, urban areas, or forestry in the watershed. MDEQ interpreted these land uses and listed several broad potential pollutant categories based on the survey results. Every watershed for which agriculture was checked, was then listed for sediment, pesticides, organic enrichment/low dissolved oxygen, and nutrients.

Since the late 1980s and early 1990s, pesticide use and pesticide delivery technology has changed considerably. The chemicals used are too expensive to waste. For example, a hooded nozzle was invented that scans the field for weeds and sprays a controlled amount of Roundup directly on the weed to kill it. Producers have greatly reduced over-spray and waste of these chemicals. Current use pesticides are not as persistent in the environment like the legacy pesticides DDT and Toxaphene.

Current Use Pesticides

This TMDL is for DDT and Toxaphene, which has been found in fish flesh samples, and it represents the pesticide listings in the 1996 and 1998 Mississippi Section 303(d) List. The original listings were not specific, however, the listings were meant to represent pesticides for which Mississippi waters have impairment. The fish consumption advisory issued for the Delta is due to elevated levels of DDT and Toxaphene. Therefore, the current use pesticides are not included in the pesticide listings unless there are data indicating impairment. When current use pesticides are found impairing a water body segment, that segment will be listed on the next 303(d) list with the specific chemical pollutant identified.

Pollutant Source

In the 1950s and 1960s agricultural producers used pesticides that were chemically and environmentally different from the current use pesticides. DDT and Toxaphene have decades long half-lives rather than most of today's environmental half-lives of days or weeks. Today's competitive market of pesticide manufacturing is also encouraging

production for more "natural" and "environmentally friendly" pesticides. In essence, effects of legacy pesticides are much different and require different evaluations than the current use pesticides. Even after 25 years of little or no use, DDT metabolites are being found that are degraded metabolites of the parent compound. DDT contamination has been linked to problems with the reproduction rates of certain avian species such as eagles and pelicans. The eggs from these and other species were weakened due to contamination and reproduction was severely impacted.

The use of DDT was prohibited in the United States in 1973, and Toxaphene was banned in 1982. Production of both has ceased in the United States. Unfortunately, the residues of the chemicals are still present in the Yazoo River Basin. Elevated levels have been found in several fish species, and sediment tests show that the legacy pesticides are still present in the fields and streams. Due to the concern of the carcinogenic impact of these pollutants, MDEQ issued a basin-wide fish consumption advisory for 4 species of fish. The good news is that the levels found are going down. The purpose of this TMDL document is to promote further reduction of the levels found in the aquatic species and to promote best management practices to keep the sediment on the fields and out of the streams.

Identification of Waterbody

This TMDL has been prepared because the federal consent decree between EPA Region 4 and the Mississippi Sierra Club contains specific requirements for TMDL development throughout the state. The consent decree is based on the 1996 Section 303(d) list. In that list, waterbodies were listed as either monitored (M) or evaluated (E).

EPA agreed to complete the TMDLs for all waterbodies identified as monitored (M) during the first five-year rotation of Mississippi's basin rotation plan. This agreement was made without regard to the status of water quality data for the specific pollutant listed for the waterbody. In the Yazoo River Basin there was no specific pesticide data available that would support a listing for a specific pesticide. However, there were several fish samples that indicated the need for a fish consumption advisory for DDT and Toxaphene contamination.

This TMDL is therefore being prepared for the pesticide listings in the Yazoo River Basin from the 1996 Mississippi 303(d) list for waterbodies listed as monitored. Table 1 lists the waterbody name, identification number, and location information for each waterbody included in this TMDL Report. The maps following the table show the locations of the waterbodies.

Pollutant of Concern

Since 1969 the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) has studied the levels of DDT and Toxaphene in fish from delta lakes. Muscle tissue concentrations of DDT up to 29 mg/kg led to advisories on Wolf Lake, Mossy Lake, and Lake Washington in the late 1960s and early 1970s. MDWFP continued annual

monitoring of these lakes, and the advisories were rescinded when the average levels fell below the Food and Drug Administration Action Levels. The advisories were removed from Washington and Mossy Lakes in 1976 and from Wolf Lake in 1982.[1]

MDEQ began sampling whole fish from the rivers and streams in the delta in 1979. This monitoring found similar levels of DDT and Toxaphene in the rivers as MDWFP had found in the lakes. MDEQ also identified a declining trend in the pesticide concentration in samples taken from the 1960s. MDEQ shifted the focus to fish muscle tissue in the 1990s to better assess human health impacts. In 1984 the U.S. Fish and Wildlife Service in its National Contaminant Biomonitoring Report found concentrations of DDT in whole carp from the Yazoo River at Redwood, Mississippi to be the highest of 112 sites collected across the nation (USFWS 1990). From 1985 – 1992, the USFWS monitored pesticides in whole fish from many of its refuges across the nation. This monitoring found concentrations of DDT up to 13 mg/kg in some species and led to the closure of the Yazoo National Wildlife Refuge to fishing (USFWS 1992, 1992a, 1993). In 1995-1996, the U.S. Geological Survey (USGS) sampled several sites in Mississippi as part of the Mississippi Embayment of their National Water Quality Assessment (NAWQA) Program. In this study, DDT and Toxaphene levels from whole carp in the Mississippi Delta streams were consistently the highest of the 230 sites sampled nationwide (USGS 1997).[2]

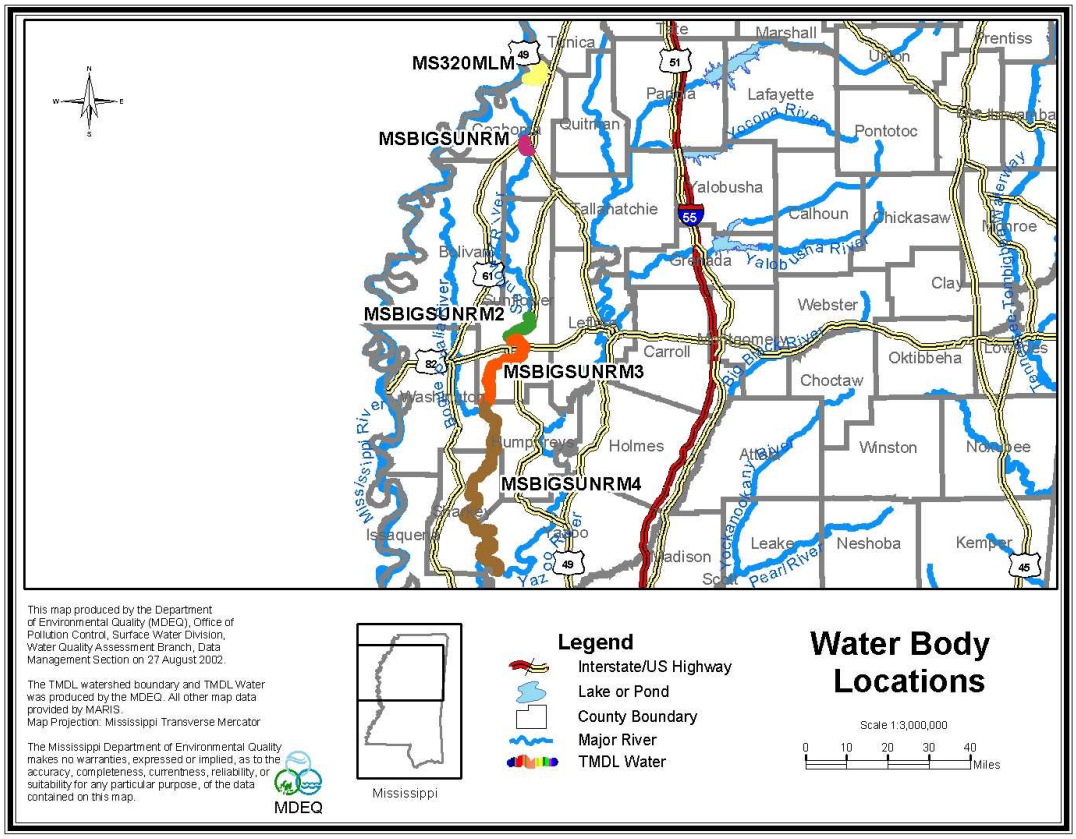
DDT and toxaphene levels remain a concern in the Mississippi Delta; however, data indicate a significant decline in levels. According to the USFWS data from the Yazoo River at Redwood, DDT levels in whole carp dropped from 5.6 mg/kg in 1984 to 2.2 mg/kg in 1996. Toxaphene levels in these fish dropped from 4.8 mg/kg to 1.6 mg/kg over the same period. Comparing MDWFP data from the late 1960s and 1970s with MDEQ data from the 1990s indicates average DDT concentrations in largemouth bass fillets have dropped approximately 10 fold from 1969 to the present.[3]

MDEQ's Delta Fish study collected 124 composite samples comprised of 433 fish. When the results were compared to the Mississippi Fish Advisory Criteria for DDT and Toxaphene several observations were made. All largemouth bass, bream, crappie, freshwater drum and all catfish less than 3 lbs were below the criteria at all sites. 66% of all samples were below the criteria for DDT. Additionally, 73% of all samples were below the criteria for Toxaphene. However, all ten sites had at least two samples that exceeded Mississippi's limit consumption criteria for DDT or Toxaphene. 7 of 9 Cassidy Bayou samples exceeded the criteria, and 7 of 13 Roebuck Lake samples exceeded the criteria, including 3 samples that were above the no consumption criteria. Unfortunately, some form of advisory was warranted at each site sampled. Generally, the tissue concentrations in the lakes and bayous were higher than the concentrations found in the Sunflower and Yazoo Rivers. Highest concentrations were found in gar, buffalo, carp and the larger catfish.[4] See Table 2 for the advisory criteria for DDT and Toxaphene.

[1] Mississippi Delta Fish Tissue Study 2000 Final Report, October 31, 2001, p. 4.
[2] Ibid.
[3] Ibid
[4] Ibid.

Table 1. Waterbody Locations

Name	Identification	County	Location
Moon Lake	MS320MLM	Coahoma	Near Lula
Wasp Lake	MS354WLM	Humphreys	Near Belzoni
Bee Lake	MS358BLM1	Holmes	At Thornton
Dump Lake	MS395DLM	Yazoo	Near Satartia
Holly Bluff Cutoff (DDT)	MSHBCUTM	Sharkey, Yazoo	Near Anguilla: from confluence with Bogue Phalia to mouth at Yazoo River
Granny Baker Bayou	MS403M3	Washington	Near James: from confluence with Granicus Bayou to Fish Farm
Unnamed tributary of Lake Washington	MS404M1	Washington	At Chatham from headwaters to Lake Washington
Unnamed tributary of Lake Washington	MS404M2	Washington	Near Glen Allan: from headwaters to Lake Washington
Big Sunflower River	MSBIGSUNRM	Coahoma	At Clarksdale: from Lyons POTW to Hopson Bridge
Big Sunflower River	MSBIGSUNRM2	Sunflower	At Sunflower: from confluence of Jones Bayou to Confluence with Porter Bayou
Big Sunflower River	MSBIGSUNRM3	Sunflower, Washington, Humphreys	At Indianola: from confluence of Porter Bayou to confluence of Bogue Phalia
Big Sunflower River (DDT)	MSBIGSUNRM4	Washington, Humphreys, Sharkey	Near Anguilla: from confluence with Bogue Phalia to mouth at Yazoo River
Coldwater River	MSCOLDR2M2	Desoto, Tate, Tunica	At Prichard: from confluence with Cub Lake Bayou to split with Pompey Ditch above Sara (Below Savage)
Tallahatchie River	MSTALARM1	Tallahatchie	At Swan Lake: from near Sharkey to Phillip Cutoff
Yalobusha River	MSYLBUSHM1	Grenada	Near Grenada at I-55: from Grenada POTW outfall to confluence with Bakers Creek
Yalobusha River	MSYLBUSHM2	Grenada	Near Holcomb at Highway 8: from confluence with Bakers Creek to near Duncan's
Cassidy Bayou (Toxaphene)	MS277E	Tallahatchie	Near Webb: From 5 miles above Webb to 5 miles below Webb


MS320MLM
MSBIGSUNRM
MSBIGSUNRM2
MSBIGSUNRM3
MSBIGSUNRM4
Tunica
Marshall
Tishomingo
Prentiss
Union
Lafayette
Pontotoc
Quitman
Coahoma
Tallahatchie
Yalobusha
Calhoun
Chickasaw
Monroe
Bolivar
Grenada
Clay
Webster
Carroll
Oktibbeha
Choctaw
Lowndes
Washington
Humphreys
Holmes
Winston
Noxubee
Attala
Issaquena
Madison
Leake
Neshoba
Kemper
Scott
Pearl River
Mississippi River
Yazoo River
Tallahatchie River
Big Black River
Natchez Trace Parkway
This map produced by the Department of Environmental Quality (MDEQ), Office of Pollution Control, Surface Water Division, Water Quality Assessment Branch, Data Management Section on 27 August 2002.
The TMDL watershed boundary and TMDL Water was produced by the MDEQ. All other map data provided by MARIS.
Map Projection: Mississippi Transverse Mercator
The Mississippi Department of Environmental Quality makes no warranties, expressed or implied, as to the accuracy, completeness, currentness, reliability, or suitability for any particular purpose, of the data contained on this map.
MDEQ
Mississippi
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Interstate/US Highway
Lake or Pond
County Boundary
Major River
TMDL Water
Water Body Locations
Scale 1:3,000,000
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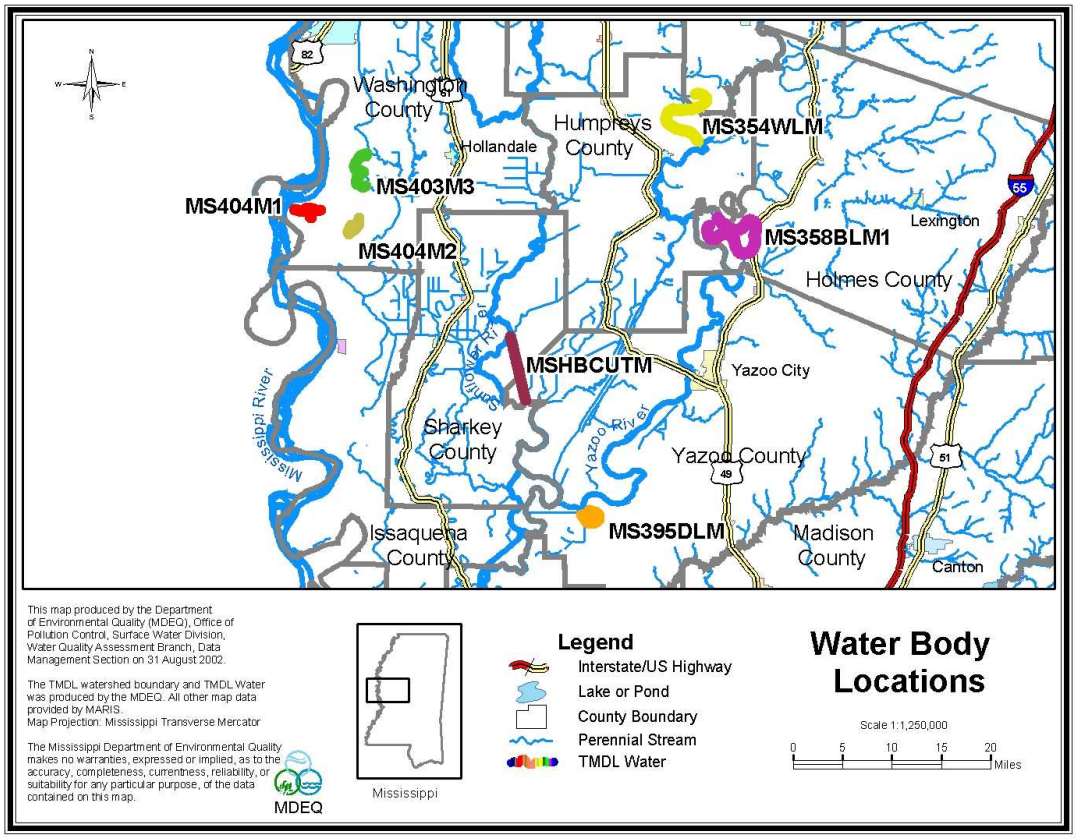
MS404M1
MS403M3
MS404M2
MS354WLM
MS358BLM1
MSHBCUTM
MS395DLM
Washington County
Hollandale
Humphreys County
Lexington
Holmes County
Yazoo City
Sharkey County
Yazoo County
Issaquena County
Madison County
Canton
Mississippi River
Yazoo River
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MDEQ
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Lake or Pond
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Perennial Stream
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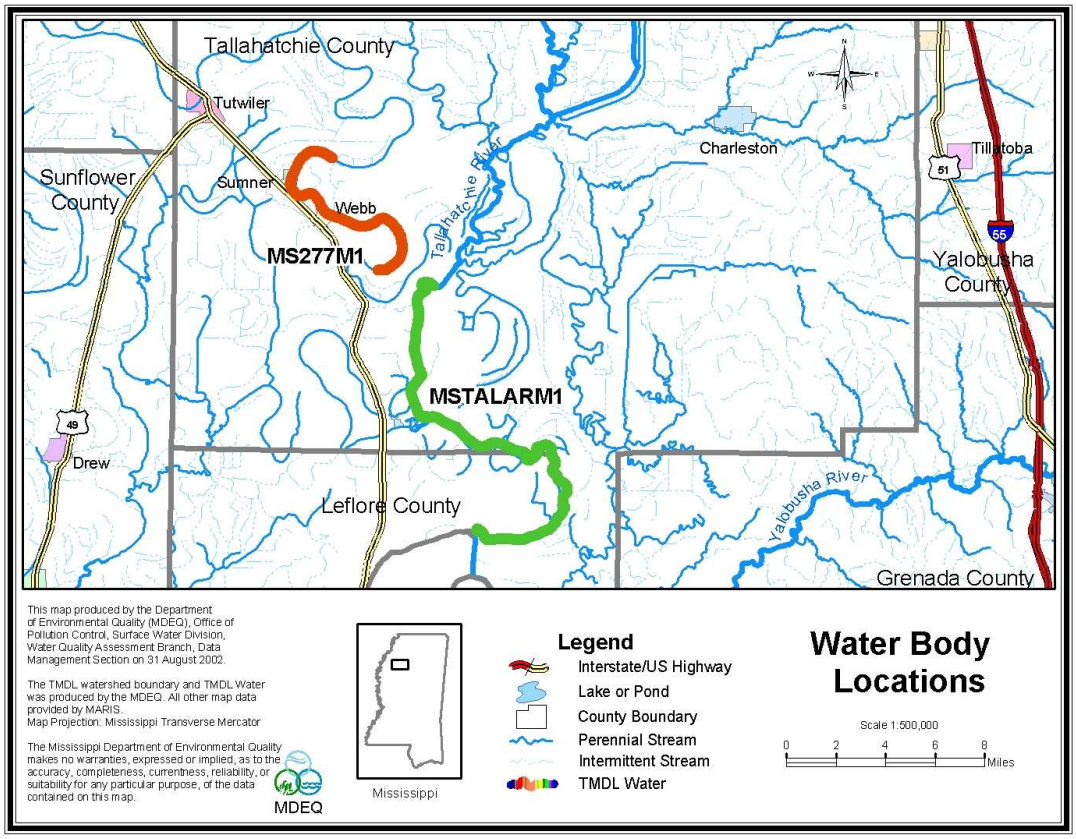
Tallahatchie County
Tutwiler
Sunflower County
Sumner
Webb
MS277M1
Tallahatchie River
Charleston
Tillatoba
51
55
Yalobusha County
MSTALARM1
49
Drew
Leflore County
Yalobusha River
Grenada County
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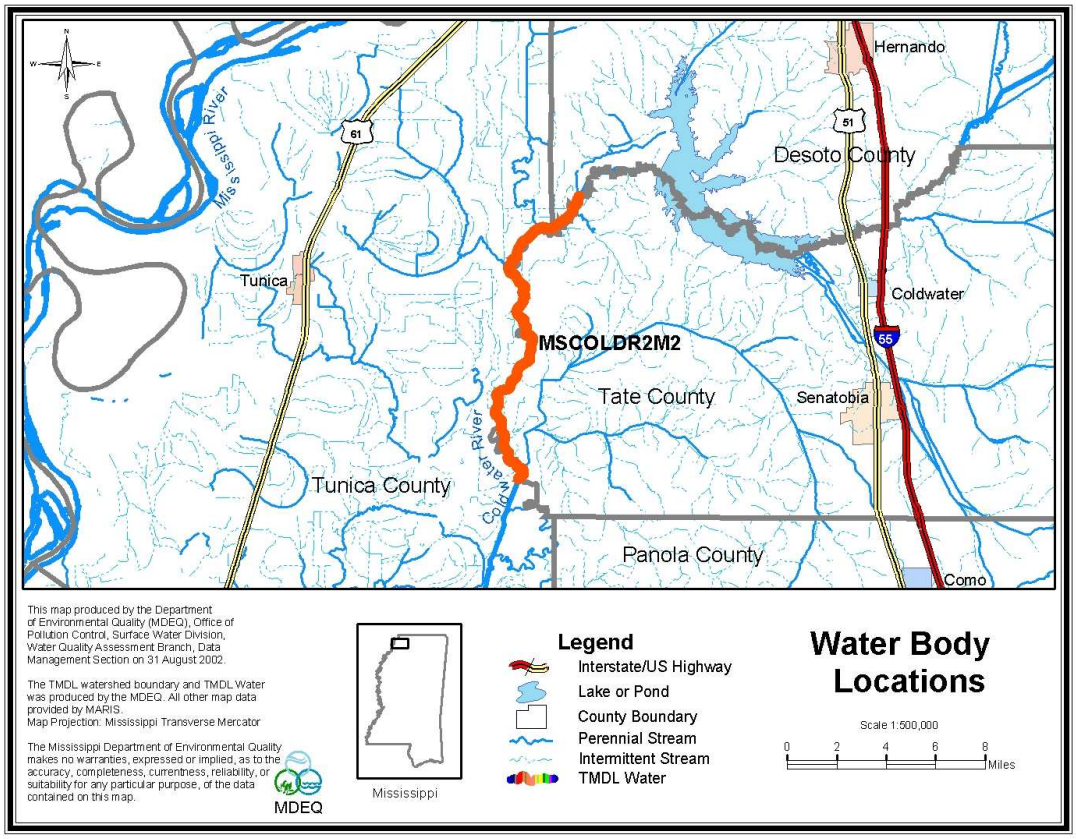
Hernando
51
Desoto County
Mississippi River
61
Tunica
Coldwater
55
MSCOLDR2M2
Tate County
Senatobia
Tunica County
Coldwater River
Panola County
Como
This map produced by the Department of Environmental Quality (MDEQ), Office of Pollution Control, Surface Water Division, Water Quality Assessment Branch, Data Management Section on 31 August 2002.
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Scale 1:500,000
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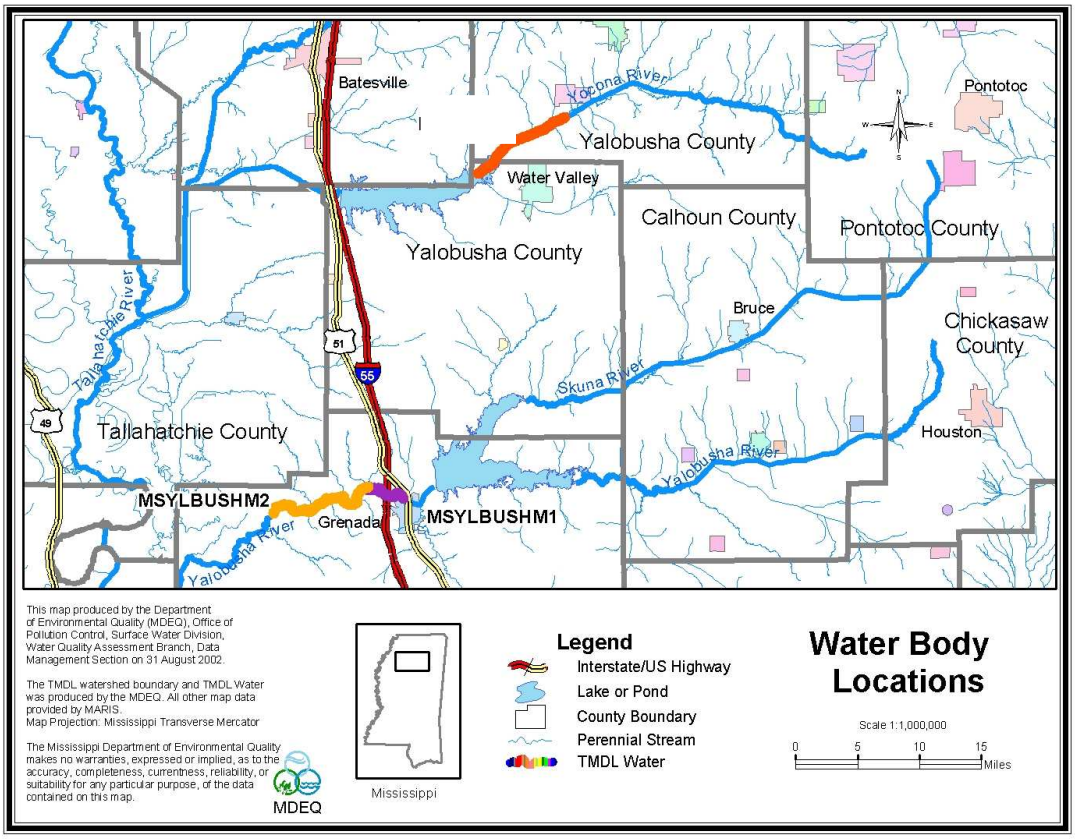

Table 2. Mississippi Fish Advisory Criteria for DDT and Toxaphene

Consumption	Fish Tissue Concentration (mg/kg) DDT	Fish Tissue Concentration (mg/kg) Toxaphene
No Limit	<1.0	<0.4
2 meals/month	1.0 – 5.9	0.4 – 1.9
No Consumption	>6.0	>2.0

Advisories

The data from the study as well as data from MDEQ's ambient monitoring program led the Fish Advisory Task Force to recommend a consumption advisory for the Mississippi Delta. Instead of issuing a patchwork map showing the 10 sites, the task force issued a regional advisory.

On June 26, 2001, MDEQ issued an advisory for the Delta Region of the Yazoo Basin. This advisory recommends that people limit the amount of carp, buffalo, gar, and large catfish (catfish larger than 22") they eat to no more than two meals per month. This advisory applies to the entire Delta from Memphis to Vicksburg from the Mississippi

River Levee on the west to the bluff hills on the East. This includes all natural waters including lakes, rivers, bayous, and sloughs.

In addition, for Roebuck Lake only, the advisory recommends that people do not eat buffalo from this lake. In August 2001, MDWFP issued a commercial fishing ban for Roebuck Lake.

The advisory does not apply to natural river connected oxbow lakes. Additionally, the advisory does not apply to bass, bream, crappie, freshwater drum, and smaller catfish, nor does it apply to farm raised catfish.[5]

Priority Ranking

Prioritization of these TMDLs is based on compliance with the federal consent decree. The consent decree calls for all of the TMDLs for waterbodies listed as monitored on the Mississippi 1996 Section 303(d) list in the Yazoo River Basin be developed by MDEQ during 2002. EPA Region 4 has an additional six months to complete TMDLs that MDEQ does not complete during this year.

Waterbody pollutant combinations that are shown not to need a TMDL based on monitoring or good cause justification are not required to be completed by EPA or MDEQ. The waterbodies in Table 1 show the listings included in the TMDL report.

Water Quality Standards and Numeric Target

Typically, MDEQ selects a target for TMDL development that corresponds to the standard for the pollutant. In this case, the target for DDT and Toxaphene are based on water column concentrations Table 3. The data, however, that show impairment are elevated fish flesh samples. Therefore, while the target for the DDT TMDL is the human health water and organism concentrations and the target for the Toxaphene TMDL is the fresh water chronic concentration, shown in table 3, the intermediate goal is no fish samples above the Fish Advisory Task Force limit shown in Table 2. While it is understood that it will take many years for these pollutants to dissipate, fish flesh monitoring does indicate a declining trend. Therefore, the intermediate goal for this TMDL is the elimination of fish advisories based on DDT and Toxaphene. The TMDL target will be water column concentrations below the standard for the pollutants.

Table 3 Numeric Criteria for All Waters

Parameter	Fresh Water	Fresh Water	Human Health	Human Health

[5] Ibid, p. 11.

	Acute	Chronic	Organisms	Water and Organisms
4,4 DDT	1.1 µg/l	0.001 µg/l	0.00059 µg/l	0.00059 µg/l
Toxaphene	0.73 µg/l	0.0002 µg/l	0.00075 µg/l	0.00073 µg/l

To gage the declining trend, the Mississippi Fish Advisory Task Force selected the levels shown in Table 2 for issuance of fish consumption advisories. It is important to note these levels and continued monitoring is needed to track future declining trends for these pollutants.

Load Allocation

DDT and Toxaphene are prohibited from use currently and have been for some time now. Declining trends shown in monitoring fish flesh indicate that the environment is heading toward recovery. The intermediate goal in this TMDL is no fish consumption advisories. The current levels indicated by monitoring should be reduced below the action level for the consumption advisory. The TMDL target is commensurate with the human health water an organism standard for DDT 0.59 ng/l, and the fresh water chronic standard for Toxaphene 0.2 ng/l shown in Table 3. Once the fish flesh target is met and no further consumption advisories are needed, the load allocation can be determined by multiplying the flow by the concentration standard. This is shown as:

$$LA = Q * \text{standard} * \text{conversion factor}$$

These will work in conjunction as BMPs are installed to reduce the sediment load in the streams.

Wasteload Allocation

The WLA factor for this TMDL is zero. There are no known permitted sources for DDT or Toxaphene in Mississippi.

Margin of Safety

The margin of safety is implicit because the TMDL does not allow for loading from point sources. The complete elimination of the fish advisories based on declining levels of the pollutant found in the fish flesh is the goal of the TMDL.

TMDL Calculation

The TMDL is calculated with the following:

$$TMDL = WLA + LA + MOS$$

where WLA = 0 and MOS is implicit. Therefore, the TMDL equals the LA, which is determined by the flow multiplied by the standard and a conversion factor.

Seasonal Variation

The target of no pollutant concentration above the fish advisory consumption level is a year-round goal. Since the WLA and LA apply at all times, the TMDL provides for year-round protection of water quality standards for pesticides. Therefore, the TMDL adequately accounts for seasonal variability.

Reasonable Assurances

This component of TMDL development does not apply. There are no point sources requesting a reduction based on LA components and reductions.

Critical Condition

The TMDL represents all flows at all times, and is based on levels of the pollutants found in monitoring fish flesh. The nature of DDT and Toxaphene causes them to have year-round impacts in the fish flesh. Since the WLA and LA apply at all times, the TMDL provides for year-round protection of the water quality standard for these pesticides, including periods when critical conditions occur.

Public Participation

The public has participated in the fish consumption advisory issued for the Delta. MDEQ sent copies of the advisory to the public libraries, bait shops, churches, and social clubs in the Delta. Signs have been posted at each public boat ramp in the region, and a brochure is included in each fishing license issued by the MDWFP. MDEQ held several public meetings to discuss the advisory, and participated in television call in shows to make the public aware of the advisory.

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the statewide newspaper and newspapers in the area of the watersheds. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. TMDL mailing list members may request to receive the TMDL reports through either, email or the postal service. Anyone wishing to be included on the TMDL mailing list should contact Greg Jackson at (601) 961-5098 or Greg_Jackson@deq.state.ms.us. At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public meeting.

All written comments received during the public notice period and at any public meeting become a part of the record of this TMDL. All comments will be considered in the ultimate completion of this TMDL for submission of this TMDL to EPA Region 4 for final approval.

Technical Analysis

Elimination of DDT and Toxaphene in the environment is a worthy goal for this TMDL Report. However, it is easier said than done. By proposing this TMDL, MDEQ makes these watersheds eligible for additional Section 319 nonpoint source pollution funding. The Section 319 Grant, which addresses nonpoint source pollution, was increased two years ago. MDEQ made the decision to use these additional funds on nonpoint source projects that directly deal with TMDL issues. Ongoing agricultural efforts such as CRP, WRP, and EQUIP also support improved water quality through installation of best management practices. The 2002 Farm Bill has an increase in conservation practices also aimed at improving water quality. Therefore it is hoped that the use of best management practices in these watersheds will be accelerated.

Prior to receiving these funds, watershed plans need to be produced and prioritized by the Yazoo River Basin Team. It is also important to include local input on each of these pollutant problems.

It is not the task of the TMDL to create new best management practices or to implement any actions. However, it is important to note that BMPs installed in these watersheds that keep the sediment on the fields and out of the stream will also keep DDT and Toxaphene out of the streams and ultimately reduce the levels available for the fish flesh. The result of implementing these BMPs will achieve dual improvements for the watershed, that is sediment reduction and pesticide reduction.

Supporting Documentation

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