LAKE WASHINGTON WATERSHED IMPLEMENTATION PLAN

DRAFT
NOVEMBER 28, 2007

LAKE WASHINGTON WATERSHED IMPLEMENTATION PLAN

Prepared for

Lake Washington Watershed Implementation Team

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EXECUTIVE SUMMARY

Lake Washington is an oxbow lake located in Washington County approximately 20 miles south of Greenville, Mississippi, and is a popular sport-fishing destination. However, Lake Washington has been plagued by water quality problems for decades, some of which affected the sport fishery (i.e., pesticides and low dissolved oxygen (DO)). In 1996, Lake Washington was placed on the Mississippi list of impaired waters under the Clean Water Act. In 2004, a Lake Washington Watershed Implementation Team (Team) was formed to address the water quality issues in Lake Washington and its watershed. The Team includes local landowners and representatives from state and county agencies. The Team consulted with Lake Washington stakeholders to determine their concerns about Lake Washington and then developed this plan of activities to address a number of these stakeholder concerns along with regulatory water quality problems.

Plans for addressing the following concerns about Lake Washington are described in this Watershed Implementation Plan:

1. Lake Washington fishery health,
2. Damage to shoreline cypress forest from large flocks of roosting cormorants,
3. Raw sewage in Lake Washington,
4. Nuisance alligators,
5. Non-attainment of applicable state water quality standards,
6. High levels of nutrients in Lake Washington, and
7. Fish kills.

Other concerns will be addressed in later revisions to the Watershed Implementation Plan. Table ES.1 summarizes the activities planned to address the concerns above.

Table ES.1 Summary of management action schedules and milestones.

Management Action	Milestones	Schedule	Responsibility	Date Achieved
Regional sewer system	1. Contact Washington County Board of Supervisors to request cost estimate 2. Cost estimate completed 3. Complete evaluation of economic feasibility	1. 26 October 2007 2. 30 June 2008 3. 31 December 2008	1. Lake Washington Foundation, 2. Washington County Engineer, 3. Glen Allan Utility Board of Directors	1. _____ 2. _____ 3. _____
Sewage Summit	1. Sewage Summit	1. 22 February 2008	Mississippi Department of Environmental Quality	
Eliminate direct discharge to Lake Washington	1. Request biannual septic tank inspection from MSDH	1. January 2008	Lake Washington Foundation	

Table ES.1. Continued.

Management Action	Milestones	Schedule	Responsibility	Date Achieved
Repair failing culverts	1. Sign grant contract with MDEQ 2. County Engineer begins surveying and designing 3. Meet with community leaders to plan events 4. Conduct media outreach 5. Meet with cooperating agencies and organizations 6. Meet with landowners for site approval and right-of-ways (if necessary) 7. Erect project signs 8. Water quality testing before site construction 9. Document condition of site before repair with pictures and soil loss estimates 10. Install at least two showcase sites in first year 11. Record conditions after site installation: pictures and soil loss estimates 12. Report progress to MDEQ 13. Inform stakeholders of progress and additional plans of operation 14. Proceed with installing additional sites in accordance with county engineers standards and specifications (Months 12-36) 15. Before and after pictures and soil loss estimates of each site (Months 12-36) 16. Press releases of implementation progress and water quality improvements (Months 12-36) 17. Water quality testing (Months 12-36) 18. Final Report to MDEQ (Month 36)	1. 2008 2. Year 1 3. Year 1 4. Year 1 5. Year 1 6. Year 1 7. Year 1 8. Month 5 9. Month 5 10. Year 1 11. Year 1 12. Month 12 13. Month 12 14. Years 2 – 3 15. Years 2 – 3 16. Years 2 – 3 17. Years 2 – 3 18. Month 36	Washington County Board of Supervisors, Mississippi Department of Environmental Quality, Soil and Water Conservation District, Landowners, USDA Natural Resources Conservation Service	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ 11. _____ 12. _____ 13. _____ 14. _____ 15. _____ 16. _____ 17. _____ 18. _____

Table ES.1. Continued.

Management Action	Milestones	Schedule	Responsibility	Date Achieved
Implement in-field sediment BMPs	1. Determine eligible sites for EQIP, Wetlands Reserve Program, and Conservation Reserve Program 2. Contract landowners on willingness to participate 3. Apply for funds; arrange cost-sharing 4. Implement BMPs 5. Monitor sediment loads from site	1. Month 1 2. Month 5 3. Month 8 4. Month 20 5. Months 24 – 60	1. USDA Natural Resources Conservation Service 2. Washington County Soil and Water Conservation District 3. Landowners 4. US Army Corps of Engineers	1. _____ 2. _____ 3. _____ 4. _____ 5. _____
Maintain sediment BMPs	1. Funding for maintenance 2. Annual maintenance	1. 2010 2. 2011+	USDA Natural Resources Conservation Service, Washington County Soil and Water Conservation District, Landowners	1. _____ 2. _____
Game fish management	1. Stocking of 200,000+ largemouth bass fingerlings 2. Stocking of crappie 3. Stocking of 100,000 hybrid striped bass fingerlings 4. Set size and creel limits on bass and crappie 5. Conduct catfish rodeos 6. Increase the presence of game wardens on Lake Washington 7. Initiate cutgrass controls in Washington Bayou	1. Winter/spring 2008 through 2012 2. Winter/spring 2008 through 2012 3. Winter/spring 2009, 2011 4. Annually 2008+ 5. Annually 2007 through 2012 6. Beginning in 2009 7. 2009	Mississippi Department of Wildlife, Fisheries, and Parks	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____
Conduct catfishing clinic and catfish rodeo	1. Conduct catfishing clinic 2. Tag catfish for rodeo	1. Spring and summer 2008 2. March 2008 through 2012	Mississippi Department of Wildlife, Fisheries, and Parks, Roy's Store	1. _____ 2. _____
Commercial harvest of catfish	1. Propose changes to Mississippi law to reduce cost of fishing with slat boxes 2. Change catfish slat box license fee on Lake Washington	1. January 2008 2. July 2008	Mississippi Department of Wildlife, Fisheries, and Parks	1. _____ 2. _____

Table ES.1. Continued.

Management Action	Milestones	Schedule	Responsibility	Date Achieved
Public fishing pier	1. Apply to Washington County Board of Supervisors 2. Secure funds for pier construction 3. Complete construction of pier	1. August 28, 2007 2. January 2008 3. July 2008	Mississippi Department of Wildlife, Fisheries, and Parks, Roy's Store	1. _____ 2. _____ 3. _____
Cormorant harassment	1. Volunteer training and harassment activities	1. October – March 2006+	Lake Washington Foundation, Local volunteers, USDA Wildlife Services	
Recruit and train volunteers for cormorant harassment	1. Recruit volunteers at Foundation meetings 2. Train volunteers	1. At each meeting 2. October 2007, September 2008 through 2012	Lake Washington Foundation, USDA Wildlife Services	1. _____ 2. _____
Cormorant harvesting	1. Authorization to harvest cormorants 2. Cormorant harvest permits 3. Completion of hunter safety course	1. November 2007 – 2012 2. December 2007 – 2012 3. December 2007 – 2012	USDA Wildlife Services, Local hunters	1. _____ 2. _____ 3. _____
Provide alternate roosts	1. Procure funding 2. Recruit landowners to plant trees 3. Plant trees	1. July, October 2009 2. March 2009 – December 2012 3. March 2009 – December 2012	USDA Natural Resources Conservation Service, US Fish and Wildlife Service, Mississippi Forestry Commission, Lake Washington Foundation, Landowners	1. _____ 2. _____ 3. _____
Lake level management	1. Request Washington County evaluate and repair Lake Washington outlet structure 2. Assess Lake Washington outlet conduits 3. Repair Lake Washington outlet conduits	1. January 2008 2. July 2008 3. July 2009	Washington County, Lake Washington Foundation	1. _____ 2. _____ 3. _____
Establish minimum lake level	1. Monitor Lake Washington water levels 2. Establish minimum lake level 3. Water withdrawal regulation program in place	1. Through 2010 2. 2011 3. 2012	Mississippi Department of Environmental Quality	1. _____ 2. _____ 3. _____

Table ES.1. Continued.

Management Action	Milestones	Schedule	Responsibility	Date Achieved
Eliminate fish processing waste in Lake Washington	1. Notify commercial fishing operations of laws against waste disposal in lake 2. Article in Foundation newsletter about laws against waste disposal in lake 3. Notify recreational fishing camps about laws against waste disposal in lake 4. Game wardens check on commercial operations 5. Game wardens check on recreational fishing camps	1. January 2008 2. January 2008 3. April 2008 4. April 2008 and quarterly thereafter 5. June 2008 and quarterly thereafter	Mississippi Department of Wildlife, Fisheries, and Parks, Lake Washington Foundation	1. _____ 2. _____ 3. _____ 4. _____ 5. _____
Alligator management plan	1. Form planning committee 2. Submit draft plan for review 3. Finalize plan 4. Distribute plan 5. Public education 6. Initiate alligator complaint process	1. 2008 2. 2008 3. 2008 4. 2008 5. 2008+ 6. 2008	Mississippi Department of Wildlife, Fisheries, and Parks Alligator Coordinator, Lake Washington Foundation	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
Signage	1. Erect two general project signs 2. Erect aquatic weed signs 3. Erect best management practice signs	1. 2008 2. 2008 3. 2008	Mississippi Department of Environmental Quality, Mississippi Department of Wildlife, Fisheries, and Parks, Washington County Soil and Water Conservation District	1. _____ 2. _____ 3. _____
Direct mail	1. Develop mail-out 2. Mail-out	1. 2008 2. 2008	Mississippi Department of Environmental Quality, Mississippi State Department of Health	1. _____ 2. _____
Mississippi Outdoors productions	1. Article in Mississippi Outdoors magazine 2. Feature on Mississippi Outdoors TV show 3. Interviews on Mississippi Outdoors radio show	1. 2009 2. 2009 3. 2009	Mississippi Department of Wildlife, Fisheries, and Parks	1. _____ 2. _____ 3. _____

Table ES.1. Continued.

Management Action	Milestones	Schedule	Responsibility	Date Achieved
Web-based education and outreach	1. Agency partners link to Lake Washington website	1. 2008	Mississippi Department of Environmental Quality, Partner agencies and organizations	1. _____ 2. _____
Printed materials	1. Create and distribute nine press releases 2. Create and distribute three sets of printed material 3. Create and publish five feature articles	1. 2009 2. 2009 3. 2009	All partner agencies and organizations	1. _____ 2. _____ 3. _____
Public activities	1. Small community event 2. Conservation Fair 3. Field Day	1. 2008 2. 2008 3. 2008	All partner agencies and organizations	1. _____ 2. _____ 3. _____

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1.0 PLAN GUIDANCE

1.1 Vision Statement

Lake Washington is an oxbow lake that provides a pleasant and safe place to live, fish, boat, and swim. Its natural shoreline has a healthy cypress forest and low intensity development. It contains a healthy, balanced sport fishery that attracts non-local anglers who contribute to the local economy. Lake Washington is free from the occurrence of bank erosion, nuisance algal blooms and aquatic plants, fish kills, and sewerage. Lake Washington, and all waterbodies in the watershed, meet state water quality standards. Management of agricultural, recreational, residential, business, and other interests in the watershed complement each other and contribute to economic sustainability and improved quality of life in the watershed.

1.2 Mission Statement

The mission of the Lake Washington Watershed Implementation Team and this Implementation Plan is to improve and maintain Lake Washington as a beautiful resource through better environmental stewardship, including conservation and restoration practices to ensure that the forestry, water quality, and water quantity in the watershed are balanced.

1.3 Lake Washington Watershed Implementation Team

Table 1.1 lists the members of the Lake Washington Watershed Implementation Team, along with their affiliations and contact information.

Table 1.1. Lake Washington Watershed Implementation Team.

Name	Associations	Contact Information
Blake New	Mississippi Natural Resources Conservation Service	3038 East Reed Road Greenville, MS 38703 662-820-7962 cell Blake.New@ms.usda.gov e-mail
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2.0 WATERSHED DESCRIPTION

2.1 Geography

Lake Washington is an oxbow lake located in Washington and Issaquena counties in western Mississippi. Its watershed is approximately 29,500 acres (Figure 2.1).

The watershed is located in the Mississippi Alluvial Plains ecoregion, and is underlain by Mississippi River Alluvium (Mississippi Department of Environmental Quality (MDEQ) 2000). Native vegetation in the watershed is bottomland hardwood forest consisting of oak, gum, cottonwood, and cypress (MARIS online mapping accessed July 15, 2004). The topography of the watershed is relatively flat, with a maximum elevation variation of about 30 ft. There are three major soil associations present in the watershed (see Table 2.1, Figure 2.2).

Table 2.1. Major soil associations in Lake Washington watershed.

Soil Association	Area (acres)	Characteristics (USDA 1958)
Commerce-Robinsonville-Crevasse	6,284	This association consists of nearly level soils formed on Mississippi River alluvium with drainage properties that range from somewhat poorly drained to excessively drained. Where these soils are somewhat poorly to well drained, they are among the best in the county for agriculture.
Sharkey-Tunica-Dundee	6,086	This association consists of level to sloping soils that formed on fine-textured Mississippi River alluvium and slack-water sediments. The soil drainage properties range from poorly drained clayey soils to moderately well drained. Those areas with slightly higher elevation or moderate drainage are well suited to agricultural use.
Dundee-Askew-Sharkey	12,782	This association consists of level to nearly level soils that formed on fine-textured Mississippi River alluvium and slack-water sediments. The soil drainage properties range from poorly drained clayey soils to moderately well drained. Those areas with moderate drainage are well suited to agricultural use.

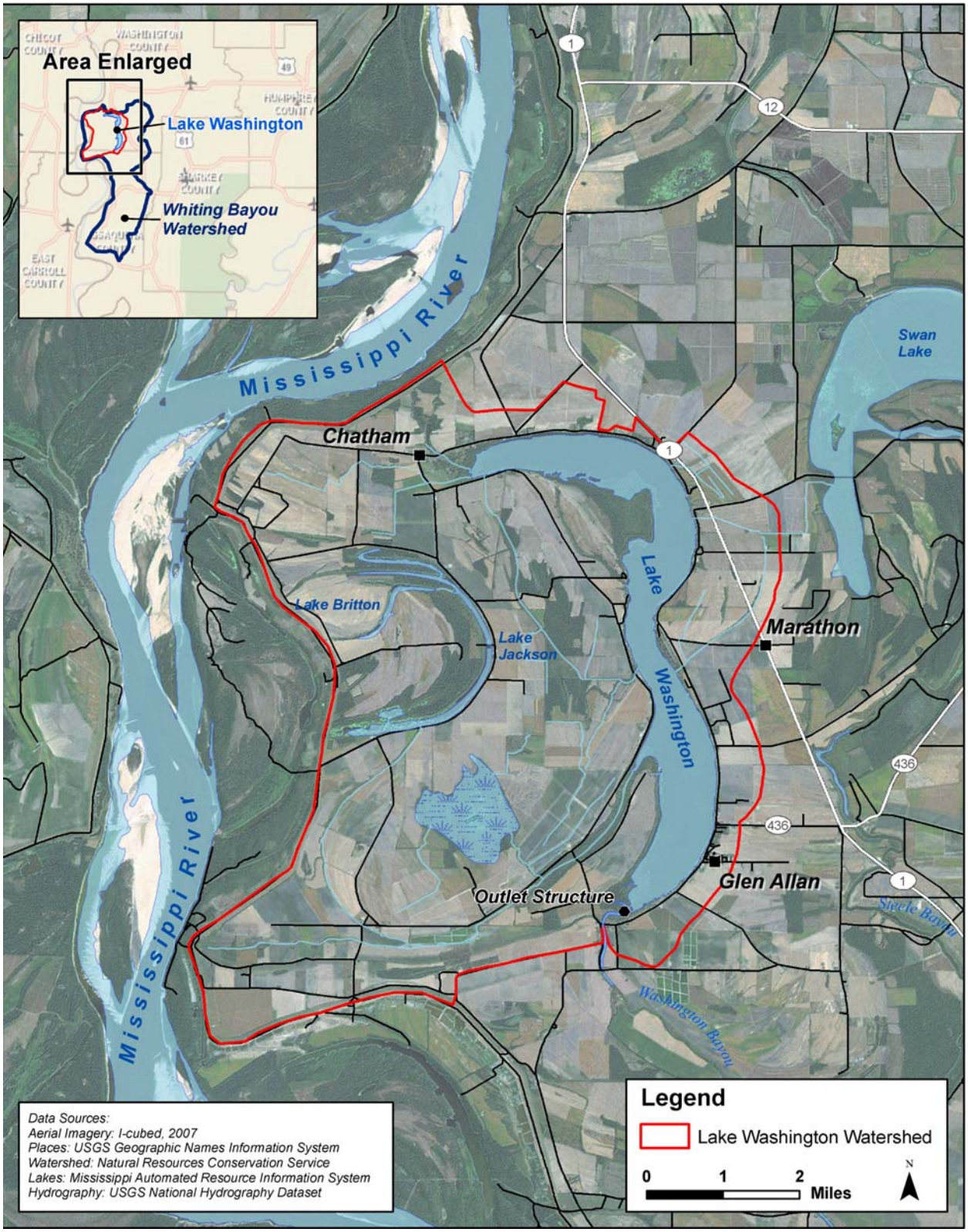


Figure 2.1. Lake Washington watershed.

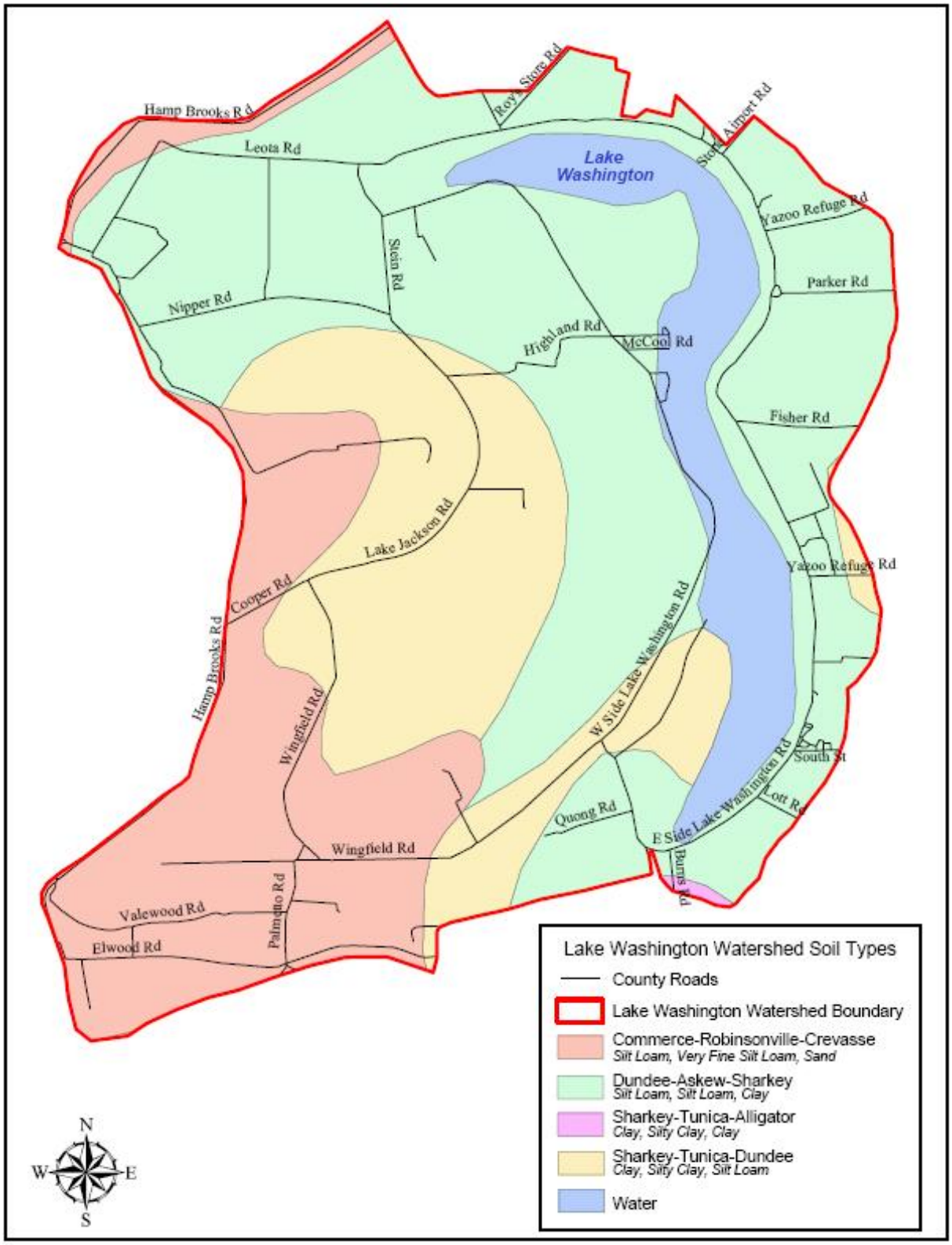


Figure 2.2. Soil associations and location within the watershed.

2.2 Land Use

In 2001 land use in the watershed was primarily agricultural, with 69% of the watershed in crop production, and 16% in wetlands (Figure 2.3). Corn has replaced cotton as the major crop in the watershed. Other crops cultivated in the watershed include soybeans, sorghum, snap beans, small grains, rice, wheat, and sunflowers (Tetra Tech 2003). The areas of land uses are summarized in Table 2.2 and shown on Figure 2.3. There are no public lands in the watershed.

The catfish ponds that existed in 1993 have been converted to cropland. Other land use changes that are occurring in the watershed include conversion of pasture as the local communities are expanding, and redevelopment of lakeshore lots on Lake Washington.

Table 2.2. Land use in Lake Washington watershed.

Land Use	Area (acres)	Percent Area
Crops	20,367	69
Wetlands	4,605	16
Water	3,289	11
Developed	1,135	< 4
Pasture/Hay	118	< 1
Forest	17	< 1
Total	29,531	100

2.3 Hydrology

The natural drainage of the watershed has been significantly altered through the installation of ditches and other hydrologic modifications (Tetra Tech 2003). The eastern border of the watershed is a Mississippi River levee, so there is no longer a direct hydrologic connection between the Mississippi River and the watershed (Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) 2005a). The watershed is a complex network of natural levees, ditches, slackwater areas, and shallow depressions that parallel the meander belt of the old Mississippi River channel (FTN Associates, Ltd. (FTN) 1991). Wetlands are associated with many water features in the watershed (see Figure 2.3).

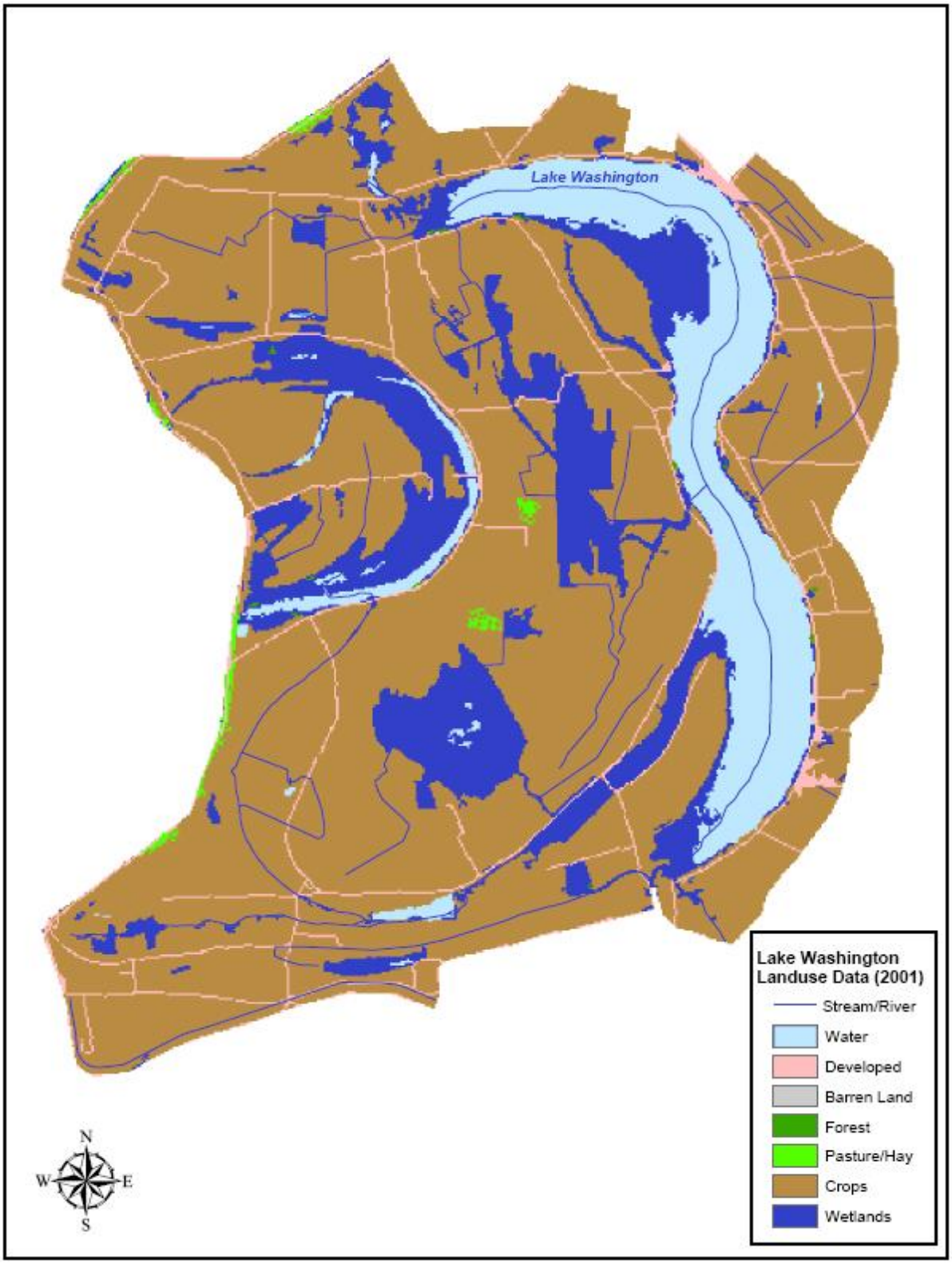


Figure 2.3. Lake Washington watershed land use and land cover.

Lake Washington is the largest waterbody in the watershed (Table 2.3). It receives drainage from a number of ditches, including several connected to Lake Britton and Lake Jackson, located west of Lake Washington in the watershed (Figure 2.3). Water from Lake Washington drains to Washington Bayou, a tributary of Steele Bayou. At the outlet to Washington Bayou is a low head dam that elevates Lake Washington water level 4 ft. The watershed is underlain by the Mississippi River Alluvial Aquifer. Groundwater from this aquifer is used by watershed inhabitants (Tetra Tech 2003).

Table 2.3. Morphometric characteristics of Lake Washington.

Parameter	Lake Washington
Volume	2.13×10^7 m^3 (17,266 ac-ft)
Surface Area	1,188 ha (2,935 acres)
Mean Depth	1.8 m (5.9 ft)
Maximum Depth	6 m (19.7 ft)
Residence Time	150 days

2.4 Socioeconomics

The Lake Washington watershed is primarily a rural area (Tetra Tech 2003, http://www.census.gov). We estimate that approximately 400 people lived in this watershed in 2000 (based on Census 2000 census block data for Washington and Issaquena counties). The towns of Chatham, Glen Allan, and Erwin are in the Lake Washington watershed. Other communities in the watershed include Foote, Leota, Byrne City, and Alhambra (http://www.mapquest.com; accessed April 14, 2006). The watershed is located less than 20 miles from Greenville and could be influenced by growth in that community. Median household income in the Lake Washington watershed in 1999 was around $25,000. Approximately 28% to 36% of the population in the watershed had income below the poverty level in 1999 (http://www.census.gov).

Lake Washington contributes to the area economy primarily through recreation. Recreational visitors contribute to the local economy through spending for lodging, food, sporting goods (there are four bait and tackle shops in the watershed), and boats (there are six

private boat ramps open to the public for a fee and one marina). The lake is known for its sport fishing. A study conducted by MDWFP found that the lake draws anglers from over 400 miles away (http://www.outfitters.org/fishing/lakes/washington.pdf). Crop and livestock agriculture and aquaculture in the watershed also contribute to the area economy.

3.0 STAKEHOLDER INTERESTS

Lake Washington stakeholders include people who live in the watershed year-round, including both property owners and renters. Some stakeholders live on the lakeshore. Other stakeholders include vacation property owners who have primary residences outside of the Lake Washington watershed, local farmers (those who own land and those who don't), absentee farmland owners, and local business owners. In addition, there are a significant number of stakeholders who don't own land or businesses in the watershed but visit Lake Washington for recreational purposes (e.g., fishing). The majority of all of these stakeholders value Lake Washington for its recreational opportunities (fishing, boating, swimming, and hunting) and aesthetics. Land-based interests in the watershed include farming and hunting.

In 2003, the Lake Washington Property Owners Association began working with MDEQ, county government, and other agencies and organizations to address their concerns about the condition of Lake Washington. Issues identified by stakeholders are summarized in Table 3.1 and discussed below.

Table 3.1. Lake Washington stakeholder concerns.

Concern	Causes	Location	Extent
Sewage in lake	Unlawful direct sewage discharges, improper sewage disposal from boats, malfunctioning septic systems	Directly along the Lake Washington shoreline	Unknown, but potentially lake-wide
High turbidity, sediment levels in lake	Agricultural runoff, bank erosion	Lake Washington and tributaries near Glen Allan and Chatham listed as impaired in 1996, Lake Jackson listed as impaired in 2004	Tributary headwaters to Lake Washington, all of Lake Washington, and Lake Jackson
High nutrient levels in lake	Agricultural and residential runoff, catfish pond discharges, malfunctioning septic systems, improper waste disposal, unlawful direct sewage discharges, cormorants, pelicans	Tributary near Chatham listed as impaired in 1996, Lake Jackson listed as impaired in 2004, Lake Washington	Headwaters to Lake Washington, all of Lake Washington, and Lake Jackson
Organic enrichment/ low dissolved oxygen	Agricultural runoff, catfish pond discharges, improper waste disposal, malfunctioning septic systems, high nutrient levels	Tributary near Chatham listed as impaired in 1996	Headwaters to Lake Washington
Condition of fishery	Overfishing of sport fish, commercial fishing operations, catfish and drum over-population	Lake Washington	Entire lake
Pesticides in fish tissue	Agricultural and residential runoff	Tributaries near Glen Allan and Chatham listed as impaired in 1996, Lake Jackson listed as impaired in 2004	Headwaters to Lake Washington, all of Lake Jackson
Fish kills	Algal blooms, low dissolved oxygen	Lake Washington	Shallower lake areas
Destruction of lakeshore forest	Cormorants	Lake Washington Watershed	Entire watershed
Lake Washington too shallow in summer (2 ft)	Current water level management inadequate, water level control structure inadequate, sedimentation	Lake Washington	Northern lake, middle of lake
Aquifer water level	Heavy agricultural use	The Mississippi River Alluvial Aquifer underlying the watershed	Yazoo Mississippi Delta Joint Water Management District has documented declines of over 2.5 ft in spring groundwater levels
Aquatic vegetation (cut grass)	Low lake levels	Lake Washington shoreline	Patchy along shoreline
Alligators	Attracted by improper disposal of offal from commercial fishing operations in the lake	Some areas of Lake Washington	East side of lake

3.1 Sewage

Sewage in Lake Washington was the first issue addressed by the Lake Washington Property Owners Association and their partners. During July 2004, the Mississippi State Department of Health (MSDH) conducted a field survey to identify onsite wastewater systems (i.e., septic systems) that might be malfunctioning. At the same time, MDEQ conducted an intensive water quality survey to check fecal coliform bacteria levels. MSDH did identify three malfunctioning onsite wastewater systems during the field survey. The MDEQ water quality survey did not find fecal coliform levels above the water quality standard. Overall, this work was inconclusive in identifying the source of sewage observed by lakeshore property owners. The Lake Washington watershed team is working toward eliminating wastewater discharges to Lake Washington by promoting sewering of the lakeshore properties. In the meantime, lakeshore property values are increasing and redevelopment of lakeshore camps, which often have questionable wastewater treatment systems, is expected. Since all new construction requires installation of wastewater treatment systems that meet MSDH health codes, redevelopment of the camps would reduce the likelihood of a discharge of improperly treated sewage to Lake Washington from shore properties.

3.2 Sediment

Lake Washington is a turbid lake. The median Secchi disk depth (a measure of water clarity) during the 2002-2004 MDEQ nutrient monitoring study on Lake Washington was 0.3 meter (about 1 ft). High turbidities in Lake Washington are believed to be the result of high loads of sediment being washed into the lake from the watershed, from bank erosion and slumping, and from head-cutting of streams and ditches from failing road culverts. Turbidity and high sediment loads can be problematic for fish and other aquatic organisms, as well as anglers, can result in premature “aging” (i.e., filling-in) of lakes, and can affect the aesthetic appeal of the lake.

During 1991 and 1992, a Section 319 project was facilitated by MDEQ’s Nonpoint Source Pollution Program that was designed to demonstrate and assess non-structural and structural practices to reduce sediment and nutrient concentrations in Lake Washington. The

project focused primarily on non-structural methods (no-till cotton, soybeans, and corn; reduced-till cotton, soybeans, and corn; and winter cover crops), but included installation of grade stabilization structures. These practices did make a measurable difference in the sediment loading to Lake Washington. When economic incentives for these practices were discontinued however, some of them were not maintained, and became less effective (http://www.epa.gov/gmpo/lmrsbc/meetsum_lakewa_oct03.html).

In 1996 and 2004, waterbodies in the Lake Washington watershed were classified as impaired due to high turbidity levels and sediment loads and included on the Mississippi 303(d) list of impaired waterbodies (see Section 5.4.2). Total maximum daily load (TMDLs) studies addressing the 1996 303(d) listings were completed for those waterbodies in 2003 (see Section 5.4.3 for detailed summaries of these TMDLs). Those TMDLs set goals for reducing inputs of sediment to waterbodies in the watershed (Tetra Tech 2003). The Clean Water Act requires that management activities to achieve these goals be implemented in the Lake Washington watershed.

3.3 Nutrients and Low Dissolved Oxygen/Organic Enrichment

Historical problems with nuisance algal blooms at Lake Washington are believed to be the result of high nutrient concentrations in the lake. In turn, these algal blooms cause low dissolved oxygen (DO) conditions when they die and decompose. When the DO levels become low enough, fish kills can occur.

Filter strips, grassed waterways, and dropped inlet structures were installed in the Lake Washington watershed with the United States Environmental Protection Agency (USEPA) 319 funds in the late 1980s and early 1990s to reduce sediment and nutrient concentrations in Lake Washington (see Section 2.3.2). Results of a follow-up study in 1996 showed that excessive algal blooms continued to present problems in Lake Washington, and that conditions in the lake were essentially the same as those observed in the 1991 study, with no improvements in chlorophyll a, Secchi readings, or nutrient concentrations. Recent monitoring results have also indicated high nutrient levels and low DO levels (http://www.epa.gov/gmpo/lmrsbc/meetsum_lakewa_oct03.html).

Lake Washington has been classified as the second most eutrophic lake in Mississippi (eutrophic condition is linked to nutrient levels). In 1996 and 2004, waterbodies in the Lake Washington watershed were classified as impaired due to high nutrient levels, low DO levels, and organic enrichment, and were included on the Mississippi 303(d) list of impaired waterbodies (see Section 4.5.2). TMDL studies addressing the 1996 listings were completed in 2003 (see Section 4.5.3 for detailed summaries of these TMDLs). The TMDLs set goals for reducing inputs of nutrients and organic materials (i.e., oxygen demand) to waterbodies in the watershed (Tetra Tech 2003). The Clean Water Act requires that management activities to achieve these goals be implemented in the Lake Washington watershed.

In recent years, cormorant populations in the watershed have increased dramatically from a few hundred to over 13,000 (United States Department of Agriculture (USDA) Wildlife Services aerial survey). This increase has been attributed to the development of catfish ponds in the region. Cormorants roosting around the lake have also contributed to cypress tree damage and increased nutrient concentrations through their droppings.

In 2003 a nutrient showcase project was initiated for Lake Washington under the Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico. The project involves:

- Identification and assessment of sources of nitrogen loads in the watershed,
- Identification of widely available, cost-effective best management practices (BMPs) appropriate for the nitrogen sources in the watershed, and
- Assessment of site-specific nutrient load reductions resulting from implementation of one or more of the identified BMPs (http://www.epa.gov/gmpo/lmrsbc/meetsum_lakewa_oct03.html).

3.4 Fishery Condition

In recent years stakeholders have commented that fewer bass and crappie were being caught in Lake Washington than previously. Reduced likelihood of catching bass and crappie in Lake Washington could make the lake less appealing to recreational anglers, reducing the number of visitors and potentially negatively impacting the local economy. MDWFP fish surveys on Lake Washington indicate that gamefish populations have been declining since

about 1999 and that the catfish, drum, and shad populations have increased (MDWFP 2005a). The MDWFP assessment was that the fishery had become unbalanced (Garry Lucas, MDWFP, personal communication February 14, 2006).

There is no consensus on the cause of this imbalance. Some stakeholders believe that over-fishing is the cause and have proposed eliminating commercial fish harvesting, and prohibiting the use of some fishing gear, such as yo-yos. Researchers at MDWFP suspect that catfish are impacting the survival of gamefish fry and believe the best course is to continue to encourage catfish harvest (MDWFP 2005a).

MDWFP has developed a management plan for Lake Washington, and has already instituted several measures geared toward reducing catfish and shad and increasing crappie and bass in Lake Washington. A program that offered prizes from a local store for catching tagged catfish during 2005 was geared toward promoting increased catfish harvest on Lake Washington. Increasing the size restriction for crappie caught on the lake in 2005 was geared toward increasing the crappie in the lake, as are regulations recently adopted to more closely control yo-yo fishing for crappie on Lake Washington. MDWFP also has an active bass stocking program at Lake Washington. With a new north Mississippi hatchery, there should soon be the ability to also stock crappie. They also stock hybrid striped bass at Lake Washington to help control shad (MDWFP 2005a).

There is concern that large flocks of migratory cormorants and white pelicans that are present on Lake Washington during the fall and winter could be contributing to the reduced sport fishery. Cormorants reportedly consume approximately 0.5 pound of fish per day, per bird, while pelicans reportedly consume approximately 2 pounds of fish per day, per bird. Prior to 2005, cormorant flocks of over 10,000 birds were commonly measured on Lake Washington during the winter.

3.5 Pesticides in Fish

All of the waterbodies in the Mississippi Delta, including those in the Lake Washington watershed, were placed under a fish consumption advisory for dichlorodiphenyltrichloroethane (DDT) and toxaphene in carp, buffalo, gar, and catfish larger than 22 inches in 2001. TMDLs

addressing pesticide contamination of fish in the Yazoo River Basin (which included the Lake Washington watershed) were completed in 2003 and 2005 (see Section 4.5.3 for detailed summaries of these TMDLs). These TMDLs noted that DDT and toxaphene are no longer in use, so it isn't really possible to further reduce loadings of these pollutants, but that fish tissue DDT and toxaphene levels exhibited decreasing trends in the Mississippi Delta, suggesting that banning these pesticides has had the desired effect and the natural systems are recovering (Figure 3.1). Therefore, the TMDLs recommend monitoring of fish tissue pesticide concentrations until the fish consumption advisories can be canceled (MDEQ 2003, 2005b). MDWFP and Wildlife Conservation monitor pesticide levels in fish in Lake Washington (MDEQ 2003). In addition, Delta State University personnel are currently analyzing fish tissue pesticide concentrations in Lake Washington.

3.6 Fish Kills

Historically, fish kills have occurred almost annually at Lake Washington (MDWFP 2005a). The most recent major fish kill occurred in 2004. These fish kills likely were the result of low DO levels that occurred after algal blooms. Implementing the nutrient reduction goals identified in the nutrient TMDL discussed above is expected to reduce the occurrence of algal blooms and associated fish kills in Lake Washington.

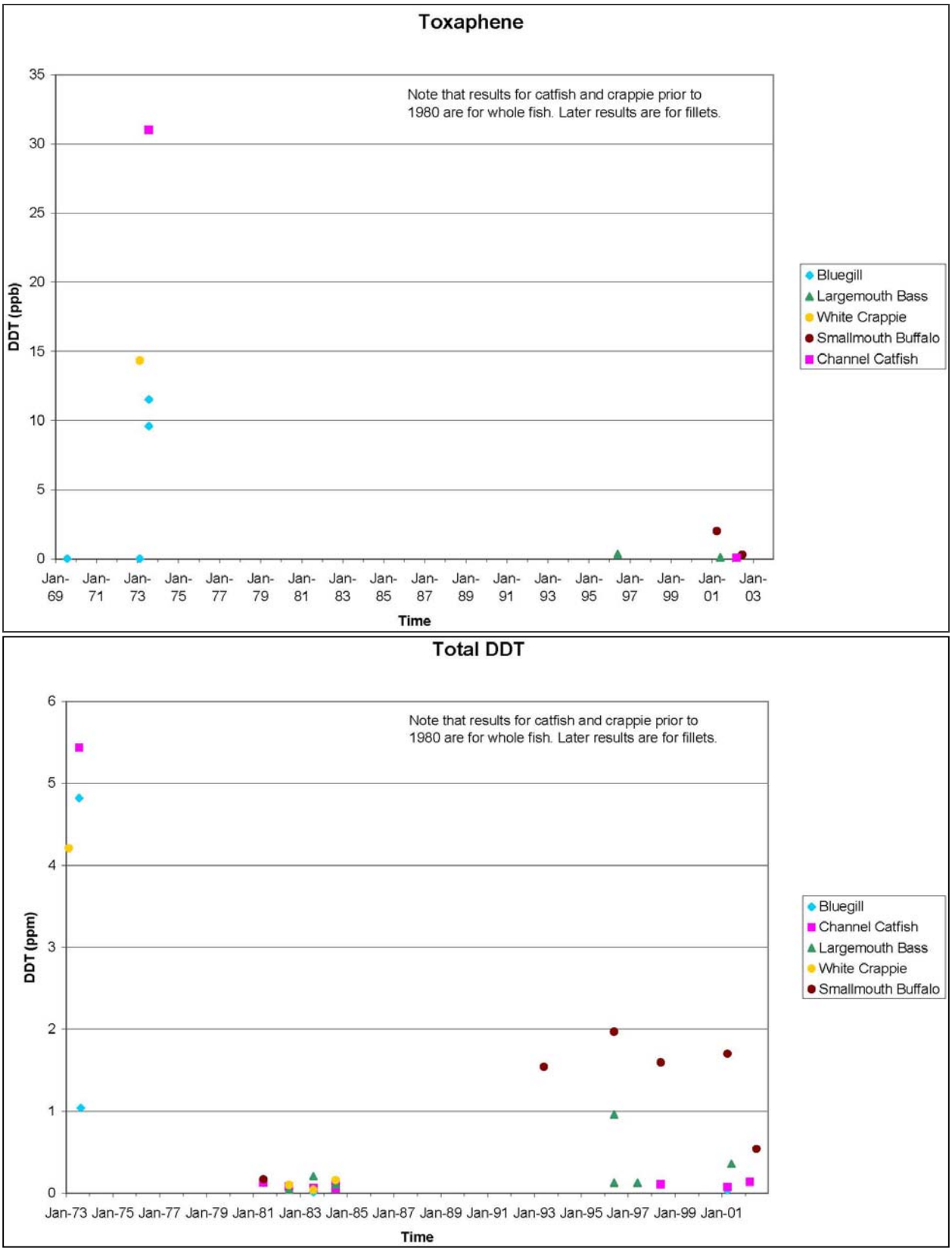


Figure 3.1. Historical trends in fish tissue pesticide residues for toxaphene and DDT.

3.7 Destruction of Lakeshore Forests

The cypress forest surrounding Lake Washington is the largest stand of bald cypress in the Delta. This unique natural feature of the watershed is threatened by cormorants and lakeshore property owners.

While cormorants are native to the area, the population exploded when catfish farming was introduced to the Mississippi Delta. Cormorants exploited the catfish ponds as an easy food source, and their numbers increased dramatically. The large migratory population of cormorants on Lake Washington has caused visible damage to the lakeshore cypress forest (USDA Wildlife services estimates that during the fall and winter of 2000, approximately 13,000 cormorants were roosting on Lake Washington). The droppings produced by this large population of birds have killed cypress trees along the lakeshore. Starting in the fall of 2000, lakeshore landowners, USDA Wildlife Services, US Fish and Wildlife Service, and MDWFP have been working to discourage the cormorants from roosting at Lake Washington. This effort, which has been fairly successful, is centered on a program that uses pyrotechnics launched from boats and lakeshore piers to frighten the birds off the lake when they congregate in large flocks.

There is some concern that migratory flocks of pelicans that use Lake Washington could also eventually become large enough to significantly contribute to nutrient problems and possibly affect the lake fishery.

3.8 Lake Water Level

Lake Washington is subject to significant evaporation during the summer months, resulting in lowering of the lake water level. At times and in places, Lake Washington becomes shallow enough that it is difficult to use boat ramps, with exposed stumps creating additional boating hazards. Water level fluctuations also promote bank erosion and slumping. Lake Washington does have a control structure at its outlet, which is operated by Washington County. Several possibilities for raising summer lake levels have been suggested, but no course of action has been decided. It is possible that the spillway elevation could be raised in conjunction with repairs to the outlet conduits that are being planned (the outlet conduits have rusted and are in need of repair).

3.9 Aquifer Water Levels

The majority of drinking, irrigation, and agriculture water use in this watershed is supplied by groundwater from the alluvial aquifer (MDEQ 2000). Heavy agricultural groundwater usage has resulted in the lowering of the groundwater table throughout the Yazoo River Basin (MDEQ 2000). The Yazoo Mississippi Delta (YMD) Joint Water Management District conducts groundwater level surveys in the Yazoo River Basin in the spring and fall, which include monitoring wells near the Lake Washington watershed. According to the most recent survey report (YMD 2005), between 2003 and 2004, fall groundwater levels in the Lake Washington watershed increased 1.0 to 1.5 ft, while spring groundwater levels decreased between 0.5 and 1.0 ft. This report also indicates that over the last 10 years spring water levels in the watershed have dropped over 2.5 ft, while fall water levels have declined somewhere between 0.0 and 1.0 ft (YMD 2005). Water conservation BMPs have been implemented by some farmers in the watershed.

3.10 Aquatic Vegetation

Cutgrass has moved into shallow areas. While cutgrass helps stabilize the shoreline, it decreases the ability for fishers to fish in shallow waters. In addition, cutgrass can become so invasive, it eliminates other shoreline plant species. Water hyacinth, although not currently present in Lake Washington, does pose a threat. It is abundant in Steel Bayou at the outlet of Washington Bayou.

3.11 Alligators

Alligators have reached nuisance levels in some areas of Lake Washington. In at least one instance, there is some indication that the dumping of fish processing waste from a commercial fishing operation is attracting alligators.

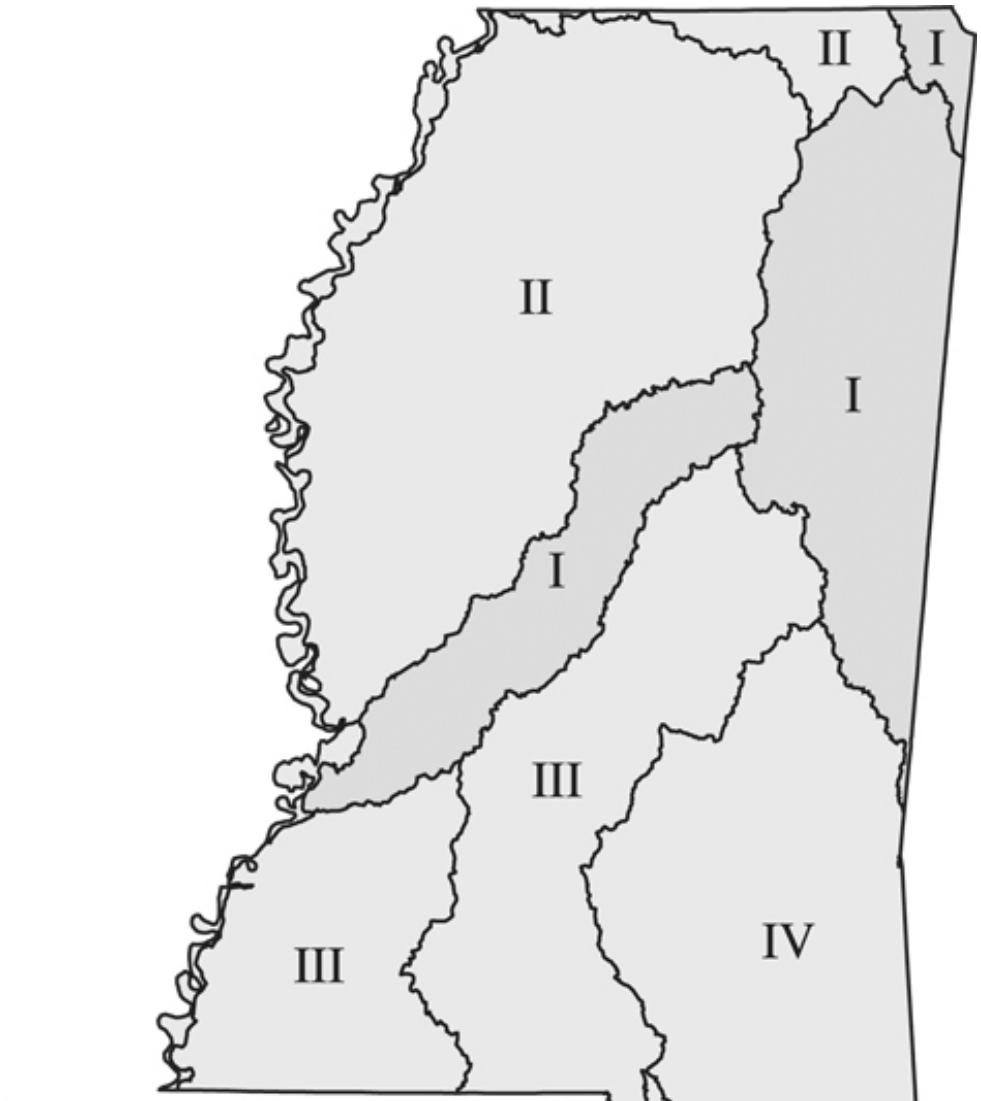
4.0 WATER RESOURCES

4.1 Historical Management

4.1.1 History of the Lake Washington Watershed Implementation Plan

Water quality concerns at Lake Washington were raised at least as early as the 1970s, when Lake Washington was closed to commercial fishing due to pesticide contamination of fish in the lake. Several fish kills and algal blooms have been documented at Lake Washington since the mid 1980s. Lake studies in the 1990s attributed these problems to high nutrient levels in Lake Washington from runoff from agricultural land in the watershed. During the period from 1991 to 1992, MDEQ worked with the Natural Resources Conservation Service (NRCS) to implement agricultural management practices to reduce nutrient inputs to Lake Washington. A 1996 study of Lake Washington, after implementation of the management practices, did not find any indication that these practices had reduced nutrient levels in the lake. That same year, Lake Washington and two of its tributaries were identified as having impaired water quality and were slated for TMDL studies.

In 1998, MDEQ implemented the Basin Management Approach (BMA) to water quality to carry out the mandates of the Clean Water Act. The intention of BMA was to bring together state, federal, and local agencies to improve and maintain the quality of Mississippi's water resources on a basin scale through comprehensive, long-range water quality planning and management strategies. The nine major river watersheds in Mississippi were combined into five basin groups that form the basis for the BMA (Figure 4.1). The BMA is based on a 5-year management cycle, with each year dedicated to a different management activity in each basin group (Figure 4.2).



Group	Basin
I	Big Black, Tombigbee, and Tennessee River Basins
II	Yazoo River and North Independent Streams Basins, And adjacent tributaries of the Mississippi River
III	Pearl River and South Independent Streams Basins, And adjacent tributaries of the Mississippi River
IV	Pascagoula River Basin
V	Coastal Streams Basin

Figure 4.1. MDEQ Basin Management Approach.

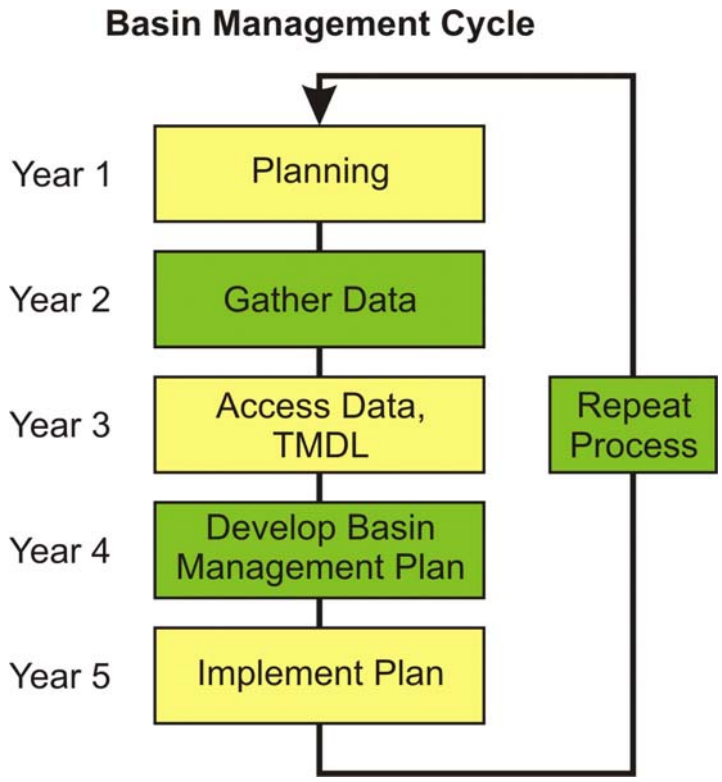


Figure 4.2. Mississippi basin management cycle.

Lake Washington is located in the Yazoo Basin Group, or Basin Group II, which began BMA activities in 1999. A basin management plan was developed for Basin Group II in 2004 by the Yazoo Basin Team. Table 4.1 lists the agencies and groups involved in Basin Group II.

Table 4.1. Yazoo Basin (Basin Group II) Team Members.

Natural Resources Conservation Service	Mississippi Soil and Water Conservation Commission
U.S. Fish & Wildlife Service	Mississippi State Department of Health
Mississippi Department of Environmental Quality • Field Services Division • Office of Land and Water Resources • Total Maximum Daily Load Program • Nonpoint Source Program • State Revolving Fund • Drinking Water Systems Improvements Revolving Loan Program	Delta F.A.R.M.
	U.S. Army Corps of Engineers, Vicksburg District
	U.S. Geological Survey
	Yazoo Mississippi Delta Joint Water Management District
	Mississippi Farm Bureau
	The Nature Conservancy
	Mississippi Farm Services Agency
U.S. Department of Agriculture Cooperative Extension Service	Mississippi Department of Wildlife, Fisheries, and Parks
	Ducks Unlimited

As part of the Basin Group II management planning activities of 2004, 15 watersheds within Basin Group II were identified as priority watersheds for development of watershed management plans and implementation of restoration activities. Lake Washington watershed was one of these priority watersheds. A ranking system was used to select watersheds for implementation.

The first step in the ranking process was to calculate prioritization scores for waterbodies. In this first round of ranking, only waterbodies for which TMDLs had been completed were prioritized. The prioritization score was based on evaluation of the water quality data available for the waterbody, the method used to develop the TMDL, and the resource value of the waterbody based on its designated uses and the presence of threatened or endangered species. The waterbody scores were then aggregated into watershed scores. Eight-digit hydrologic unit codes were used to define watersheds in the Delta portion of the basin group, and 10-digit hydrologic unit codes were used to define watersheds in the Bluff Hills (MDEQ 2004).

The second step in the ranking process was to calculate a targeting score for each watershed. The targeting score was based on 1) evaluation of local and agency support for restoration projects in the watershed; 2) restoration and conservation projects that were active, planned, or had been completed in the watershed; and 3) the value of waterbodies in the watershed with regard to quality of life issues such as recreation and aesthetics (MDEQ 2004).

The prioritization scores and targeting scores for the watersheds were combined in the final ranking score. At a Basin Team meeting in July 2004, the team designated approximately 15 of the highest ranked watersheds as high priority watersheds for restoration and development of Watershed Implementation Plans (WIPs).

Agencies and groups involved in the Basin Group II Team committed to target these priority watersheds for restoration and management activities and funding. Representatives of these groups also committed to serve on Watershed Implementation Teams for each priority watershed, to develop goals for the watersheds with local stakeholder inputs, develop comprehensive plans for activities to achieve the watershed goals, coordinate implementation of activities in these watersheds, and track progress toward the watershed goals. The intention of the BMA is that watershed restoration through Watershed Implementation Teams and Plans be

locally driven. Members of the Lake Washington implementation team involved in developing the 2006 Lake Washington Implementation Plan are listed in Table 1.1.

Just prior to the year the Basin Group II Team was involved in their management planning, Lake Washington became a focus of federal and local interest. In 2003 a nutrient showcase project was initiated for Lake Washington under the federal Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico (http://www.epa.gov/gmpo/lmrsbc). During this same period, at the local level, the Lake Washington Property Owners Association contacted MDEQ about water quality concerns, sewage discharge to Lake Washington, and cormorant and commercial fishing issue at Lake Washington. In addition, in 2003, the Washington County Board of Supervisors also contacted MDEQ about sewage discharge at Lake Washington. Local and federal interest in Lake Washington restoration contributed to the ranking of the Lake Washington watershed as a priority watershed by the Basin Group II Management Team.

4.2 Water Quantity

The majority of drinking, irrigation, and agricultural water use in this watershed is supplied by groundwater from the Mississippi River Alluvial Aquifer (MDEQ 2000). There is only one farm that uses water from Lake Washington to supply part of its irrigation water needs. The high carbonate levels in the groundwater makes it marginally suitable for drinking water, but suitable for agricultural uses. Nutrient levels in the groundwater are low, and nitrate levels are below the USEPA drinking water standard (Tetra Tech 2003). Heavy agricultural groundwater usage has resulted in the lowering of water levels in aquifers throughout the Yazoo River Basin (MDEQ 2000). Long-term recorded water levels in alluvial aquifer monitoring wells in the Lake Washington watershed do not exhibit downward trends (http://nwis.waterdata.usgs.gov). Semi-annual water level surveys conducted and analyzed by YMD Joint Water Management District, however, indicated a long-term decline in spring groundwater levels of approximately 2.5 ft in the Lake Washington watershed (YMD 2005).

Washington County manages the low head dam that regulates water levels in Lake Washington. Water is released from two drain culverts in the dam to control lake water levels.

The culverts are used primarily to lower the lake level during high water conditions resulting from heavy rains (MDWFP 2005a). Lake Washington is subject to significant evaporation in the summer months, which increases the number of shallow areas in the lake. These shallow areas are subject to more wind mixing and wave action, which can increase water column temperatures and cause bottom sediments to be suspended in the water column, increasing turbidity and releasing nutrients and other chemicals stored in sediments.

4.3 Water Conservation

Groundwater conservation BMPs have been implemented by some farmers in the watershed.

4.4 Wildlife Resources

The Mississippi Natural Heritage Inventory (http://www.mdwfp.com/museum/html/research/nhp.html) indicates that one federally listed endangered species, Florida panther (*Puma concolor coryi*), and one federally listed threatened species, Louisiana black bear (*Ursus americanus luteolus*), could be present in Washington County. These species have been identified as species of greatest conservation need in Mississippi (MDWFP 2005b). The Natural Heritage Inventory also lists six animal and 12 plant species of "special concern" for Washington and Issaquena counties that could potentially be present in the Lake Washington watershed (Tables 4.2 and 4.3). In addition, American white pelicans, which have been identified as a species of greatest conservation need in Mississippi (MDWFP 2005b), are seen in the Lake Washington watershed during their migrations through the area (Figure 4.3).

Table 4.2. Animal species of 'special concern' listed for Washington and Issaquena counties that may occur in the Lake Washington watershed.

Common Name	Scientific Name	Species Greatest Conservation Need (MDWFP 2005b)	Habitat Characteristics (http://www.natureserve.org/explorer/)
Flat Floater (mussel)	*Anodonta suborbiculata*	N	A backwater species of large river floodplain waters. Tolerant of impoundments. Occurs in medium-sized creeks to large river backwaters, as well as in oxbows, sloughs, and impoundments with muddy substrates (Williams and Bulter 1994).
Rock Pocketbook (mussel)	*Arcidens confragosus*	Y	Found in mud- and sand-bottom pools in medium to large rivers in standing or slow-flowing water. A species typical of large, lowland streams with little or no flow.
Wartyback (mussel)	*Quadrula nodulata*	Y	Generally found in large rivers with sand or fine gravel substrate.
Deertoe (mussel)	*Truncilla truncata*	Y	Found only in rivers, generally large rivers with sand or fine gravel substrate.
Alligator Snapping Turtle	*Macrochelys temminckii*	Y	Slow-moving, deep waters of rivers, sloughs, oxbows, and canals or lakes associated with rivers (e.g., impoundments); also swamps, bayous, and ponds near rivers, and shallow creeks that are tributaries to occupied rivers. Usually occurs in water with mud bottom and some aquatic vegetation.
Paddlefish	*Polyodon spathula*	Y	Slow-flowing water of large and medium-sized rivers, river-margin lakes, channels, oxbows, backwaters, impoundments with access to spawning areas. Prefers depths greater than 1.5 meters; seeks deeper water in late fall and winter (Burkhead and Jenkins 1991). Spawns in fast, shallow water over gravel bars.

Table 4.3. Plant species of 'special concern' listed for Washington and Issaquena counties that may occur in the Lake Washington watershed.

Common Name	Scientific Name	Habitat Characteristics
San Antonio False-Foxglove	*Agalinis homalantha*	Moist grasslands and open woods.
Lake Cress	*Armoracia aquatica*	Found in Mississippi in calcareous soil in open areas which are subject to periodic flooding. It has also been found in Delta bottomland hardwood forests (and adjacent roadside ditches) on sharkey clay soils (http://www.natureserve.org/explorer/).
Purple Milkweed	*Asclepias purpurascens*	Roadsides and prairies.
Cypress-Knee Sedge	*Carex decomposita*	Marshes and wet ditches.
Tissue Sedge	*Carex hyalina*	Marshes and wet ditches.
Swamp Hickory	*Carya leiodermis*	Bottomland hardwood forests.
Hooker's Eryngo	*Eryngium hookeri*	Moist grasslands.
Pumpkin Ash	*Fraxinus profunda*	Shallow, permanent to near-permanent wetlands.
Arkansas Manna-Grass	*Glyceria arkansana*	
Texas Spider-Lily	*Hymenocallis liriosome*	Open, wet woods or cleared, wet areas.
Hairy Water-Fern	*Marsilea mucronata*	Shallow water.
Sharp-Sepal Beardtongue	*Penstemon tenuis*	Wet ditches.
Delta Post Oak	*Quercus mississippiensis*	Seasonally flooded bottomland woods.

Figure 4.3. American white pelicans on Lake Jackson (photo by New).

The Lake Washington watershed is located along the Mississippi River flyway, and waterbodies in the watershed are used by several species of migratory birds. The American white pelicans mentioned above are one such species. Cormorants are another migratory species that use Lake Washington. Cormorants roost at Lake Washington in such large numbers that they are viewed as a nuisance by locals (see Section 2.3.6). Several species of ducks, including mallards, also use Lake Washington. During the December 2005 waterfowl survey, the Lake Washington watershed was characterized as an area of low duck density (http://www.mdwfp.com/Level2/Wildlife/hunting_waterfowl_survey.asp, http://www.mdwfp.com/Level2/Wildlife/region_waterfowl_reports.asp).

Lake Washington is known for its crappie, bluegill, and catfish fisheries. However, in recent years, these fisheries have been declining, and recreational anglers have been catching fewer of these fish. At the same time, the catfish and shad populations seem to be increasing, leading researchers to conclude that the fishery has become unbalanced. In addition, there is a history of fish kills occurring at Lake Washington. The most recent one occurred in August 2004. Lake Washington and other surface waters in the watershed have been under a fish

consumption advisory for DDT and toxaphene in carp, buffalo, gar, and catfish larger than 22 inches since 2001 (MDEQ 2003).

4.5 Water Quality

4.5.1 Standards

The designated use class for surface waters in the Lake Washington watershed, as stated in the Mississippi water quality regulations, is Fish and Wildlife Support. The designated beneficial uses for Lake Washington are Aquatic Life Support and Primary Contact Recreation. Designated beneficial uses for the rest of the surface waters in the watershed are Aquatic Life Support and Secondary Contact Recreation (http://www.deq.state.ms.us/MDEQ.nsf/page/WMB_yazoodesignate?OpenDocument). Table 4.4. lists the numeric water quality criteria applicable to Lake Washington watershed surface waters (MDEQ 2002).

Mississippi's water quality standard for sediment is narrative and reads as follows: "Waters shall be free from materials attributed to municipal, industrial, agricultural or other discharges producing color, odor, taste, total suspended or dissolved solids, sediment, turbidity, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation or to aquatic life and wildlife or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated use" (MDEQ 2002).

Table 4.4. Water quality criteria for Lake Washington watershed.

Parameter	Criteria
Dissolved oxygen	5.0 mg/L daily average, 4.0 mg/L instantaneous
pH	Between 6.0 and 9.0 su
Temperature	32.2ºC
Fecal coliform	Lake Washington: All year - geometric mean of 200 per 100 mL, 400 per 100 mL less than 10% of the time during a 30-day period. Other Surface Waters: May – Oct.: geometric mean of 200 per 100 mL, 400 per 100 mL less than 10% of the time during a 30-day period. Nov. – April: geometric mean of 2,000 per 100 mL, 4,000 per 100 mL less than 10% of the time during a 30-day period.
Specific conductance	1,000 µohms/cm
Dissolved Solids	750 mg/L monthly average, 1,500 mg/L instantaneous

4.5.2 Current Condition

There is not a routine water quality monitoring station in the Lake Washington watershed. However, several water quality studies have been conducted on the lake (e.g., FTN 1991, MDEQ 1996, Tetra Tech 2003). There have been concerns related to Lake Washington water quality for over 30 years. The lake was closed to commercial fishing in the 1970s due to pesticide contamination. Several fish kills occurred in 1986 and one occurred in August 2004. In 1990 a toxic algal bloom occurred that caused the death of several domestic animals (MDEQ 1996). Clean Lake studies in 1991 and 1996 documented excessive algal blooms. While issues related to pesticides, nutrients, and organic enrichment in the lake have become less in recent years, recent monitoring results have indicated high nutrient levels and low DO levels (http://www.epa.gov/gmpo/lmrsbc/meetsum_lakewa_oct03.html).

During 2002 to 2004, Lake Washington was sampled as part of MDEQ's Lakes and Reservoirs Nutrient Criteria Development Project. Water quality summary statistics for chlorophyll a, total phosphorous, and total nitrogen concentrations, plus Secchi disk depth, are shown in Table 4.5. Based on analyses conducted as part of the Nutrient Criteria Development Project, proposed numeric water quality targets for Delta oxbows, including Lake Washington, are also listed in Table 4.5.

Table 4.5. Summary statistics for selected Lake Washington water quality variables monitored during 2002 – 2004 and proposed water quality targets.

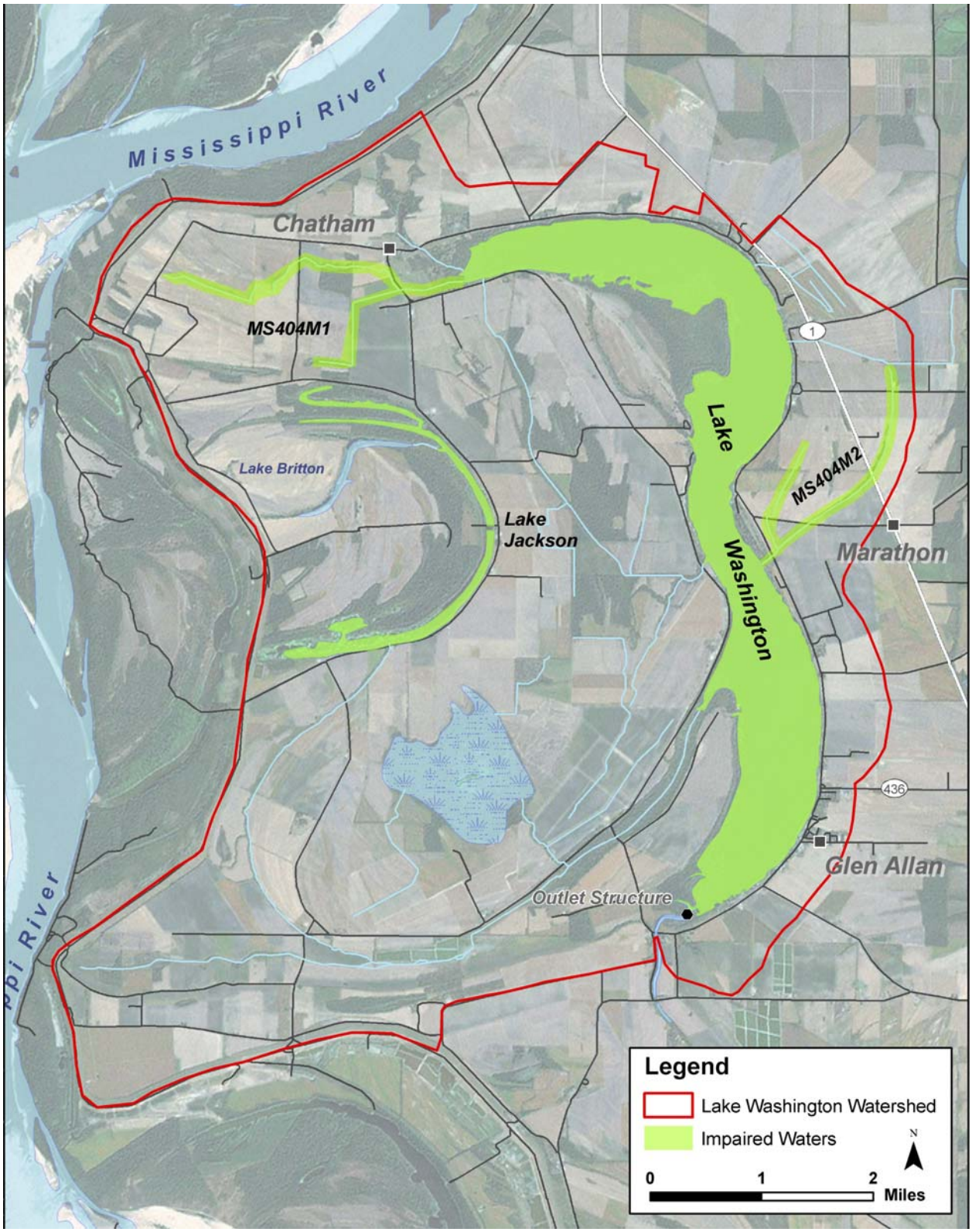
Statistic	Variable			
	Secchi (m)	**Chlorophyll a (mg/L)**	**Total Phosphorous (mg/L)**	**Total Nitrogen (mg/L)**
N	15	15	15	15
Minimum	0.18	24	90	370
Maximum	0.55	171	400	3580
Mean	0.32	98	199	2411
Median	0.30	111	200	240
Proposed Target	0.6	46	90	1250

Lake Washington and two of its tributaries were included on the 1996 303(d) list as impaired due to sediment/siltation (Figure 4.4). In addition, the tributaries were also listed as impaired due to pesticides, and one of the tributaries was also listed for nutrients and organic enrichment/low DO (Table 4.6). TMDLs addressing these impairments were completed in 2003. These TMDLs have been approved by USEPA Region IV, and Lake Washington and its tributaries are in the process of being removed from the 303(d) list (MDEQ 2005a).

Table 4.6. Section 303(d) listings in the Lake Washington watershed.

Waterbody Name	Waterbody ID	Location	Beneficial Use	Impairment	Year Listed
Unnamed tributary of Lake Washington	MS404M1	At Chatham from headwaters to Lake Washington	Aquatic Life Support	Sediment/siltation, organic enrichment/ low DO, nutrients, pesticides	1996
Unnamed tributary of Lake Washington	MS404M2	Near Glen Allan: from headwaters to Lake Washington	Aquatic Life Support	Sediment/siltation, pesticides	1996
Lake Washington	MS404LWM	Near Glen Allan	Recreation, Fish and Wildlife	Sediment/siltation	1996
Lake Jackson	MS404LJE	Near Glen Allan	Aquatic Life Support	Nutrients, pesticides, sediment/siltation	2004

Lake Jackson, which is located west of Lake Washington in the watershed (see Figure 2.1), was included on the 2004 303(d) list as impaired due to sediment/siltation, nutrients, and pesticides (Table 4.6). A TMDL addressing the pesticide impairment has been completed (MDEQ 2005b) and approved by USEPA Region IV.


Mississippi River
Chatham
MS404M1
Lake Britton
Lake Jackson
Lake Washington
MS404M2
Marathon
1
436
Glen Allan
Outlet Structure
Legend
Lake Washington Watershed
Impaired Waters
N
0
1
2
Miles

4.5.3 TMDLs

TMDLs addressing the impairments of Lake Washington and its two listed tributaries have been completed and approved; one addresses nutrients, organic enrichment/low DO, and sediment/siltation, and one addresses pesticides.

A TMDL addressing organic enrichment/low DO and sediment/siltation has been completed and was approved by USEPA (Tetra Tech 2003). The TMDL report states that no known point sources related to these pollutants/impairments are present in the watershed. Nonpoint sources related to these pollutants/impairments, accounted for in the development of the TMDL, included runoff from cultivated and non-cultivated agricultural lands, catfish pond discharges, failing septic systems, and background sources (forest land). Since Mississippi does not currently have numeric nutrient water quality criteria, a nutrient TMDL was not developed; however, nutrient contributions to oxygen demand were included in this TMDL. This TMDL recommended a 50% reduction in the load of oxygen-demanding materials entering the listed waterbodies in the watershed, and 32% to 59% reductions in sediment loads to the listed waterbodies.

The pesticide impairments in the Lake Washington watershed (i.e., for Lake Washington, tributary MS404M2, and Lake Jackson) were addressed in pesticide TMDLs for the Yazoo River Basin (MDEQ 2003, 2005b). The target for these TMDLs was removal of fish consumption advisories for DDT and toxaphene, and reduction of water column concentrations to the DDT human health and aquatic organism standard, and the toxaphene fresh water chronic standard. The use of both DDT and toxaphene has been banned, and neither pesticide is currently being applied. Therefore, the methods proposed for achieving these targets included implementation of BMPs to reduce sediment loading to waterbodies (pesticides are present in basin soils) (MDEQ 2003) and natural attenuation (historical pesticide monitoring data from the Yazoo River Basin indicate a decreasing trend in pesticide concentrations in soils, fish tissue, and water) (MDEQ 2003, 2005b).

5.0 WATERSHED MANAGEMENT ACTIONS

There are two underlying management principles of this WIP: ecosystem-based management and adaptive management. The goals and objectives of this plan reflect these principles. Each of these management principles is briefly described below, followed by watershed management actions that are planned for the near future to work toward the vision for Lake Washington. Goals related to other existing or potential concerns in this watershed will be addressed in future implementation plans.

5.1 Ecosystem-Based Management

Lake Washington and its watershed represent the ecosystem management unit. Although Lake Washington is typically considered the ecosystem, a lake and its watershed cannot be divorced. Land use and land cover activities in the watershed directly or indirectly affect the lake. Sediment and nutrient loadings from the watershed drive many lake processes, including both desirable and undesirable changes in the lake. The ecosystem, however, is characterized not only by its environmental attributes, but also by its socioeconomic attributes. Humans are part of, not apart from, aquatic ecosystems. Watershed management is fundamentally a social activity (Thornton and Creager 2001).

The benefits that accrue from reduced sediment and nutrient loadings to Lake Washington are not just associated with the lake in terms of increased water clarity, reduced sedimentation and loss of volume, reduced algal blooms, a more productive sport fishery, and greater recreational and aesthetic values. The agricultural community also benefits from reduced sediment and nutrient loadings. For example, Pimentel et al. (1995) estimated that each ton of sediment lost was worth about $6.75 per year to the farmer ($5.00 per ton for lost nutrients, and $1.75 per ton for lost soil and water capacity). Using the TMDL estimates for tons of sediment entering Lake Washington per year, the minimum estimate of dollars lost from the watershed is about $65,450 per year (9,695 tons per year x $6.75). This is equivalent to almost $50,000 in lost nutrients from the watershed and $15,000 in lost sediment and water capacity. These estimates are very conservative because they are based on yield from the watershed, not loss from the

fields (field losses are higher than delivery to the waterbody). An ecosystem-based approach is being used for watershed management in the Lake Washington watershed.

5.2 Adaptive Management Process

In addition to ecosystem-based management, an adaptive management process is being used for watershed management in the Lake Washington watershed. Adaptive management is "learning by doing" and has become the recommended approach for ecosystem and natural resources management, including watershed management (Christensen et al. 1996; Holling 1978; Jackson et al. 2001). Adaptive management has helped shift management from the concept that there is a "balance of nature" to a more realistic concept that ecosystems are dynamic, non-equilibrium systems. The environment is continually changing – climate, development, agricultural practices, demographics, and societal values. Adaptive management is the only feasible approach for moving toward sustainable water resources (Coleman 1998).

Adaptive management, or learning by doing, means that periodic assessments must be made to determine if results-based criteria (e.g., largemouth bass catch per unit effort (CPUE) at around 20 fish per hour) are being attained and if the lake and watershed are moving toward the desired vision for Lake Washington. The schedule for these periodic assessments and revision of the watershed management plan is discussed in Chapter 8. The rotating basin approach used by MDEQ is part of this periodic assessment process.

5.3 Watershed Management Actions

Watershed management actions fall within seven general areas, discussed below. The seven general areas are:

1. Sewerage Discharge Elimination;
2. Sediment Loading Reductions;
3. Nutrient Loading Reductions;
4. Fisheries Management;
5. Cypress Forest Protection;
6. Water Level Management; and
7. Alligator Control.

For each category, there is a general introduction followed by a table(s) that provides information on the specific management action, its objective(s) and benefit(s), each of the participants involved in implementing the management activity, their role and responsibility, the schedule, the performance measure(s), and estimated budget.

5.3.1 Sewerage Discharge Elimination

Our vision statement states, "Lake Washington provides a pleasant and safe place to live, fish, boat, and swim." This watershed planning process was initiated primarily as a result of concerns over raw sewage being discharged into Lake Washington. There are three management actions that are being taken to address the discharge of raw sewage into Lake Washington:

1. Assess the feasibility of a regional sewer system around Lake Washington;
2. Conduct a Sewage Summit to inform residents about decentralized and onsite septic systems; and
3. Eliminate direct discharge and failing septic system discharges into Lake Washington.

Each of these management actions is briefly discussed and then highlighted in Tables 5.1 – 5.3 at the end of this section.

1. Regional Sewer Cost Estimate

The Washington County Board of Supervisors discussed the alternative of installing a regional sewer system around Lake Washington to connect with the Glen Allan wastewater treatment facility in 2004 and 2005. It was determined that it was feasible to construct a regional sewer line around Lake Washington and connect to the Glen Allan facility. The cost of this effort was unknown. This management action will determine the socioeconomic feasibility of a regional sewer system (Table 5.1).

2. Sewage Summit

Many property owners are unaware of requirements, instituted by MSDH, MDEQ, and Washington County, regulating the installation, inspection, and maintenance of onsite

wastewater treatment systems (septic and decentralized wastewater treatment systems), as well as the new technologies available to them. Many property owners are also unaware of funding sources available for cost-share on the purchase and installation of onsite systems. This management action will inform property owners, local and state officials, and others about onsite, decentralized wastewater treatment systems, and these options (Table 5.2).

3. Eliminate Direct Discharge and Failing Septic System Discharges into Lake Washington

MSDH and MDEQ conducted an investigation of failing septic systems and sampled for fecal coliform indicators of pollution in 2005. Two failing septic systems were identified. The water quality sampling indicated that water quality standards were being attained for fecal coliforms. This was a one-time inspection and sampling and did not investigate direct discharges into the lake. This management action will focus on 100% elimination of all sewage discharge into Lake Washington (Table 5.3). This management action will also contribute to reducing organic enrichment of Lake Washington (see Sections 5.3.2 and 5.3.3).

5.3.2 Sediment Loading Reduction

Part of our vision for the Lake Washington watershed is that all waterbodies meet all applicable state water quality standards. In the watershed, Lake Washington, two of its tributaries, and Lake Jackson have been assessed as not meeting applicable water quality standards due to sediments/siltation and organic enrichment/low DO (Figure 4.4). Three management actions are being taken to reduce sediments/siltation by about 55% and associated organic matter loading by about 50% to Lake Washington:

1. Repair failing culverts under Washington County roads;
2. Implement sediment BMPs on agricultural fields in the watershed; and
3. Maintain BMPs following implementation.

Management actions 2 and 3 will also reduce sediments/siltation to the listed Lake Washington tributaries and Lake Jackson by at least 32%, and associated organic matter loading

to these waterbodies by 50%. Each of these management actions is briefly discussed and then highlighted in Tables 5.4 – 5.6 at the end of this section.

1. County Road Culverts

Land leveling and similar management practices in the watershed have resulted in county roads being below the level of neighboring fields. Ditches running through culverts under these roads are exhibiting head-cutting into the fields upstream of the culverts. This head-cutting is caused because elevation differences between the culvert invert and fields have changed over time. The location of these culverts is shown in Figure 5.1. This head-cutting has increased sediment loads to Lake Washington and sedimentation in the lake. The Washington County Board of Supervisors will be contacted to evaluate the possibility of modifying the roads, culverts, or ditches to stop the head-cutting erosion. A Section 319 grant will be prepared to fund part of the cost of repairing the failing culverts. This management action will reduce one of the primary sources of sediment entering Lake Washington and achieve part of the TMDL-recommended sediment load reduction (Table 5.4).

2. Individual Field Sediment BMPs

Sediment loading is also occurring from the erosion of individual agricultural fields. Potential sites for the installation of dropped inlets, grassed waterways, and vegetative buffer strips (25 ft wide per state standards) have been identified (Figure 5.2). This management action will address erosion and sediment transport from individual fields to the listed lakes and tributaries to achieve the remainder of the TMDL-recommended sediment load reduction (Table 5.5).

3. Maintenance of BMPs

Agricultural BMPs require some maintenance following implementation to remain effective. This management action will be taken to continue the maintenance of landowner BMPs following implementation (Table 5.6).

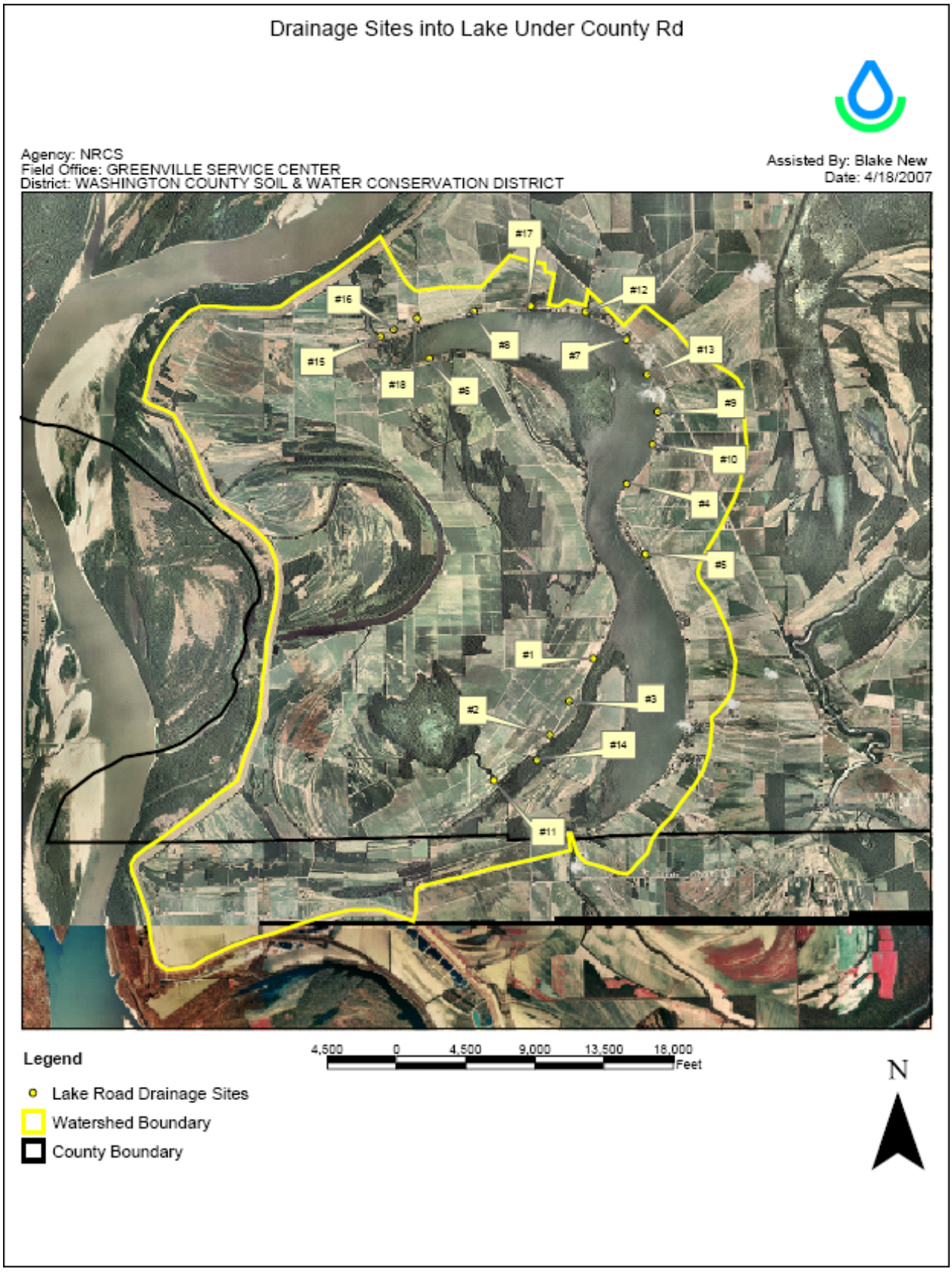


Figure 5.1. Locations of county road culverts exhibiting head-cutting.

Figure 5.2. Location for sediment and nutrient BMPs.

5.3.3 Nutrient Loading Reductions

Numeric nutrient criteria are not available for most states, including Mississippi. However, nutrient reductions are anticipated to occur with the implementation of sediment/sedimentation BMPs because some nutrients (particularly phosphorus and organic nitrogen) absorb onto sediments. Reducing sediment loadings will have a concomitant reduction in nutrient loading. Some BMPs, such as filter strips, can remove up to 70% of the total phosphorous load leaving the agricultural field (Freedman et al. 2003). In addition, some sediment BMPs such as grassed waterways and vegetative buffer strips can remove soluble nutrients through vegetative uptake and incorporation in biomass. The anticipated reductions in nutrients associated with the sediment management practices are highlighted in Tables 5.7 – 5.8.

1. Nutrient Reduction through Sediment Control

BMPs for soil erosion and sediment load reductions have also been demonstrated to reduce nutrient loading to waterbodies because both phosphorus and nitrogen species can sorb onto sediment particles ((Freedman et al. 2003; Shaver et al. 2002). As much as a 70% reduction in total phosphorus loads have been observed by installing riparian filter strips at the fields edge (Freedman et al. 2003). Total phosphorus and total nitrogen load estimates were included in the Lake Washington sediment TMDL (Tetra Tech 2003). For this management action, these loading estimates will be verified through field monitoring, as noted below in Table 5.7. The actual reduction in nutrient loading will be determined following the implementation of BMPs for sediment control.

2. Individual Field Nutrient BMPs

Lake Washington has been selected as a nutrient reduction showcase for Mississippi as part of the Gulf of Mexico Hypoxia Reduction Program. While there are not currently numeric nutrient criteria for Mississippi, these criteria are being developed. In the interim, nutrient targets have been proposed for Lake Washington (see Section 4.5.2). As noted above, nutrient loading reductions through sediment control will be determined for Lake Washington, Lake Jackson, and tributary MS404M1. If additional nutrient loading reductions are needed following the

implementation of sediment BMPs to achieve the Lake Washington nutrient targets, individual field nutrient BMPs will be implemented as outlined in Table 5.8.

5.3.4 Lake Washington Fishery

In our vision statement we envision Lake Washington as having a healthy, balanced, sport fishery, that attracts non-local anglers who contribute to the local economy. Current thinking is that there are too many catfish, shad, and drum in Lake Washington, and not enough bass and crappie. Because the fishery does contribute to the local economy, improving it also contributes to the sustainability of the local economy and quality of life in the watershed, additional elements that are included in our vision statement. Four management actions are proposed for managing the Lake Washington fisheries:

1. Game fish management;
2. Conduct Catfishing Clinic and Catfish Rodeo;
3. Commercial harvest of catfish; and
4. Public fishing pier.

Each of these management actions is briefly discussed and then highlighted in Tables 5.9 – 5.12 at the end of this section.

1. Game Fish Management

MDWFP has developed a fisheries management plan for Lake Washington (MDWFP 2005a) detailing activities that will be used to manage the fishery to achieve the following overall goals:

1. Increase largemouth bass stock;
2. Increase crappie stock;
3. Decrease shad stock; and
4. Decrease catfish stock.

Specific management objectives associated with each of these overall goals are listed in Table 5.9. These objectives and management actions will be implemented, funded, and tracked by MDWFP. Activities to reduce drum in Lake Washington may be undertaken in later plans.

2. Conduct Catfishing Clinic and Catfish Rodeo

The activities described under this action are potential activities only, and have not been discussed or committed to by anyone involved in the Lake Washington Watershed Implementation Team.

"Catch a Tagged Catfish" is a promotion offered by Roy's Store to promote catfish harvest on Lake Washington. Other sponsors are Budweiser, Lowe's, Farm Bureau, Bostick Brothers, Pepsi, Guaranty Bank, Allstar Motors, Ceranti-Oakes Toyota, Washington County Farm Bureau, Longwood Flying Service, Delta Democrat Times, and Lake Washington Landowners Foundation. MDWFP tagged and released catfish in March 2005, March 2006, and March 2007. Those that catch a tagged catfish take the fish to Roy's to see if they have won a t-shirt, a vendor product, or cash prizes up to $500.00.

Local sponsors could team with MDWFP to host a clinic on Lake Washington to teach children how to fish for catfish. A fishing pier could be built or a contract initiated to use a private pier where the pier is baited to attract catfish to the pier for the event. Publicity of the event would highlight the abundance of catfish on Lake Washington to attract people to the lake to fish for catfish. The desired result of this action would be to increase harvest of catfish in Lake Washington, promote sport fishing harvest, and promote fishing, thereby decreasing the catfish stock in the lake.

3. Commercial Harvest of Catfish

The catfish fishery in Lake Washington has the capacity to support commercial harvest. Incentives or contracts could be developed to promote commercial harvest of catfish in Lake Washington. One action would be to propose changes to Mississippi laws that would make it less expensive for people to fish slat boxes on Lake Washington. The desired result of this action would be to reduce the catfish stock in the lake, thereby allowing for increase of the gamefish stock. As the entity primarily responsible for the Lake Washington fishery, MDWFP would be involved in this action. Schedule and budget for this action will be developed if this action is accepted by the Lake Washington Watershed Implementation Team.

4. Public Fishing Pier

Currently, there is no public fishing pier on Lake Washington. Building a pier would not only provide greater recreational opportunities for fishing on Lake Washington, but also contribute to catfish harvest. This management action is to construct a fishing pier on Lake Washington.

5.3.5 Watershed Cypress Forests Protection

In our vision statement we envision Lake Washington as having healthy shoreline cypress forest. Areas of cypress forest around Lake Washington have been damaged by very large flocks of cormorants roosting in them as the cormorants migrate through the area. Cypress forests around Lake Jackson are also being threatened by large flocks of cormorants as they move off of Lake Washington. Cormorants have historically over-rested on Lake Washington during their spring and fall migration. However, the number of cormorants in recent years has exploded because of the aquaculture in the watershed. The intent of these management actions is to reduce the number of cormorants to historical levels, not eliminate them from the lake ecosystem. In addition to damage from cormorants, cypress forests in the watershed are also being harvested by landowners in ways that could affect the aesthetics of the watershed and the functioning of its systems. Five management actions will be implemented to protect the cypress forests surrounding Lake Washington:

1. Cormorant harassment programs;
2. Recruiting and training additional volunteers for cormorant harassment;
3. Cormorant harvest;
4. Planting alternate cormorant roosting sites; and
5. Educating landowners on the benefits and increased property value associated with cypress forests.

Each of these management actions is briefly discussed and then highlighted in Tables 5.13 – 5.16 at the end of this section.

1. Cormorant Harassment Programs

The harassment program currently in use consists of three volunteers in boats using pyrotechnics to scare off the cormorants when they begin to roost in large flocks on Lake Washington. Additional support is provided by volunteers firing pyrotechnics from the shore. The cormorant harassment program implemented has been effective. While the reduction in birds has been gradual over the past several years, damaged cypress trees are showing signs of recovery, with new growth in damaged tree tops and branches.

2. Recruiting and Training Additional Volunteers

While the current harassment program has been effective, additional volunteers are needed to continue to effectively implement it. USDA Wildlife Services is willing to provide technical support in the form of training for volunteers on implementing the program.

3. Cormorant Harvest

USDA Wildlife Services, US Game and Fish Commission, and MDWFP have initiated cormorant harvest in the Lake Washington watershed for control of the cormorant population in the area.

4. Planting Alternate Cormorant Roosting Sites

The activities described under this action are potential activities only, and have not been discussed or committed to by anyone involved in the Lake Washington Watershed Implementation Team.

Planting trees such as tupelo gum, cypress, oak, pecan, persimmon, and sycamore in other areas of the watershed could potentially relieve some of the roosting pressure. Providing more alternate roosting areas could potentially reduce the number of cormorants roosting in the cypress forest around Lake Washington, and subsequently reduce the associated damage to that forest. Alternatively, roosts could be constructed in other areas of the watershed. Constructed roosts could be designed in such a manner that bird excrement could be collected and used as fertilizer, composted, or disposed of in some other safe manner.

5. Educating Landowners

A major element in any management program is creating public awareness of the importance of the resource. This management action will be implemented through Public Education and Outreach, which is discussed in Chapter 6. Cypress trees are an integral part of southern lakes, including Lake Washington. Cypress trees contribute not only to a number of ecosystem services, such as shoreline stabilization, fish habitat structure, and water temperature regulation, but also to socioeconomic benefits, such as increased property value, wind breaks, and lower air conditioning requirements and costs. Urban forestry studies have indicated that each tree greater than 3 inches in diameter can increase property values by up to $500.00 per tree.

5.3.6 Lake Water Level Management

Stable lake levels contribute to our vision for Lake Washington as a recreational paradise with enjoyable scenic vistas. In addition, stable lake levels contribute to stable vegetation and reduced erosion from drawdown and exposure. The management actions that will be implemented for stable lake water levels are to repair the outlet structure and to establish a minimum lake level. These management actions are briefly discussed and then highlighted in Tables 5.17 and 5.18 at the end of this section.

1. Repair the Outlet Structure

The outlet pipes from the lake have rusted and, if not currently leaking, will soon leak. While replacing the outlet pipes, it will also be determined if stoplogs or a similar water level riser can be added to offset the loss of volume that has occurred through sedimentation. However, only a modest increase in water surface elevation can be permitted to prevent flooding or damage to existing docks and structures around the lake. This management action is presented in Table 5.17.

2. Establish Minimum Lake Level

Lake Washington is part of the state's water supplies available for out-of-lake beneficial use. Water withdrawals for beneficial use should be managed under the regulations established by the Commission on Environmental Quality. A minimum lake level needs to be established for Lake Washington to provide for effective management of water supplies and to protect lake water levels. This management action is presented in Table 5.18.

5.3.7 Alligator Control

Alligators are native to the Lake Washington watershed and have historically been present at Lake Washington. In recent years, however, alligators have occasionally moved into populated areas of Lake Washington, posing a potential safety issue to residents. Two management actions will be implemented to control alligator populations in Lake Washington:

1. Eliminate fish processing waste from Lake Washington; and
2. Alligator management plan.

Each of these management actions is briefly discussed and then highlighted in Tables 5.19 – 5.20 at the end of this section.

1. Eliminate Fish Processing Waste from Lake Washington

Commercial fish harvesting operations have dumped waste from fish processing into Lake Washington, which likely has attracted alligators feeding on this waste to the populated areas of the lake. MDWFP contacted the commercial fish harvesting operations on Lake Washington and notified them that dumping of their waste into Lake Washington is against the law. The management action to address this issue is described in Table 5.19.

2. Alligator Management Plan

Alligators are a common feature in Lake Washington and, in general, are not a problem if they are left alone. However, alligators can become aggressive both during breeding season and

when fed. In these instances, the alligators need to be trapped and relocated to other lakes in the area or wildlife refuges. The management action to address this issue is described in Table 5.20.

Table 5.1. Regional sewer system.

Management Action	Assess economic feasibility of regional sewer system.		
Objective	• Eliminate 100% of raw sewage discharge to Lake Washington.		
Performance Measure	• Feasible/unfeasible decision on regional sewer system by 1 March 2009.		
Benefits	• Eliminate onsite wastewater treatment systems. • Eliminate organic, nutrient, and pathogen discharges to Lake Washington from onsite wastewater treatment systems.		
Participant	**Activity**	**Schedule**	**Budget**
Lake Washington Foundation	Contact Washington County Board of Supervisors to request regional sewer line cost estimate.	26 Oct. 2007	No funds requested. Subsumed in Washington County budget.
Washington County Engineer	Estimate cost of regional sewer line around Lake Washington, with connection to Glen Allan wastewater treatment plant.	30 June 2008	
Glen Allan Utility Board of Directors	Evaluate economic feasibility of using MDEQ State Revolving Fund loan (or similar funding vehicle) to pay for installation of line and operation.	31 Dec. 2008	

Table 5.2. Sewage Summit.

Management Action	Sewage Summit.		
Objective	• Increase public awareness of onsite and decentralized wastewater treatment for individual homes, camps, and housing clusters in the Delta.		
Performance Measures	• Participation by more than 100 attendees representing at least three Delta counties. • Follow-up by 15 participants to vendors or county or state agencies for additional information.		
Benefits	• Increase awareness of maintenance requirements for onsite wastewater treatment systems. • Reduce number of existing or failed septic systems.		
Participant	**Activity**	**Schedule**	**Budget**
MDEQ	Host the summit and provide information on regulatory requirements for point source discharges.	22 Feb. 2008	$12,020.00
Mississippi State Department of Health	Provide information on human health regulatory requirements for onsite and decentralized wastewater treatment systems.		
Washington County	Discuss engineering requirements and inspections of wastewater treatment systems.		
Alabama Onsite Wastewater Treatment Board	Discuss various types of septic and decentralized wastewater treatment systems, along with costs, maintenance needs, and installation.		
MDEQ State Revolving Fund, Delta Regional Authority, Washington County, Fannie Mae, Delta Regional Commission	Discuss funding options available to homeowners, communities, and businesses to pay for wastewater treatment systems.		
USEPA Region IV, Gulf Alliance	Provide financial support through Section 319 or similar funds to sponsor the summit.		

Table 5.3. Eliminate direct discharge.

Management Action	Eliminate direct discharge and failing septic systems.		
Objective	• Eliminate 100% of raw sewage discharge to Lake Washington.		
Performance Measures	• Biannual inspections of onsite wastewater treatment systems and straight pipes into lake. • Elimination of 100% of raw sewage discharge into Lake Washington.		
Benefits	• Reduced potential for waterborne disease. • Reduced organic matter loading to the lake. • Reduced nutrient loading to the lake.		
Participant	**Activity**	**Schedule**	**Budget**
Lake Washington Foundation	Contact Mississippi State Department of Health for biannual inspection of failing septic systems and MDEQ for direct discharge inspection.	January 2008	Activities are assumed to be part of the function of MDEQ and Mississippi State Department of Health.
Mississippi State Department of Health	Conduct biannual review of septic systems during late July through September when green grass is evident.	Biannually	
MDEQ	Conduct biannual inspections of sections of Lake Washington shoreline for direct pipes into the lake during late August and September when lake level is low.	Biannually	
Lake Property Owners	Contact Mississippi State Department of Health or MDEQ when failing septic systems or apparent straight pipes are observed on lakeshore property.		

Table 5.4. Repair failing culverts.

Management Action	Repair failing culverts under Washington County roads.	
Objective	• Reduce nutrient load to Lake Washington by 35% by repairing/replacing culverts discharging to the lake under county roads.	
Performance Measure	• Reduction in sediment load by 2,500 tons/year within 5 years of full implementation.	
Benefits	• Significantly reduced sediment and sorbed organic nutrient loads to Lake Washington. • Increased lake clarity. • Reduced loss of lake volume. • Reduced soil loss for increased agricultural production.	
Participant	**Activity**	**Schedule**
Washington County Board of Supervisors	Support through in-kind contribution to matching funds for design and installation of culverts under county roads through the County Engineer's Office.	1. Sign grant contract with MDEQ (Month 0). 2. County Engineer begins surveying and designing (Months 1-12). 3. Meet with community leaders to plan events (Months 1-12). 4. Conduct media outreach (Months 1-12). 5. Meet with cooperating agencies and organizations (Months 1-12). 6. Meet with landowners for site approval and right-of-ways (if necessary) (Months 1-12). 7. Erect project signs (Months 1-12). 8. Water quality testing before site construction (Months 1-5). 9. Document condition of site before repair with pictures and soil loss estimates (Months 1-5). 10. Install at least two showcase sites in first year (Months 1-12). 11. Record conditions after site installation – pictures and soil loss estimates (Months 1-12). 12. Report progress to MDEQ (Month 12). 13. Inform stakeholders of progress and additional plans of operation (Month 12). 14. Proceed with installing additional sites in accordance with County Engineer's standards and specifications (Months 12-36). 15. Before and after pictures and soil loss estimates of each site (Months 12-36). 16. Press releases of implementation progress and water quality improvements (Months 12-36). 17. Water quality testing (Months 12-36). 18. Final report to MDEQ (Month 36).
MDEQ, USEPA Region IV	Support through Section 319 funds for design and installation and for conducting outreach and media events.	
Washington County Soil and Water Conservation District	Administer funds and document change in sediment loading following installation.	**Budget**
Landowners	Consent to install head-cutting BMPs on their land and possible cost-sharing.	
US Department of Agriculture – Natural Resources Conservation Service	Ensure County Engineer's design addresses sediment issues.	<u>County Road Structures</u> 18 sites @ $40,505.89 $729,106.02 23 smaller sites $660,000.00 Total Estimated Cost $1,389,106.02

Table 5.5. Implement in-field sediment BMPs.

Management Action	Implement in-field sediment BMPs.	
Objective	• Reduce sediment load to Lake Washington by 1,500 tons per year by installing dropped-inlet structures, grassed waterways, and filter strips.	
Performance Measure	• Reduction in sediment load to Lake Washington by 1,500 tons per year within 3 years of full implementation.	
Benefits	• Decreased soil erosion and increase agricultural production. • Decreased organic and nutrient loads sorbed to soil particles. • Increased lake clarity. • Reduced loss of lake volume.	
Participant	**Activity**	**Schedule**
US Department of Agriculture – Natural Resources Conservation Service	Provide funding assistance for cost-sharing for dropped inlets, grassed waterways, filter strips, and other BMPs and conservation measures through the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Program (CRP). Provide technical assistance on the installation.	1. Potential sites identified in Figure 5.1. 2. Determine eligible sites for EQIP, CRP, and Wetlands Reserve Program (Month 1). 3. Contract landowners on willingness to participate (Month 5). 4. Apply for funds; arrange cost-sharing (Month 8). 5. Implement BMPs (Month 20). 6. Monitor sediment loads from site (Months 24-60).
Private Landowners	Private landowners and farmers in the watershed voluntarily participating and providing equipment, fuel, and some money to offset cost-share requirements for BMPs implementation.	**Budget** Structural Practices Pipes (100 @ $2,500 each) $250,000.00 Pads (120,800 cubic yards @ $1.10/cu yd) $132,880.00 Non-Structural Practices Establish Vegetation (100 acres @ $160/ac) $16,000.00 Winter Cover Crops (500 ac for 3 yrs @ $17/ac) $25,500.00 Winter Water Impoundments (2,000 ac for 3 yrs @ $2/ac) $12,000.00 Total Estimated Cost $436,380.00
Washington County Soil and Water Conservation District	Administer funds and document change in sediment loading following installation. Provide technical assistance on installation of BMPs.	
US Army Corps of Engineers	Ensure BMPs are not installed in wetlands or waters of the US without appropriate permits.	

Table 5.6. Maintain sediment BMPs.

Management Action	Maintain sediment BMPs.		
Objective	• Maintain structural and non-structural BMPs implemented to control sediment loading.		
Performance Measure	• No increase in sediment loading to Lake Washington above reductions attained through BMP implementation.		
Benefits	• Maintained sediment reductions following implementation of BMPs. • Reduced soil erosion and sustained agricultural practices. • Reduced future expenditures to implement additional BMPs. • Lake Washington sustained for the future.		
Participant	**Activity**	**Schedule**	**Budget**
Landowners	Annual inspection and maintenance of BMPs.	Late winter, before field preparation and planting activities begin.	Individual Landowners
Washington County Soil and Water Conservation District	Provide funding and cost-sharing assistance for BMP maintenance. Provide technical assistance on maintenance of BMPs.	2010+	Based on specific BMP
US Department of Agriculture – Natural Resources Conservation Service	Provide technical assistance on maintenance of BMPs.	2010+	Based on specific BMP

Table 5.7. Repair failing culverts – nutrients.

Management Action	Repair failing culverts – nutrients.		
Objective	• Reduce nutrient load to Lake Washington by 35% by repairing/replacing culverts discharging to the lake under county roads.		
Performance Measure	• Reduction in nutrient loads by 35% within 5 years of full implementation (estimated from sediment TMDL).		
Benefits	• Decreased algal blooms and algal toxins. • Increased water clarity. • Improved dissolved oxygen regime and reduced fish kills.		
Participant	**Activity**	**Schedule**	**Budget**
Washington County Board of Supervisors	Support through in-kind contribution to matching funds for design and installation of culverts under county roads through the County Engineer's Office.	1. Sign grant contract with MDEQ (Month 0). 2. County Engineer begins surveying and designing (Months 1-12). 3. Meet with community leaders to plan events (Months 1-12). 4. Conduct media outreach (Months 1-12). 5. Meet with cooperating agencies and organizations (Months 1-12). 6. Meet with landowners for site approval and right-of-ways (if necessary) (Months 1-12). 7. Erect project signs (Months 1-12). 8. Water quality testing before site construction (Months 1-5). 9. Document condition of site before repair with pictures and soil loss estimates (Months 1-5). 10. Install at least two showcase sites within first year (Months 1-12). 11. Record conditions after site installation – pictures and soil-loss estimates (Months 1-12). 12. Report progress to MDEQ (Month 12). 13. Inform stakeholders of progress and additional plans of operation (Month 12). 14. Proceed with installing additional sites in accordance with County Engineer's standards and specifications (Months 12-36). 15. Before and after pictures and soil loss estimates of each site (Months 12-36). 16. Press releases of implementation progress and water quality improvements (Months 12-36). 17. Water quality testing (Months 12-36). 18. Final report to MDEQ (Month 36).	Included with sediment control
MDEQ, USEPA Region IV	Support through Section 319 funds for design and installation and conducting outreach and media events.		
Washington County Soil and Water Conservation District	Administer funds and document change in nutrient loading following installation.		
Landowners	Consent to install head cutting BMPs on their land and possible cost-sharing.		

Table 5.8. Implement in-field nutrient BMPs.

Management Action	Implement in-field nutrient BMPs.		
Objective	• Reduce nutrient load to Lake Washington by 35% by installing dropped-inlet structures, grassed waterways, and filter strips.		
Performance Measure	• Nutrient load reduction of 35% to Lake Washington 3 years after full implementation (based on sediment TMDL).		
Benefits	• Decreased algal blooms and algal toxins. • Increased water clarity. • Improved dissolved oxygen regime and reduced fish kills.		
Participant	**Activity**	**Schedule**	**Budget**
US Department of Agriculture – National Resources Conservation Service	Provide funding assistance for cost-sharing for dropped inlets, grassed waterways, filter strips, and other BMPs and conservation measures through the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Program (CRP). Provide technical assistance on installation of BMPs.	1. Potential sites identified in Figure 5.1. 2. Determine eligible sites for EQIP, CRP, and the Wetlands Reserve Program (Month 1). 3. Contract landowners on willingness to participate (Month 5). 4. Apply for funds; arrange cost-sharing (Month 8). 5. Implement BMPs (Month 20). 6. Monitor sediment loads from site (Months 24-60).	Included in sediment control BMPs (Table 5.5).
Private Landowners	Private landowners and farmers in the watershed voluntarily participating and providing equipment, fuel, and some money to offset cost-share requirements for BMP implementation.		
Washington County Soil and Water Conservation District	Provide technical assistance on the installation of BMPs.		
US Army Corps of Engineers	Ensure BMPs are not installed in wetlands or waters of the US without appropriate permits.		

Table 5.9. Game fish management.

Management Action	Game fish management.	
Objectives	1. Increase largemouth bass catch per unit effort (CPUE) from 10 per hour to 20 per hour by 2012. 2. Increase crappie CPUE from 6 per hour to 10 per hour by 2012. 3. Decrease shad CPUE from 84 per hour to < 50 per hour by 2010. 4. Decrease catfish CPUE from 93 per hour to < 15 per hour by 2012.	
Performance Measures	• Increased largemouth bass CPUE from 10 per hour to 20 per hour by 2012. • Increased crappie CPUE from 6 per hour to 10 per hour by 2012. • Decreased shad CPUE from 84 per hour to < 50 per hour by 2010. • Decreased catfish CPUE from 93 per hour to < 15 per hour by 2012. • Ten percent decrease in extent of cutgrass by 2012. • One additional game warden by 2010.	
Benefits	• Increased game fish harvest and associated economic revenues in Lake Washington. • Reduced catfish and shad due to increased recreational fishing visits.	
Participant	**Activity**	**Schedule**
Mississippi Department of Wildlife, Fisheries, and Parks	1. Annual stocking of 200,000+ largemouth bass fingerlings. 2. Annual stocking of crappie. 3. Stocking of 100,000 hybrid striped bass fingerlings in odd number years as predators to control shad. 4. Set size and creel limits on bass and crappie to reduce fishing pressure and encourage viability of game fish stocks. 5. Conduct catfish rodeos to encourage catching catfish and reduce stocks. 6. Increase the presence of game wardens on Lake Washington to prevent and reduce illegal recreational and commercial harvest of bass and crappie. 7. Control giant cutgrass in Washington Bayou.	1. Annual winter/spring stocking of bass and crappie. 2. Odd number year stocking of hybrid striped bass. 3. Increase number of game wardens beginning in 2009. 4. Initiate cutgrass controls in 2009. **Budget** Fish Population Monitoring $4,600 field 6 @ $590/day reports 4 @ $266/day Harvest Survey $10,730 field 28 @ $288/day reports 10 @ $266/day Regulatory Enforcement $20,580 2-Officer Patrol 35 @ $538/day

Table 5.10. Conduct catfishing clinic and catfish rodeo.

Management Action	Conduct catfishing clinic and catfish rodeo.		
Objectives	1. Teach individuals how to catch, clean, and prepare catfish, and the benefits of fish in the diet. 2. Increase the interest and participation in catfishing and reduce the catfish population in the lake. 3. Stimulate increased interest through financial rewards for catching tagged catfish.		
Performance Measures	• Teach at least 10 youth and 5 adults how to fish for catfish in each session. • Increase the distribution of payout by 10% over the previous year. • Increase catfish harvest by 10% per year through 2012.		
Benefits	• Introduction of fishers to catfishing and increased fishing pressure on catfish. • Increased economic revenues from Lake Washington fisheries. • Reduced catfish and shad due to increased recreational fishing visits.		
Participant	**Activity**	**Schedule**	**Budget**
Mississippi Department of Wildlife, Fisheries, and Parks	1. Conduct a clinic on how to fish for catfish, clean the fish, and prepare them. 2. Purchase tags, catch the fish, tag them, and release them.	1. One clinic in the spring and another during summer. 2. March of each year.	Tagging 2 @ $590/day $1,180 Tags 200 @ $0.80/tag $160 Children's Rodeo 5 @ $266/person $1,330
Roy's Store	• Sponsor the catfish rodeo, advertise, design and print brochures, and distribute rewards for tagged fish.	• Year-round.	Total: $2,670

Table 5.11. Commercial harvest of catfish.

Management Action	Commercial harvest of catfish.		
Objectives	1. Promote commercial catfish harvest on Lake Washington. 2. Increase fishing pressure on catfish. 3. Generate additional revenue within Washington County.		
Performance Measures	• Slat box license fees reduced. • Increased number of slat box licenses purchased.		
Benefits	• Reduced catfish population; game fish populations stimulated. • Increased economic revenues from Lake Washington fisheries.		
Participant	**Activity**	**Schedule**	**Budget**
Mississippi Department of Wildlife, Fisheries, and Parks	1. Propose changes to Mississippi laws to make it less expensive for individuals to fish slat boxes for catfish on Lake Washington.	1. January 2008.	Subsumed in MDWFP budget.
	2. Change license fees for slat box fishing for catfish on Lake Washington.	2. July 2008.	

Table 5.12. Public fishing pier.

Management Action	Construct a public and handicapped fishing pier on Lake Washington.		
Objectives	1. Increase fishing opportunities and interest in Lake Washington for every member of the community. 2. Provide a place where handicapped individuals can participate in fishing. 3. Stimulate increased fishing pressure on catfish.		
Performance Measure	• Public, handicapped fishing pier constructed.		
Benefits	• Opportunities are created for handicapped individuals to enjoy fishing. • Increased economic revenues from Lake Washington fisheries. • Reduced catfish and shad due to increased recreational fishing visits.		
Participant	**Activity**	**Schedule**	**Budget**
Mississippi Department of Wildlife, Fisheries, and Parks	1. Provide application forms to Washington County Board of Supervisors requesting a public, handicapped fishing pier.	1. 28 August 2007.	$10,000
	2. Secure funds to construct the pier.	2. January 2008.	
	3. Construct the fishing pier.	3. June/July 2008.	
Roy's Store	Contact the Washington County Board of Supervisors to determine if there are county properties around Lake Washington on which a pier could be constructed.	Contact made on 20 August 2007. County does own property near Glen Allan.	

Table 5.13. Cormorant harassment program.

Management Action	Cormorant harassment program.		
Objective	• Reduce the population of cormorants roosting on and around Lake Washington to approximately 200 cormorants by 2010, and maintain the population.		
Performance Measures	• Cormorant population reduced to between 200-300 birds on Lake Washington. • Cormorant population does not increase above historic numbers on Lake Jackson.		
Benefits	• Lake Washington Bald Cypress forests allowed to recover and flourish. • Excessive predator pressure removed from the fishery. • Inputs to Lake Washington of nutrients and oxygen-demanding organic material from cormorant waste that can lead to reduced fish kills.		
Participant	**Activity**	**Schedule**	**Budget**
Local Stakeholders	1. Local volunteers implement the harassment program. 2. Approximately 10 volunteers participated in the boat-based portion of the program in 2006. 3. Twenty lakeshore residents have pyrotechnic launchers.	1. Initiate the program in October or when cormorants begin migration. 2. Conclude in March after spring cormorant migration.	
Lake Washington Foundation	• Provide funding for the harassment program.	• Annually	$12,000 per year for pyrotechnic rounds.
US Department of Agriculture – Wildlife Services	1. Provide training of volunteers in the use of pyrotechnics and cormorant behavior. 2. Provide support for the harassment program.	• On an as-needed basis	Approximately $300-worth of pyrotechnic rounds annually.

Table 5.14. Recruit and train volunteers for cormorant harassment.

Management Action	Recruit and train volunteers for cormorant harassment.		
Objective	• Reduce the local cormorant population to 200 birds.		
Performance Measures	• Recruit at least two additional volunteers per year for Lake Washington. • Local cormorant population between 200 and 300 birds.		
Benefits	• Restoration and recovery of the cypress forest. • Reduced nutrient and organic loading to Lake Washington. • Restoration of natural carrying capacity of Lake Washington for cormorants.		
Participant	**Activity**	**Schedule**	**Budget**
US Department of Agriculture – Wildlife Services	1. Train volunteers on pyrotechnics and other procedures for harassing cormorants, such as air cannons. 2. Offer training for both Lake Washington and Lake Jackson residents and property owners.	October 2007; September in successive years.	TBD
Lake Washington Foundation	1. Recruit volunteers for cormorant harassment, both on water in boats and on land. 2. Develop and distribute schedule for weekly harassment activities. 3. Monitor progress and rotate teams as number of volunteers increases.	August through December each year.	

Table 5.15. Cormorant harvesting.

Management Action	Cormorant harvesting.		
Objective	• Reduce the local cormorant population to 200 birds.		
Performance Measure	• Local cormorant population between 200 and 300 birds.		
Benefits	• Restoration and recovery of the cypress forest. • Reduced nutrient and organic loading to Lake Washington. • Restoration of natural carrying capacity of Lake Washington for cormorants.		
Participant	**Activity**	**Schedule**	**Budget**
US Department of Agriculture – Wildlife Services; US Fish and Wildlife Service	1. Authorization to harvest cormorants 2. Permits for harvesting cormorants 3. Hunter training and safety instruction for harvesting cormorants	1. Harvesting authorization – November (following waterfowl survey). 2. Permits for harvesting – December. 3. Hunter training – December.	TBD.
Local Hunters	• Local residents can hunt cormorants in the Lake Washington watershed after completing an (agency) hunter safety course.	• December through March.	

Table 5.16. Plant alternate roosts.

Management Action	Plant/Construct alternate cormorant roosting sites.		
Objective	• Distribute cormorant population throughout the watershed to eliminate concentrated flocks in given areas.		
Performance Measures	• Two landowners increase trees on property by 2010. • Three Lake Washington property owners increase cypress trees on lakeshore line by 2010.		
Benefits	• Restoration and recovery of the cypress forest. • Reduced nutrient and organic loading to Lake Washington. • Restoration of the natural carrying capacity of Lake Washington for cormorants.		
Participant	**Activity**	**Schedule**	**Budget**
US Department of Agriculture – National Resources Conservation Service; US Fish and Wildlife Service	1. Provide funding for wildlife enhancement – plant tupelo, gum, cypress, oak, pecan, persimmon, and sycamore trees. 2. Provide funding to evaluate constructed roosting sites for fertilizer and compost collection.	1. October 2009. 2. October 2010.	TBD
Mississippi Forestry Commission	• Provide funding and planting guidance for increasing forest around Lake Washington and throughout watershed. • Promote "Second Crop" Program in Lake Washington watershed.	• July 2009.	
Lake Washington Foundation	• Recruit Lake Washington property owners to plant additional cypress trees around the lake.	• Initiate in March 2009 – ongoing.	
Lake Washington Landowners	• Participate in program to increase trees throughout the watershed, particularly as a second crop for timber harvest rotation and wildlife habitat creation to lease for hunting, in addition to alternate cormorant roosting sites during migration.	• January 2010 – ongoing.	

Table 5.17. Lake level management.

Management Action	Repair outlet conduits to maintain lake level.		
Objective	• Repair the outlet conduits to increase and stabilize lake levels on Lake Washington.		
Performance Measures	• Outlet structure repaired by October 2009. • Water level stabilized by October 2010.		
Benefits	• Increased lake volume and assimilative capacity for sediment and nutrient loading. • Decreased shoreline erosion from water level fluctuation.		
Participant	**Activity**	**Schedule**	**Budget**
Washington County	1. Assess outlet conduits on Lake Washington. 2. Repair outlet conduits with capability of increasing lake level by no more than 2 ft.	1. July 2008. 2. July 2009.	TBD
Lake Washington Foundation	• Request Washington County evaluate and repair outlet structure on Lake Washington.	• January 2008.	

Table 5.18. Establish minimum lake level.

Management Action	Establish minimum lake level.		
Objective	• Provide for proper regulation of out-of-lake water usage.		
Performance Measure	• Minimum lake level set by 2011.		
Benefits	• Protection of assimilative capacity for sediment and nutrient loading. • Allows reasonable use of Lake Washington water for irrigation.		
Participant	**Activity**	**Schedule**	**Budget**
MDEQ	1. Monitor Lake Washington water levels. 2. Establish minimum water level based on lake level and water quality monitoring. 3. Monitor, permit, and regulate water withdrawals from Lake Washington.	1. MDEQ Office of Land and Water Resources currently monitoring lake levels. 2. 2011 3. 2012	TBD

Table 5.19. Eliminate fish processing waste.

Management Action	Eliminate fish processing waste.		
Objective	• Eliminate 100% of fish processing waste disposal into Lake Washington.		
Performance Measures	• Newsletter article – April 2008. • Reduction by 95% of recreational fish processing waste disposal in Lake Washington. • Elimination of commercial fish processing waste disposal in Lake Washington.		
Benefits	• Reduced nuisance alligator population. • Reduced organic loading to Lake Washington.		
Participant	**Activity**	**Schedule**	**Budget**
Mississippi Department of Wildlife, Fisheries, and Parks	1. Notify commercial fishers it is illegal to dispose of fish processing waste in Lake Washington. 2. Game wardens periodically check commercial fishers. 3. Game wardens notify recreational fishing camps that it is illegal to dispose of fish processing waste in lake. 4. Game wardens periodically check recreational fishing camps.	1. January 2008. 2. April 2008, periodically thereafter. 3. April 2008. 4. June 2008, periodically thereafter.	TBD
Lake Washington Foundation	• Newsletter article on illegality of disposing of fish processing waste in Lake Washington and contribution of waste to nuisance alligator problems.	• January 2008.	

Table 5.20. Alligator management plan.

Management Action	Lake Washington alligator management plan.		
Objective	• Reduce alligator threat to Lake Washington residents and users to one alligator threat per season.		
Performance Measure	• One alligator complaint per season.		
Benefits	• Reduced nuisance alligator population.		
Participant	**Activity**	**Schedule**	**Budget**
Mississippi Department of Wildlife, Fisheries, and Parks – Alligator Coordinator	1. Provide technical support of the process of developing the Lake Washington alligator management plan. 2. Track alligator complaints.	1. 2008 2. 2009+	Local contributions of time and expense; state costs associated with trapping/ removal efforts.
Lake Washington Foundation	Prepare the alligator management plan, involving the following activities: 1. Form a planning committee, 2. Develop a draft plan, 3. Revise of the draft plan based on review comments, 4. Finalize the plan based on review comments, 5. Distribute and implement the plan, 6. Educate public on behavior of alligators and human behavior around alligators.	2008	

6.0 EDUCATION AND OUTREACH ACTIVITIES

Education and outreach activities are an important part of achieving the vision for the Lake Washington watershed. Education and outreach assist with achievement of the implementation plan goals by increasing public awareness and interest. The overall objective of community education in the Lake Washington watershed is to increase awareness of water quality issues and encourage behaviors that promote sustained, long term restoration, stewardship, and protection of aquatic resources in the watershed. Specific education and outreach activities planned for the Lake Washington watershed are described below. Specific objectives of education efforts in the watershed include the following:

- Increase public awareness of agricultural/urban nonpoint source pollution problems and solutions and encourage behaviors that will reduce pollution and restore Lake Washington;
- Increase public awareness of how BMPs can be used to conserve water and reduce negative water quality and habitat effects and encourage the appropriate installation/use of BMPs;
- Increase public awareness of the long-term environmental and economic advantages of protecting and improving water quality and habitat in the Lake Washington watershed;
- Increase public awareness of issues surrounding skewed fish population in Lake Washington and encourage behaviors that will return the fish population to a balanced level;
- Increase awareness of cormorant issues as they relate to the skewed fish population, increased nutrient levels in the lake and damage to shoreline trees and encourage behaviors that will reduce the cormorant population; and
- Increase public awareness of issues concerning noxious weeds, nuisance alligators and inappropriate harvest of cypress trees.

6.1 Signage

Signage in the proper location and with the proper message should provide long-term educational opportunities within the watershed. Signs should be erected for both the project in

general and for specific aspects of the project. Plans for adding signage in the Lake Washington watershed are summarized in Table 6.1.

Table 6.1. Signs as education and outreach tools in Lake Washington watershed.

Management Action	Signage		
Objective	Increase public awareness of Lake Washington issues and restoration activities occurring in watershed.		
Performance Measures	Installation of specified number of signs on schedule, Mississippi Department of Transportation annual traffic statistics for Highway 1 can be used to document the number of vehicles that pass within a visual of the highway signs. BMP signs will be seen by those who attend field days and tours. These people will be documented after the tours are held.		
Benefits	Increase awareness of and ability to participate in and support watershed restoration activities.		
Participant	**Activity**	**Schedule**	**Budget**
MDEQ	Highway Signs - Two general project signs should be erected at the watershed boundary line. A general message will be conveyed along with the logos of all partners involved in the project.	2007-2008	$2,200.00
MDWFP	Aquatic Weed Signs – Signs should be erected around the lake, educating fishermen about noxious aquatic weeds and informing fishermen about prevention of further spreading of the weeds in Lake Washington and transfer to other lakes.	2007-2008	$800.00
MSWCC	BMP Signs – Signs should be erected at select BMP sites. These signs can be used during field days and tours.	2007-2008	$2,400.00
Total			**$5,400.00**

6.2 Direct Mail

Direct mail pieces can be used to further educate the community on septic system issues. Information about approved septic systems should be provided to all home owners around the lake. Specifics are summarized in Table 6.2.

Table 6.2. Education and outreach via direct mail.

Management Action	Direct mail		
Objective	Increase public awareness of septic system issues and regulations in the watershed.		
Performance Measures	A list of all recipients of direct mail pieces will be provided to MDEQ.		
Benefits	Increase awareness of and ability to participate in remediation of septic system issues.		
Participant	**Activity**	**Schedule**	**Budget**
MDEQ	Develop septic system mail-out	2007-2008	$2,212.00
MSDH	Develop septic system mail-out		

6.3 Mississippi Outdoors Productions

MDWFP publishes Mississippi Outdoors Magazine, produces Mississippi Outdoors TV show, and hosts a weekly radio show. These media outlets reach nearly all hunters, fishermen, and outdoorsmen in the State of Mississippi. These opportunities shall be utilized to educate the public on the Lake Washington WIP and specific aspects of the project. Specific plans for utilizing this outlet for education and outreach are summarized in Table 6.3.

Table 6.3. Education and outreach through Mississippi Outdoors Productions

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Management Action	Mississippi Outdoors Productions		
Objective	Increase public awareness of Lake Washington issues and restoration activities occurring in watershed.		
Performance Measures	Circulation of the Mississippi Outdoors Magazine will be documented and reported to MDEQ. Number of television viewers/radio listeners will be documented to the extent possible.		
Benefits	Increase awareness of and ability to participate in and support watershed restoration activities.		
Participant	**Activity**	**Schedule**	**Budget**
MDWFP	Magazine – At least one article will be written about the Lake Washington WIP and published in the Mississippi Outdoors Magazine.	2007-2009	$1,000.00
	TV Show – At least one feature will be filmed on Lake Washington highlighting the project and run on the Mississippi Outdoors TV Show.		$2,400.00
	Radio – At least one interview per year will be made on Mississippi Outdoors Radio pertaining to the project.		$1,500.00 (per interview)
Total			**$4,900.00**

6.4 Website Linkages

As many agencies and organizations are involved in this WIP, information about this project will be listed on many different websites. Some websites will take a holistic approach to describing the WIP and all associated information, while others will only have information on specific items. Information about implementation of this activity is summarized in Table 6.4.

Table 6.4. Education and outreach on the web.

Management Action	Website links		
Objective	Increase public awareness of Lake Washington issues and restoration activities occurring in watershed.		
Performance Measure	Websites will monitor traffic. Traffic will be reported to MDEQ.		
Benefit	Increase awareness of and ability to participate in and support watershed restoration activities.		
Participant	**Activity**	**Schedule**	**Budget**
MDWFP, MWF, NRCS, MDEQ, MSWCC,TNC	Develop Lake Washington website and/or link to MDEQ website	2008	Subsumed in operations budgets

6.5 Press Releases, Public Service Announcements, and Printed Materials

Numerous press releases, public service announcements, and printed materials will be made throughout the WIP implementation. Each stage of the project and each public event will be advertised by targeted press releases and other printed materials. Press releases will be developed by many of the Watershed Implementation Team partners (Table 6.5).

Table 6.5 Use of press releases, public service announcements and articles for Lake Washington education and outreach.

Management Action	Press releases, PSAs and printed materials		
Objective	Increase public awareness of septic system issues and regulations in the watershed.		
Performance Measures	All press releases will be documented by the circulation of the publication it runs in. Printed materials will be distributed to a target audience, depending on the purpose.		
Benefits	Increase awareness of and ability to participate in remediation of septic system issues.		
Participant	**Activity**	**Schedule**	**Budget**
MDEQ, MSDH, MDWFP, MWF, NRCS, MSWCC, TNC, LW	Create and distribute nine press releases	2007-2009	$2,250.00
	Create and distribute three sets printed material	2007-2009	$1,500.00
	Create and publish five feature articles	2007-2009	$2,500.00
Total			**$6,250.00**

6.6 Community Events, Conservation Fairs, Tours, and Field Days

Several public activities will be scheduled as a part of the WIP. These activities include small community events (e.g., storm drain marking events, local Adopt-A-Stream workshops, conservation fair, field days). Specific activities planned are summarized in Table 6.6.

Table 6.6. Education and outreach through public activities.

Management Action	Community events, conservation fairs, tours, field days		
Objective	Increase public awareness of Lake Washington issues and restoration activities occurring in watershed.		
Performance Measure	Attendance at all WIP-associated activities will be documented and reported to MDEQ.		
Benefits	Increase awareness of, ability to participate in, and support of watershed restoration activities.		
Participant	**Activity**	**Schedule**	**Budget**
MDEQ, MWF	Small community event - This will be a local event, targeting residents of Lake Washington watershed, educating and encouraging proactive participation in specific stewardship activities.		$3.000.00
MDEQ, MSWCC, NRCS, MWF, TNC, MDWFP	Conservation Fair – This will be a large event with a fishing rodeo, BBQ cookout, field tour for farmers, Q & A session, press conference, and other events.	2008	$3,500.00
NRCS, MDEQ, MSWCC, MWF, TNC, MDWFP	Field Day – At least one additional field day will be held other than the one during the Conservation Fair. The tour will highlight the BMPs that were installed to improve the lake.	2008	$1,000.00
Total			**$7,500.00**

6.7 Sewage Summit

MDEQ is in the process of coordinating a sewage summit for Washington and Issaquena Counties and surrounding areas for Spring 2008. Details of this activity are summarized in Table 5.2.

7.0 EVALUATION

7.1 Monitoring

An important element of watershed management is monitoring of appropriate indicators to determine if the activities implemented have had the desired effect. USGS has committed to developing and implementing a routine water quality monitoring program on Lake Washington. Data from this program will be useful for identifying changes in lake water quality resulting from management activities. Table 7.1 is a summary of the monitoring methods and indicators planned related to the management actions (described in Chapter 5.0) and the education and outreach activities (described in Chapter 6.0). These planned monitoring activities are described in detail below.

7.2 Assessment of Progress

Implementation milestones and schedules have been developed for the management actions and education and outreach activities described in this plan. This information is summarized in Table 7.2 for use in tracking and evaluating implementation of this plan. For implementation to be considered successful, all activity milestones must be met on time.

The Team will meet quarterly to review progress on achieving the milestones and make needed adjustments to the schedule. Each Team member serves as the chair for one of the major management categories, such as sewerage, sediment and nutrient loading, etc. There is a subcommittee associated with each of these categories to ensure that the management actions are implemented.

7.2.1 Evaluation of Management Actions and Education/Outreach Activities

Specific management action goals and/or expectations are described in Chapter 5.0. Specific goals and/or expectations for education and outreach activities are described in Chapter 6.0. If the activity goals were not met, the causes behind the failure to meet the goals will be determined. In addition, the plan activities will be evaluated with regard to information and knowledge about the watershed and its waterbodies that has been gained since the existing

plan was developed, as well as any relevant physical changes in the watershed or changes in policy affecting the watershed. Implementation of the activities will be reevaluated in light of all of this information on a quarterly basis, as discussed above.

7.3 Evaluation of Plan

Specific management action schedules toward achieving the vision for the Lake Washington watershed are described in Chapters 5.0 and 6.0 and summarized in Table 7.2. If the schedules are not being met, the causes behind the failure to meet the goals will be determined, and actions will be taken.

Table 7.1 Monitoring Activities.

Management Activity	Performance Measure	Monitoring Activity	Responsibility	Schedule
Regional sewer system	Decision on regional sewer system	Track issue	Sewage discharge elimination committee	Through March 1, 2009
Sewage Summit	1. Participation 2. Participant follow-up information request	1. Participant sign-in 2. Track sewage – related information requests to agencies and vendors	1. Sewage Summit committee 2. Sewage discharge elimination committee, agencies and vendors	1. Feb. 2008 2. Feb. – Dec. 2008
Eliminate discharge from failed septic systems	Elimination of raw sewage discharge from lakeshore properties	Biannual inspection	MSDH	July and September of each year, starting in 2008
Repair failing culverts	Reduce sediment load by 2,500 ton/year Reduce nutrient loads by 35%	1. Pre-implementation sediment load estimation at each culvert site 2. Post-implementation monitoring	Washington County Soil and Water Conservation District	1. Month 1 2. Years 2 through 5
Implement in-field sediment BMPs	Reduce sediment load by 2,500 ton/year Reduce nutrient loads by 35%	1. Pre-implementation sediment load estimation at each site 2. Post-implementation monitoring	Washington County Soil and Water Conservation District	1. Year 1 2. Years 3 through 5
Maintain sediment BMPs	No increase in sediment or nutrient loads after implementation of BMPs	Post-implementation monitoring	Washington County Soil and Water Conservation District	1. Biannual inspection
Game fish management	1. CPUE for largemouth bass, crappie, shad, and catfish 2. Extent of cutgrass 3. Game warden numbers	1. Electrofishing, creel surveys, gill netting 2. Field survey 3. Track warden numbers	1. MDWFP 2. MDWFP 3. Fisheries management committee	1. Annually 2. Annually 3. Annually, 2008 – 2010

Table 7.1. Continued.

Management Activity	Performance Measure	Monitoring Activity	Responsibility	Schedule
Catfishing clinic and catfish rodeo	1. Attendance of at least 10 youth and 5 adults at catfishing clinics 2. Increase catfish rodeo payout 10% annually 3. Increase catfish harvest 10% annually	1. Sign-in at catfishing clinics 2. Track payouts for catfish rodeo 3. Creel surveys	1. MDWFP 2. Roy's Store 3. MDWFP	1. At each clinic 2. Continuously through the year 3. Annually
Commercial harvest of catfish	1. Slat box license fees 2. Number of slat box licenses purchased	1. Track slat box license fee amendment 2. Track purchase of slat box licenses	1. Fishery management committee 2. MDWFP	1. Through July 2008 2. Annually
Construct public fishing pier on Lake Washington	Completion of fishing pier	Track construction process	Fishery management committee	Through July 2008
Cormorant harassment	1. Lake Washington cormorant population of 200-300 2. No increase in Lake Jackson cormorant population	1. Aerial photographic surveys of waterfowl numbers 2. Same as for 1.	USDA Wildlife Services	Biweekly October through March every year
Recruit and train volunteers for harassment program	1. At least two additional volunteers annually 2. Lake Washington cormorant population between 200-300	1. Track volunteers roster 2. Aerial photographic surveys of waterfowl numbers	1. Cypress forest protection committee 2. USDA Wildlife Services	1. Annually starting in 2008 2. Biweekly October through March
Cormorant harvesting	Watershed cormorant population of 400	Aerial photographic surveys of waterfowl numbers	USDA Wildlife Services	Biweekly October through March
Alternate cormorant roosting sites	1. Two landowners increase trees on their property 2. Three lakeshore property owners increase cypress on their property	Track recruitment of landowners for tree planting	Cypress forest protection committee	2008 through 2010

Table 7.1. Continued.

Management Activity	Performance Measure	Monitoring Activity	Responsibility	Schedule
Lake level management	1. Outlet structure repaired 2. Water level stabilized	1. Track repair project 2. Monitor water level	1. Lake level management committee 2. Committee and/or local volunteers	1. July 2008 through July 2009 2. July 2009 through December 2010
Eliminate fish processing waste	1. Newsletter article 2. 95% reduction recreational fish processing waste disposal into Lake Washington 3. Elimination of disposal of commercial fish processing waste to Lake	1. Track article publication 2. Routine check of recreational fishing camps 3. Routine check of commercial fishing operations	1. Alligator control committee 2. MDWFP game wardens 3. MDWFP game wardens	1. Through April 2008 2. Quarterly starting in April 2008 3. Quarterly starting in June 2008
Alligator management plan	1. Completion of management plan 2. Implementation of management plan 3. One alligator complaint per season	1. Track development of management plan 2. Track implementation of management plan 3. Track alligator complaints	1. Alligator control committee 2. Alligator control committee 3. MDWFP	1. Through 2008 2. 2008 through 2009 3. Annually starting in 2009

Table 7.2 Summary of management action schedules and milestones.

Management Action	Milestones	Schedule
Regional sewer system	1. Contact Washington County Board of Supervisors to request cost estimate 2. Cost estimate completed 3. Complete evaluation of economic feasibility	1. 26 October 2007 2. 30 June 2008 3. 31 December 2008
Sewage Summit	1. Sewage Summit	1. 22 February 2008
Eliminate direct discharge to Lake Washington	1. Request biannual septic tank inspection from MSDH	1. January 2008
Repair failing culverts	1. Sign grant contract with MDEQ 2. County Engineer begins surveying and designing 3. Meet with community leaders to plan events 4. Conduct media outreach 5. Meet with cooperating agencies and organizations 6. Meet with landowners for site approval and right-of-ways (if necessary) 7. Erect project signs 8. Water quality testing before site construction 9. Document condition of site before repair with pictures and soil loss estimates 10. Install at least two showcase sites in first year 11. Record conditions after site installation: pictures and soil loss estimates 12. Report progress to MDEQ 13. Inform stakeholders of progress and additional plans of operation 14. Proceed with installing additional sites in accordance with county engineers standards and specifications (Months 12-36) 15. Before and after pictures and soil loss estimates of each site (Months 12-36) 16. Press releases of implementation progress and water quality improvements (Months 12-36) 17. Water quality testing (Months 12-36) 18. Final Report to MDEQ (Month 36)	1. 2008 2. Year 1 3. Year 1 4. Year 1 5. Year 1 6. Year 1 7. Year 1 8. Month 5 9. Month 5 10. Year 1 11. Year 1 12. Month 12 13. Month 12 14. Years 2 – 3 15. Years 2 – 3 16. Years 2 – 3 17. Years 2 – 3 18. Month 36
Implement in-field sediment BMPs	1. Determine eligible sites for EQIP, Wetlands Reserve Program, and Conservation Reserve Program 2. Contract landowners on willingness to participate 3. Apply for funds; arrange cost-sharing 4. Implement best management practices 5. Monitor sediment loads from site	1. Month 1 2. Month 5 3. Month 8 4. Month 20 5. Months 24 – 60
Maintain sediment BMPs	1. Funding for maintenance 2. Annual maintenance	1. 2010 2. 2011+

Table 7.2. Continued.

Management Action	Milestones	Schedule
Game fish management	1. Stocking of 200,000+ largemouth bass fingerlings 2. Stocking of crappie 3. Stocking of 100,000 hybrid striped bass fingerlings 4. Set size and creel limits on bass and crappie 5. Conduct catfish rodeos 6. Increase the presence of game wardens on Lake Washington 7. Initiate cutgrass controls in Washington Bayou	1. Winter/spring 2008 through 2012 2. Winter/spring 2008 through 2012 3. Winter/spring 2009, 2011 4. Annually 2008+ 5. Annually 2007 through 2012 6. Beginning in 2009 7. 2009
Conduct catfishing clinic and catfish rodeo	1. Conduct catfishing clinic 2. Tag catfish for rodeo	1. Spring and summer 2008 2. March 2008 through 2012
Commercial harvest of catfish	1. Propose changes to Mississippi law to reduce cost of fishing with slat boxes 2. Change catfish slat box license fee on Lake Washington	1. January 2008 2. July 2008
Public fishing pier	1. Apply to Washington County Board of Supervisors 2. Secure funds for pier construction 3. Complete construction of pier	1. 28 August 2007 2. January 2008 3. July 2008
Cormorant harassment	1. Volunteer training and harassment	1. October – March 2006+
Recruit and train volunteers for cormorant harassment	1. Recruit volunteers at Foundation meetings 2. Train volunteers	1. At each meeting 2. October 2007, September 2008 through 2012
Cormorant harvesting	1. Authorization to harvest cormorants 2. Cormorant harvest permits 3. Completion of hunter safety course	1. November 2007 – 2012 2. December 2007 – 2012 3. December 2007 – 2012
Provide alternate roosts	1. Procure funding 2. Recruit landowners to plant trees 3. Plant trees	1. July, October 2009 2. March 2009 – December 2012 3. March 2009 – December 2012
Lake Washington level management	1. Request Washington County evaluate and repair Lake Washington outlet structure 2. Assess Lake Washington outlet conduits 3. Repair Lake Washington outlet conduits	1. January 2008 2. July 2008 3. July 2009
Establish minimum lake level for Lake Washington	1. Monitor Lake Washington water levels 2. Establish minimum water level 3. Water withdrawals regulation program in place	1. Through 2010 2. 2011 3. 2012
Eliminate fish processing waste in Lake Washington	1. Notify commercial fishing operations of laws against waste disposal in lake 2. Article in Foundation newsletter about laws against waste disposal in lake 3. Notify recreational fishing camps about laws against waste disposal in lake 4. Game wardens check on commercial operations 5. Game wardens check on recreational fishing camps	1. January 2008 2. January 2008 3. April 2008 4. April 2008 and quarterly thereafter 5. June 2008 and quarterly thereafter

Table 7.2. Continued.

Management Action	Milestones	Schedule
Alligator management plan	1. Form planning committee 2. Submit draft plan for review 3. Finalize plan 4. Distribute plan 5. Public education 6. Initiate alligator complaint process	1. 2008 2. 2008 3. 2008 4. 2008 5. 2008+ 6. 2008
Signage	1. Erect two general project signs 2. Erect aquatic weed signs 3. Erect BMP signs	1. 2008 2. 2008 3. 2008
Direct mail	1. Develop mail-out 2. Mail-out	1. 2008 2. 2008
Mississippi Outdoors productions	1. Article in Mississippi Outdoors magazine 2. Feature on Mississippi Outdoors TV show 3. Interviews on Mississippi Outdoors radio show	1. 2009 2. 2009 3. 2009
Web-based education and outreach	1. Agency partners link to Lake Washington website	1. 2008
Printed materials	1. Create and distribute nine press releases 2. Create and distribute three sets printed material 3. Create and publish five feature articles	1. 2009 2. 2009 3. 2009
Public activities	1. Small community event 2. Conservation Fair 3. Field Day	1. 2008 2. 2008 3. 2008

8.0 PLAN REVISION

After evaluation, the Team will prepare a revised WIP, incorporating the changes requested by the reviewers and reconciling any conflicting comments or requests for change.

If the evaluation criteria are all being met for Lake Washington, the WIP will be revised to address different restoration issues, and to continue activities that protect the water quality of the lake. If the evaluation criteria are not being met, the approach for restoring Lake Washington watershed quality will be revised based on knowledge that has been gained since 2007. The draft of the revised WIP will be completed one month after the evaluation has been completed.

The draft WIP will be submitted to the Team and all others who submitted comments. Within two weeks of receiving the draft WIP, the Team will notify their stakeholders of the availability of the revised WIP for stakeholder review. One month will be allowed for review of the draft. Comments will be due at the end of this review period.

Within a month after the comments on the draft WIP are received, the Team will prepare a final updated WIP. The updated WIP will be submitted to the Team for review and approval. After the updated WIP has been approved, the Team will notify their stakeholders of the completion and availability of the updated WIP for use as a guide to watershed restoration and protection activities.

The plan will be reviewed and revised following the MDEQ Rotating Basin schedule for the Yazoo River Basin. This will permit the Team to incorporate monitoring information and assessment reports prepared by MDEQ. This approach also is consistent with adaptive management and the process used by the Team for managing Lake Washington.

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