KIAMICHI RIVER BASIN WATER RESOURCES DEVELOPMENT PLAN

Kiamichi River Basin Working Group
February 1, 2000

Prepared by the
Oklahoma Water Resources Board
Duane Smith, Executive Director

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INTRODUCTION

Prompted by the ongoing legal dispute between the State of Oklahoma and the federal government concerning the outstanding Sardis Lake water storage obligation and years of discussion concerning proposed uses of water from Sardis and the Kiamichi River Basin, the State Legislature passed House Concurrent Resolution 1066 on May 28, 1999. HCR 1066 directs the OWRB, designated Tribal representatives and local citizens – together comprising the Kiamichi River Basin Working Group, co-chaired by Duane Smith, OWRB Executive Director and L.V. Watkins, Tribal advisor-- to develop this Kiamichi River Basin Water Resources Development Plan for submittal to the State Legislature by February 1, 2000. This landmark legislation also provides the authority necessary for the Oklahoma Water Resources Board to negotiate with the Choctaw and Chickasaw Tribes, whose lands encompass the Kiamichi River Basin, in an effort to facilitate development of the Basin's water supplies and identify potential benefits that those resources may provide to citizens of Oklahoma.

Kiamichi River Basin Working Group HCR 1066

Co-Chairs

Duane A. Smith, Executive Director, Oklahoma Water Resources Board
L.V. Watkins, Choctaw/Chickasaw Tribal Representative

Members

Gary Batton, Choctaw Nation
Janie Ben, Clayton
David Davies, Little Dixie Community Action Agency
Chuck Hutchison, Tuskahoma
Rob Martin, Talihina
Butch Needham, Hugo
Danny Simon, Lamar
Stan Stamper, Hugo
Wendell Thomason, Oklahoma Water Resources Board
Jerry Buchanon, Clayton
Brian Campbell, Chickasaw Nation
Lyndol Fry, Hugo
Jim Koopman, Clayton
Larry Morgan, Latimer County News
Jack Pate, Choctaw Nation
John Sirmans, Choctaw Nation
Jefferson Keel, Chickasaw Nation

Dates and Locations of Formal Kiamichi Group Meetings

August 3, 1999	@ Antlers Community Building
August 27, 1999	@ Stillwater, Oklahoma State University, Wes Watkins Center
September 16, 1999	@ Hugo Lake Hospitality Center
November 11, 1999	@ Talihina, Choctaw Community Building
January 11, 2000	@ Clayton
January 25, 2000	@ Hugo

BACKGROUND

Sardis Lake, on Jackfork Creek in southeast Oklahoma, was constructed by the U.S. Army Corps of Engineers between 1975 and 1982 primarily for water supply, flood control and recreation, fish and wildlife purposes. Because the state had confidence that the lake's water supply would be utilized by local users and/or as a supplemental regional source for central Oklahoma, the Oklahoma Water Storage Commission entered into the Sardis Reservoir Storage Contract with the Corps.

The Oklahoma Water Storage Commission was created by the Oklahoma Legislature in 1963 to promote the maximum development of state water resources. The Commission, comprised of the seven (later nine) members of the Oklahoma Water Resources Board, was charged with reviewing and determining the feasibility of proposed federal projects as well as the present and anticipated needs of users in the projects' watersheds. If such a determination was made, the Commission was directed to negotiate with the federal government, municipalities and other interests to repay the cost of conservation storage in the project. The Commission had no authority to build projects, only power to underwrite construction. Only storage not estimated for present or future needs could be contracted for; the Commission would then hold this surplus water in trust until needed. At that time, the state would recover its storage costs from the new customer(s). The Water Storage Commission survived for 16 years, holding its first meeting in August 1963. Senate Bill 138, known as the "Oklahoma Sunset Law," terminated the Water Conservation Storage Commission and transferred all existing obligations to the OWRB. The Commission's last meeting was held in June 1979.

The Sardis Lake Water Storage Contract enables the state to use storage in the lake for municipal and industrial water supply in return for repayment of the project's construction costs attributed to water supply use. Forty-seven percent of the project's water supply storage is reserved for "present use" while 53 percent is reserved for "future use" where the contract's interest (4.012 percent) accumulates until that storage is used. The 1974 contract estimated water supply construction costs to total $16.4 million. Through the Statewide Water Development Revolving Fund, which also serves as the funding source for Oklahoma communities in need of water and sewer project improvements, the state initially made six annual payments to the Corps for approximately $2.7 million. Sardis is the only water supply lake in Oklahoma for which the state holds a contract to repay storage costs.

Anticipated development and subsequent use of Sardis Lake's water supply has not been realized and because the contract states that the Oklahoma Legislature is not legally obligated to appropriate funds for the payments, the State Legislature elected in 1989 not to authorize additional payments to the Corps. While payments were made in 1996 and 1997, bringing the paid amount to $4.3 million, the state again deferred payments in 1998 and 1999. Oklahoma is currently $5.5 million in arrears, with the Corps claiming late payment interest of more than $2 million; outstanding storage costs now amount to approximately $40 million. Annual payments for use of Sardis water storage could reach as much as $2 million when both present and future water supply storage are utilized.

Since 1990, several studies have been conducted and numerous efforts made to address the Sardis Reservoir contract/water use controversy. Progressively, each has resulted in better understanding of issues pertinent to the matter. However, further

uncertainties presented through two lawsuits filed in 1998 prompted additional review of the situation.

Responding to local concerns, the Board adopted a permanent rule in July 1999 that set aside 20,000 ac-ft/yr for future water use in the 10-county area incorporating the Kiamichi River Basin. As the OWRB continues working to fulfill its mandate under HCR 1066, the agency is cooperating with the Corps of Engineers and the Office of Management and Budget to negotiate details of a potential discounted purchase of the Sardis water supply storage, estimated at approximately $20 million or less. In addition, Section 545 of the Water Resources Development Act of 1999 authorizes the Corps to accept a discounted prepayment in an amount to be determined by an independent accounting firm.

OVERVIEW OF KIAMICHI RIVER BASIN WATER RESOURCES

The following section of this report summarizes the hydrologic data and related information pertinent to Basin resources presented to the members of the Kiamichi River Basin Working Group during the five formal meetings held in southeast Oklahoma from August through November 1999.

Hydrology

The Kiamichi River Basin (Figure 1) is the state's most prolific watershed. The river originates in the Ouachita National Forest in extreme western Arkansas, enters Oklahoma in southeastern LeFlore County, then meanders for 172 miles prior to its termination at the Red River in Choctaw County. Jackfork Creek -- one of the river's four major tributaries along with Cedar, Buck and Ten Mile Creeks -- impounds Sardis Lake. With a drainage area of 1,830 square miles, the Kiamichi River flows through six Oklahoma counties.

Rainfall in the Kiamichi River Basin is relatively high, especially in the eastern portion due to the influence of the Kiamichi Mountains combined with moist air masses from the Gulf of Mexico. Average annual precipitation in the basin is approximately 47 inches, ranging from less than 44 inches in the far western portion to more than 50 inches in the east. The maximum yearly rainfall of 77 inches occurred in 1945, the minimum of 23 inches in 1963. Area rainfall is usually greatest in May and September and lowest during January and February

Evaporation in the Kiamichi River Basin averages 69 inches per year, varying from almost 71 inches in the western part of the basin to almost 63 inches in the east portion. Although evaporation is greater than precipitation in the basin, substantial runoff causes abundant water to flow in many streams and accumulate in area reservoirs. For the purposes of this report, flow, which is the amount of water which passes a given point, is quantified in both cubic feet per second (cfs; one cubic foot of water flowing at an average rate of one foot per second) and acre-feet per year (ac-ft; the amount of water required to cover one acre of land to a depth of one foot).

Significant precipitation and steep topography make the Ouachita Mountain region of the Kiamichi River Basin one of the highest runoff-per-square-mile regions in the state. Average annual runoff varies from more than 1,050 ac-ft per square mile in the eastern portion of the basin to almost 750 ac-ft per square mile in the south and west. Three U.S. Geological Survey stream gages exist on the Kiamichi River; an additional gage at Hugo dam was discontinued in 1992, but provides valuable information on river flows at the basin's end prior to construction of Hugo Lake.

The average annual flow of the Kiamichi River (Table 1) at the USGS stream gage near Big Cedar is 62,264 ac-ft/yr. Flow downstream increase as the contributing drainage area measured by each gage increases. At Clayton, the average annual flow for the period of record is 815,948 ac-ft; at Antlers, more than 1.3 million ac-ft. Estimated inflow into Hugo Lake is 1,594,248 ac-ft/yr or 1,422 million gallons per day (mgd). The minimum annual regulated flow ever recorded at the Corps of Engineers' Hugo Lake gage is 484,356 ac-ft; the maximum is 3,050,000 ac-ft.

Figure 1
The Kiamichi River Basin

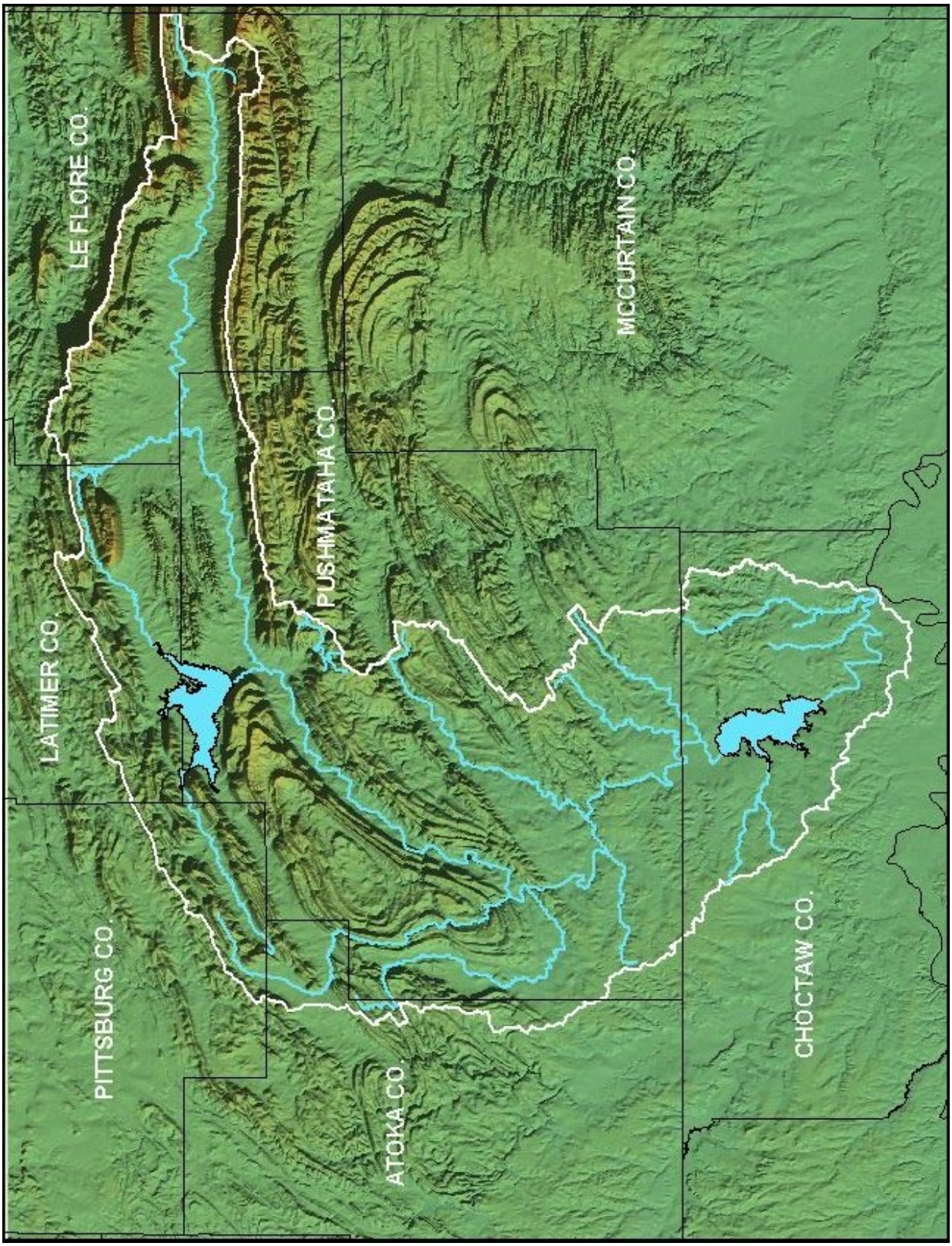


Table 1
Historical Streamflow Data, Kiamichi River Basin

Gage	Drainage Area (square miles)	Annual Flow for Period of Record				
		Minimum (ac-ft/yr)	Maximum (ac-ft/yr)	Average (cfs)	Average (ac-ft/yr)	Average (mgd)
Big Cedar	40	24,544	110,048	86	62,264	56
Clayton	708	396,028	1,424,108	1,127	815,948	728
Antlers	1,138	569,064	2,305,216	1,821	1,318,404	1,176
Hugo	1,709	484,356	3,050,000	2,202	1,594,248	1,422

All data from U.S. Geological Survey stream gages, except Hugo, which is estimated inflow from the Corps of Engineers reservoir gage.

Stream Water Quality

The quality of water in the Kiamichi River Basin is considered excellent with little mineralization. The water is suitable for irrigation and, with treatment, is an excellent source for municipal and industrial purposes. The water is moderately turbid and classified as soft.

Groundwater Resources & Quality

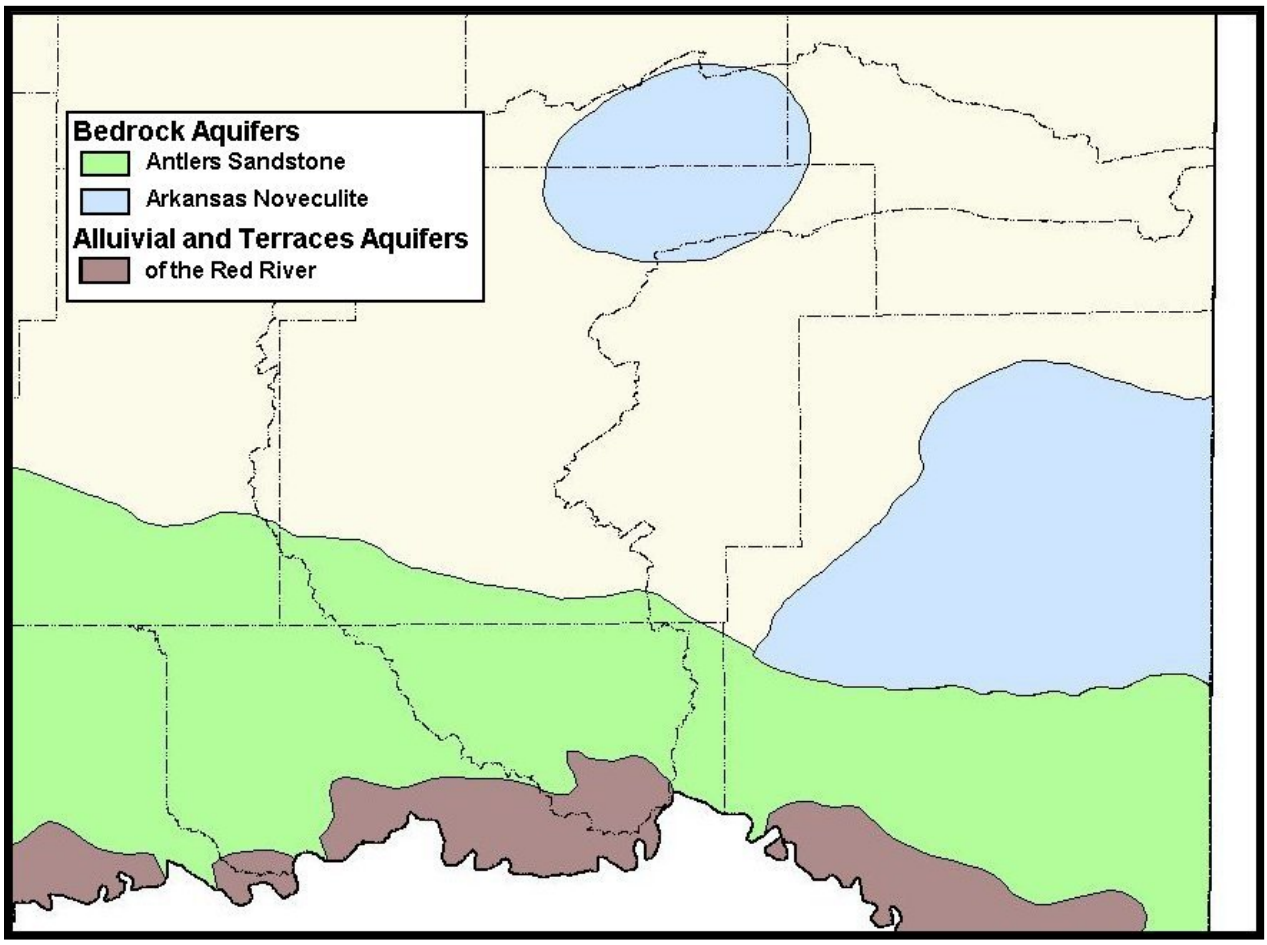
In addition to alluvium and terrace deposits of the Red River, two major groundwater basins underlie the Kiamichi River Basin (Figure 2). The Antlers Sandstone (Cretaceous in age, laid down 53 to 133 million years ago) is a fine-grained sand interbedded with clay, unconsolidated and friable. It crops out in a 10-mile-wide belt in parts of Atoka, Bryan, Choctaw, Johnston, McCurtain and Pushmataha Counties. The entire Choctaw County portion of the Kiamichi River Basin, along with small portions of Atoka and Pushmataha Counties, is underlain by the Antlers Sandstone formation. It is estimated that at least 320 square miles of the aquifer's 4,400-square-mile area (2,816,000 acres) lies under the basin.

Through its entire extent, the Antlers Sandstone ranges in thickness from 180 feet in the west to more than 880 feet in the southeast. Well yields range from 5 to 50 gallons per minute (gpm) for water table wells and from 50 to 650 gpm in artesian wells. An average yield for wells completed in the groundwater basin is 100 to 150 gpm.

Groundwater quality is good in the outcrop areas and suitable for industrial, municipal and irrigation use. Downdip from those areas, the quality deteriorates. Dissolved solids range from 130 to 1,240 milligrams per liter (mg/L); hardness from 8 to 300 mg/L; sodium from 1 to 350 mg/L; and bicarbonate from 10 to 580 mg/L.

The other major groundwater basin, the Arkansas Novaculite and Bigfork Chert, exists in the Potato Hills area of Pushmataha and Latimer Counties and virtually the entire extent of the two formations (estimated at 33 square miles, or 21,120 acres) underlie the Kiamichi River Basin. With a combined thickness of 850 to 1,200 feet, the formations consist of highly fractured novaculite and chert with some interbedded shale and limestone. The formations are probably capable of storing and yielding moderate to large amounts of water. However, because of the area's remoteness, few wells have been drilled into the aquifer and its potential can only be inferred. Due to extensive folding and faulting of the formations, selection of a well site requires careful study.

Figure 2
Groundwater Resources, Kiamichi River Basin



Water Resources Development

Sardis Lake

Sardis Lake (Figure 3), one of the two major reservoir development projects in the Kiamichi River Basin, was authorized by Congress with passage of the Flood Control Act in 1962. Located on Jackfork Creek, a tributary of the Kiamichi River, construction of Sardis was completed in 1983 by the U.S. Army Corps of Engineers. The project's authorized multiple purposes are flood control, water supply, recreation and fish and wildlife mitigation. The dam is located in Pushmataha County approximately three miles north of the Town of Clayton and five miles northwest of Tuskahoma.

The total initial conservation storage capacity of the reservoir is 274,210 ac-ft and it will yield almost 140 million gallons per day (156,800 ac-ft/yr) of excellent quality water. Initial capacity of the Sardis flood pool, prior to 100-year sediment accumulation, is 122,570 ac-ft. (Pool elevation and storage capacity information for Sardis Lake is depicted in Table 2). The length of the lake's shoreline is 117 miles; the contributing drainage area of the lake's watershed is 275 square miles. The final cost of the project is almost $40 million.

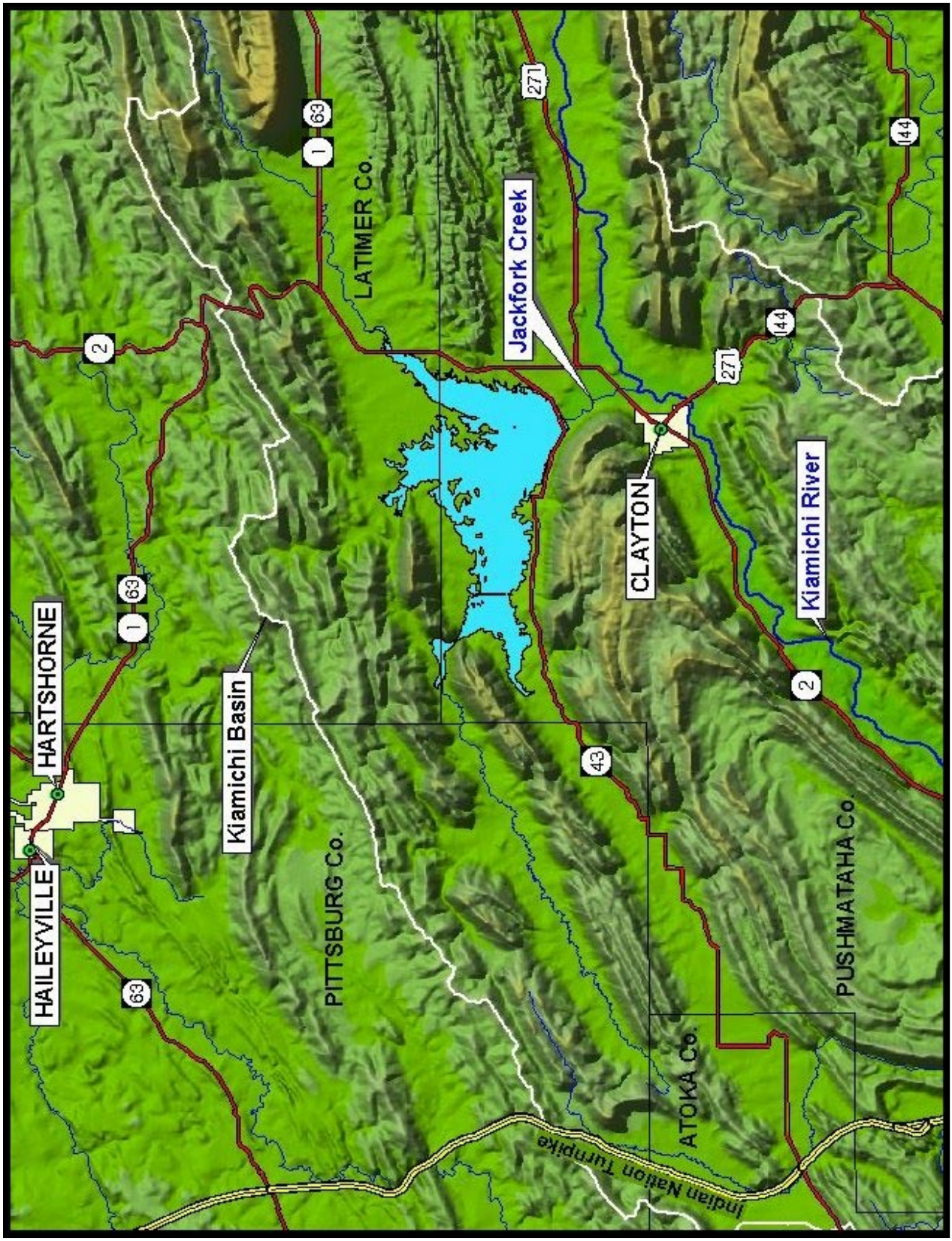
Table 2
Pertinent Data for Sardis Lake

Feature	***Elevation*** ***(feet)***	***Area*** ***(acres)***	***Capacity*** ***(ac-ft)***
Initial Flood Control Storage	599.0-607.0	16,960	122,570
Initial Conservation Storage	542.0-599.0	13,610	274,210
Initial Inactive Storage	530.0-542.0	40	120
Sardis Water Supply Yield = 156,800 (140 mgd)			

The flood of record at the dam site occurred in May 1943 with an estimated discharge of 60,000 cfs and volume of 80,000 ac-ft. The total volume of inflow during the 1990 flood was 270,000 ac-ft (April through May) with a peak daily inflow of 33,600 cfs. The peak release during that flood was 5,675 cfs.

Sardis Lake, which is the tenth largest in Oklahoma by surface area (13,610 acres), contains four recreational areas comprising more than 1,500 acres. Public hunting and wildlife propagation areas have been set aside on 8,435 acres of land surrounding the reservoir. The lake is home to one of the nation's premiere trophy largemouth bass fisheries, incorporating one fishing pier and berm, three boat ramps, two designated campsites and one swimming beach. Sardis Lake hosts at least 400,000 visitors each year. The greatest number of recreationists visit Sardis Lake in the four-month period April through July. According to the Department of Wildlife Conservation, fishing at Sardis generates at least $4 million per year to the local economy.

Figure 3
Sardis Lake Area



Hugo Lake

Hugo Lake (Figure 4), the other major impoundment in the Kiamichi River Basin, is impounded by the Kiamichi River in the far southern reach of the basin. Originally authorized by the Flood Control Act of 1946, the lake was constructed by the U.S. Army Corps of Engineers and completed in 1971 for flood control, water supply, water quality, recreation and fish and wildlife uses. The dam is located in Choctaw County approximately seven miles east of the City of Hugo, 30 miles north of Paris, Texas and 18 river miles upstream of the Kiamichi's confluence with the Red River.

The conservation storage capacity of the reservoir is 158,617 ac-ft and it will yield approximately 58 million gallons per day for water supply and 90 mgd for water quality control. Capacity of the Hugo flood pool is 955,176 ac-ft. (Pool elevation and storage capacity information for Hugo Lake is depicted in Table 3). The length of the lake's shoreline is 110 miles; the drainage area is 1,709 miles.

Table 3
Pertinent Data for Hugo Lake

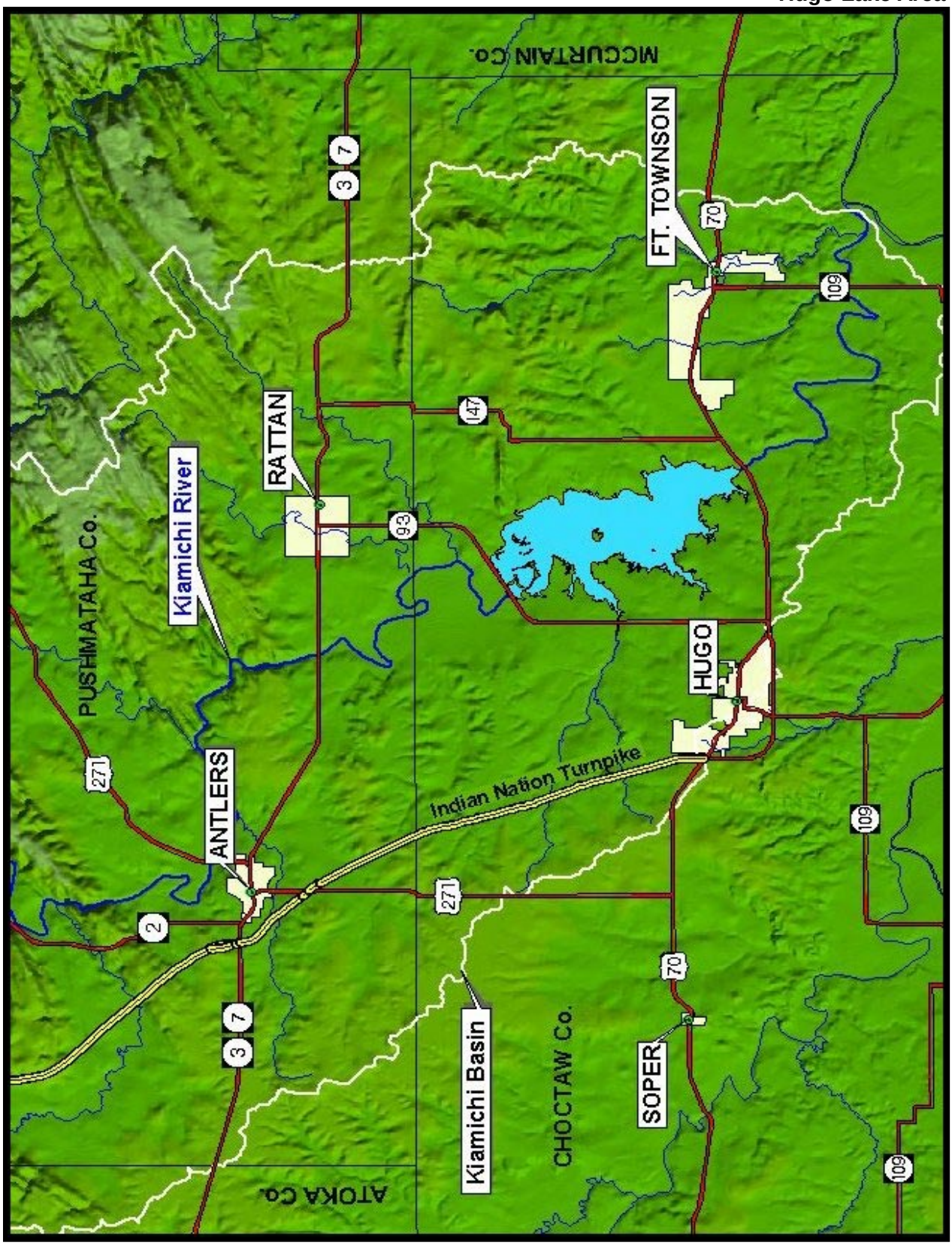
Feature	***Elevation*** ***(feet)***	***Area*** ***(acres)***	***Capacity*** ***(ac-ft)***
Initial Flood Control Storage	404.5-437.5	35,045	809,100
Initial Conservation Storage	390.0-404.5	13,144	127,160
Initial Inactive Storage	352.0-390.0	3,521	24,739
Hugo Water Supply Yield = 64,960 (58 mgd); Water Quality Control Yield = 100,800 (90 mgd)			

The flood of 1990 completely filled the flood control pool. The maximum peak inflow of 120,000 cfs occurred on May 3, 1990. The maximum volume of flow past the dam site, occurring from April through June 1957, was 1,549,500 ac-ft.

Hugo Lake offers many types of recreation, including boating, fishing, hunting and sightseeing. The lake, which normally hosts more than 500,000 visitors each year, has eight recreational areas and 5,000 acres of accessible, uncleared areas for fishing enthusiasts. The Hugo Public Hunting Area covers 18,196 acres of land and water for wildlife conservation with nearly all project lands open to hunting.

Hugo was constructed with 90 mgd of water quality storage. Water quality releases are made in response to emergency conditions downstream of Hugo, such as fish kills, increased pollution loading during drought conditions, or aesthetics problems. The current 90-mgd level, a significant increase in the amount offered in the original Hugo project plan, was recommended by the Public Health Service and eventually adopted by the Corps.

Figure 4
Hugo Lake Area



ANALYSIS OF HCR 1066 CORNERSTONE PRINCIPLES BY THE KIAMICHI RIVER BASIN WORKING GROUP

Assisted and enabled by OWRB staff through the agency's Geographic Information System (GIS), the Kiamichi River Basin Working Group has conducted extensive study and discussion of issues related to identifying the most economically and environmentally beneficial uses of Kiamichi River Basin water resources, including the paramount question posed to the group through HCR 1066 -- "What are the basin's current and future water needs and is there sufficient water available for transfer out of the basin?"

From specific language stated in the legislation (Figure 5), the Kiamichi Group determined that the plan's over-riding goal should be to consider economic development objectives that protect Basin water resources, provide opportunities to address local and state water needs, and address resolution of the Sardis Lake water storage contract obligation. Furthermore, HCR 1066 provided specific "cornerstone principles" for use by the Kiamichi Group to address pertinent water use projects and issues, especially those impacting Sardis Lake, and evaluate various water development proposals that could accomplish the bill's objectives. These cornerstone principles, amended slightly by the Kiamichi River Basin Working Group, are:

1. The present and future needs for water by Oklahomans from the Kiamichi River Basin shall be considered the highest priority.
2. Future use of water by local citizens and entities shall be protected by setting aside a sufficient amount of water from Sardis Reservoir for users within the Kiamichi River Basin Region.
3. An appropriate lake level management plan, developed by the Oklahoma Department of Wildlife Conservation, shall be implemented for the use of water from Sardis Reservoir.
4. Financing opportunities for water and wastewater infrastructure within the Kiamichi River Basin area shall be optimized.
5. The obligation of the state to the United States for repayment of construction costs of the water supply at Sardis Reservoir shall be addressed.
6. The integrity of the Kiamichi River shall be protected.

Early on, the Kiamichi Group expanded upon those principles, particularly sensitive to the upper basin, to include issues that could influence the lower basin area near Hugo Lake. These additional principles are:

7. Implement an appropriate Hugo Lake level management plan that includes flexibility for adjustments due to future sedimentation.
8. Protect Hugo Lake's wildlife management and waterfowl areas, including appropriate mitigation measures.
9. Satisfy the Hugo Municipal Authority's water supply storage contract with the Corps of Engineers.
10. Protect future water supply in the Hugo and Antlers areas, as well as other communities and areas in the Kiamichi River Basin region.

Finally, at the Working Group's last meeting in Hugo, the members added this cornerstone principle:

11. The Kiamichi River Basin Working Group recommends that any proceeds derived from the development of waters in the Basin be returned for use in the Basin.

The following section of this report details the findings of the Kiamichi River Basin Working Group in their investigation of measures to satisfy the 10 specified cornerstone principles related to the potential use, development and/or transfer of Basin water resources.

Figure 5
House Concurrent Resolution 1066 and Cornerstone Principles

ENROLLED HOUSE CONCURRENT RESOLUTION NO. 1066

A Concurrent Resolution directing the Oklahoma Water Resources Board to conduct meetings with Choctaw and Chickasaw Nations and local representatives; providing guidelines; requiring development and submission of a Kiamichi River Basin Water Resources Development Plan; and directing distribution.

WHEREAS, the water resources of the Kiamichi River in southeastern Oklahoma are critical to the economic development of the Kiamichi River Basin and must be protected; and

WHEREAS, in order to provide protection of such water resources while at the same time providing opportunities to address local water needs, water needs of Oklahomans and to resolve the Sardis Reservoir water supply storage situation, a comprehensive plan based upon cornerstone principles must be developed; and

WHEREAS, the State of Oklahoma and the Choctaw and Chickasaw Nations have expressed interest in formulating such a comprehensive plan so that the issues relating to water resources development in the Kiamichi River Basin and southeastern Oklahoma can be thoroughly examined.

NOW, THEREFORE, BE IT RESOLVED BY THE HOUSE OF REPRESENTATIVES OF THE 1ST SESSION OF THE 47TH OKLAHOMA LEGISLATURE, THE SENATE CONCURRING THEREIN:

SECTION 1. A. The Executive Director of the Oklahoma Water Resources Board shall conduct meetings with designated representatives of the Choctaw and Chickasaw Nations and local citizens and entities to formulate a comprehensive Kiamichi River Basin Water Development Plan to address water resources issues in the Kiamichi River Basin in accordance with the following cornerstone principles:

1. **The lake level management plan, developed by the Oklahoma Department of Wildlife Conservation, shall be implemented for use of water from Sardis Reservoir;**
2. **Future use of water by local citizens and entities shall be protected by setting aside a sufficient amount of water from Sardis Reservoir for users within the Kiamichi River Basin Region;**
3. **Financing opportunities for water and wastewater infrastructure with the Kiamichi River Basin area shall be optimized;**
4. **The obligation of the state to the United States for repayment of construction costs of the water supply at Sardis Reservoir shall be addressed;**
5. **The present and future needs for water by Oklahomans from the Kiamichi River Basin shall be considered the highest priority; and**
6. **The integrity of the Kiamichi River shall be protected.**

B. In developing the comprehensive plan specified by this resolution, input from the Choctaw and Chickasaw Nations, from citizens from the Kiamichi River Basin area, and from other Oklahoma citizens and entities shall be solicited.

C. The Oklahoma Water Resources Board shall submit the Kiamichi River Basin Water Resources Development Plan to the Oklahoma House of Representatives and the Oklahoma State Senate by February 1, 2000.

SECTION 2. Copies of this resolution shall be distributed to the Oklahoma Water Resources Board, and officials of the Choctaw and Chickasaw Nations.

Adopted by the House of Representatives the 28th day of May, 1999.

Adopted by the Senate the 28th day of May, 1999.

Protecting the Present and Future Water Needs of Oklahomans

"The present and future needs for water by Oklahomans from the Kiamichi River Basin shall be considered the highest priority."

Although protecting water resources from the Kiamichi River Basin for users within the Basin is of utmost importance prior to the finalization of potential water development projects, HCR 1066 also directs the Kiamichi River Basin Working Group to ensure Kiamichi supply for future growth in other identified areas of the state. In addition to the relative abundance of existing water supplies throughout both the upper and lower Basin regions, four federal reservoir projects remain authorized for construction in southeast Oklahoma. At this time, however, Congress has not appropriated any funds for the construction of these projects. In addition, the Kiamichi River Basin Working Group does not necessarily recommend their construction.

Tuskahoma (Table 7, Figure 12), the only major project which would reside within the Kiamichi River Basin, has been in deferred status since 1981. The reservoir is proposed for construction on the Kiamichi River in Pushmataha and LeFlore Counties for the purposes of flood control, water supply, recreation, and fish and wildlife conservation. The reservoir would provide flood control storage of 138,600 ac-ft and conservation storage of 231,000 ac-ft. The estimated yield is 224,000 ac-ft/yr (200 mgd). The project was re-evaluated by the Corps of Engineers in 1989 with hydropower as a proposed use. The recommended configuration would have no flood control storage and only 49,100 ac-ft of conservation storage yielding 63,850 ac-ft/yr (57 mgd) of water supply. While hydropower benefits indicate that the project may be economically justified, hydropower is not an authorized use and the project does not meet federal criteria for participation. Potential construction of this project would be difficult due to the abundant existence of numerous endangered species, especially the Ouachita Rock Pocketbook Mussel, in the lake's watershed.

Parker Lake (Table 7, Figure 13), authorized by the Water Resources Development Act of 1986, is a proposed impoundment on Muddy Boggy Creek in Coal County. The lake is authorized for flood control, water supply, recreation, and fish and wildlife mitigation uses. It is estimated to have a drainage area of 164 square miles and would provide 110,300 ac-ft of flood control storage and 109,940 ac-ft of conservation storage yielding 45,900 ac-ft/yr (41 mgd) of good quality water. Pre-construction engineering and design have been completed for the project, but construction is on hold until a local sponsor for the water supply storage is secured.

Boswell Lake (Table 7, Figure 14) is an authorized project on Boggy Creek in Choctaw County. The reservoir, scaled back from its original much larger size, would provide 294,100 ac-ft of flood control storage and 60,870 ac-ft of conservation storage yielding 56,000 ac-ft/yr (50 mgd) of water supply. The project is not currently economically viable, based solely on flood control benefits. Should a local sponsor emerge for the water supply storage, the project could be reactivated.

Lukfata Lake (Table 7, Figure 15) is an authorized impoundment on Glover Creek in McCurtain County. Authorized uses include flood control and water supply. The project would have 172,000 ac-ft of flood control storage and 31,000 ac-ft of conservation storage yielding 69,450 ac-ft/yr (62 mgd) of excellent quality water supply. Lukfata Lake is the only impoundment in the seven-lake system authorized for the Little River Basin

that has not yet been constructed. In 1977, Congressional funding for the project was halted due to the potential adverse effect on the habitat of the area's Leopard Darter, a small fish on the threatened species list.

Table 7
Authorized Federal Project Data, Southeast Oklahoma

Project	*Elevation of Dam (feet)*	*Surface Area (acres)*	*Water Supply*		*Flood Control (ac-ft)*	*Location*	*Estimated Cost*
			Storage (ac-ft)	*Yield (mgd)*			
Tuskahoma	640	11,626	224,000	199	138,600	Kiamichi River Pushmataha County	$108.8 million
Parker	690	6,224	45,900	41	100,300	Muddy Boggy Creek Coal County	$74.4 million
Boswell	435	6,029	56,000	50	294,100	Boggy Creek Choctaw County	$174.6 million
Lukfata	506	730	69,450	62	172,000	Glover River McCurtain County	$81.2 million

Figure 12
Tuskahoma Lake (proposed)

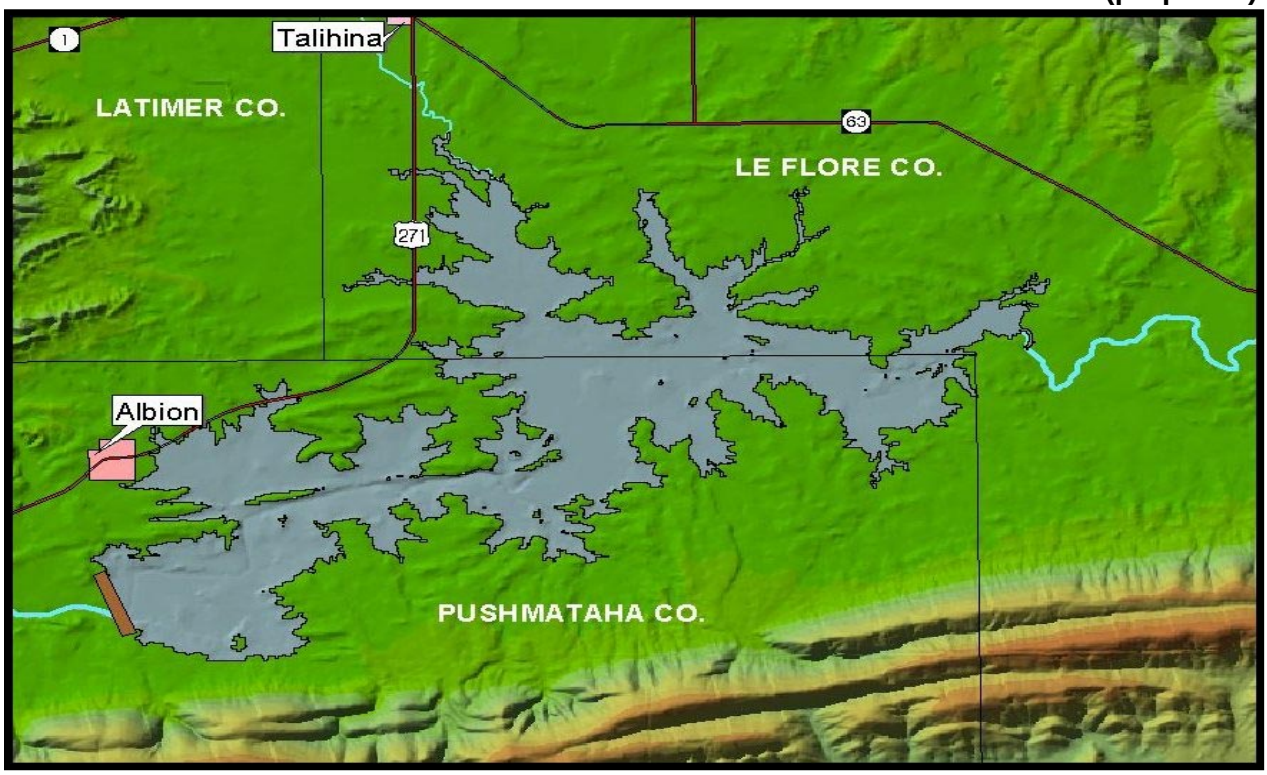


Figure 13
Parker Lake (proposed)

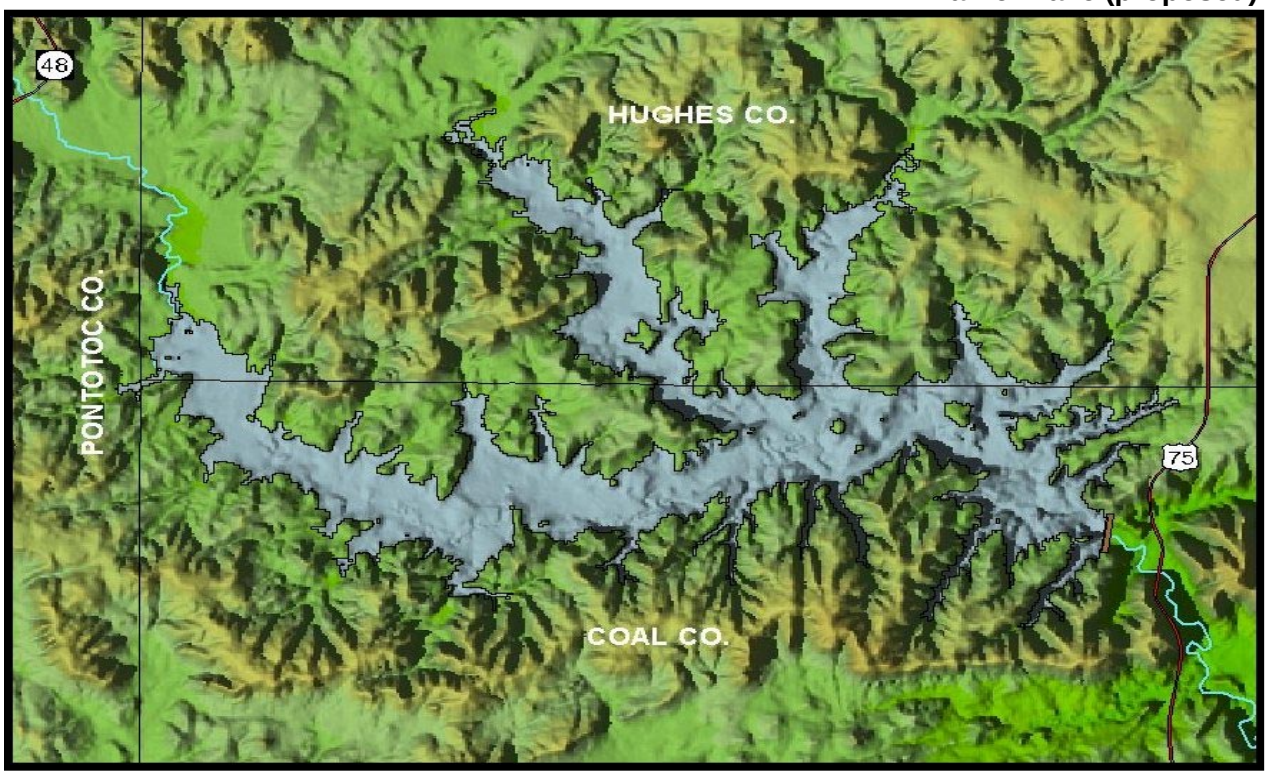


Figure 14
Boswell Lake (proposed)

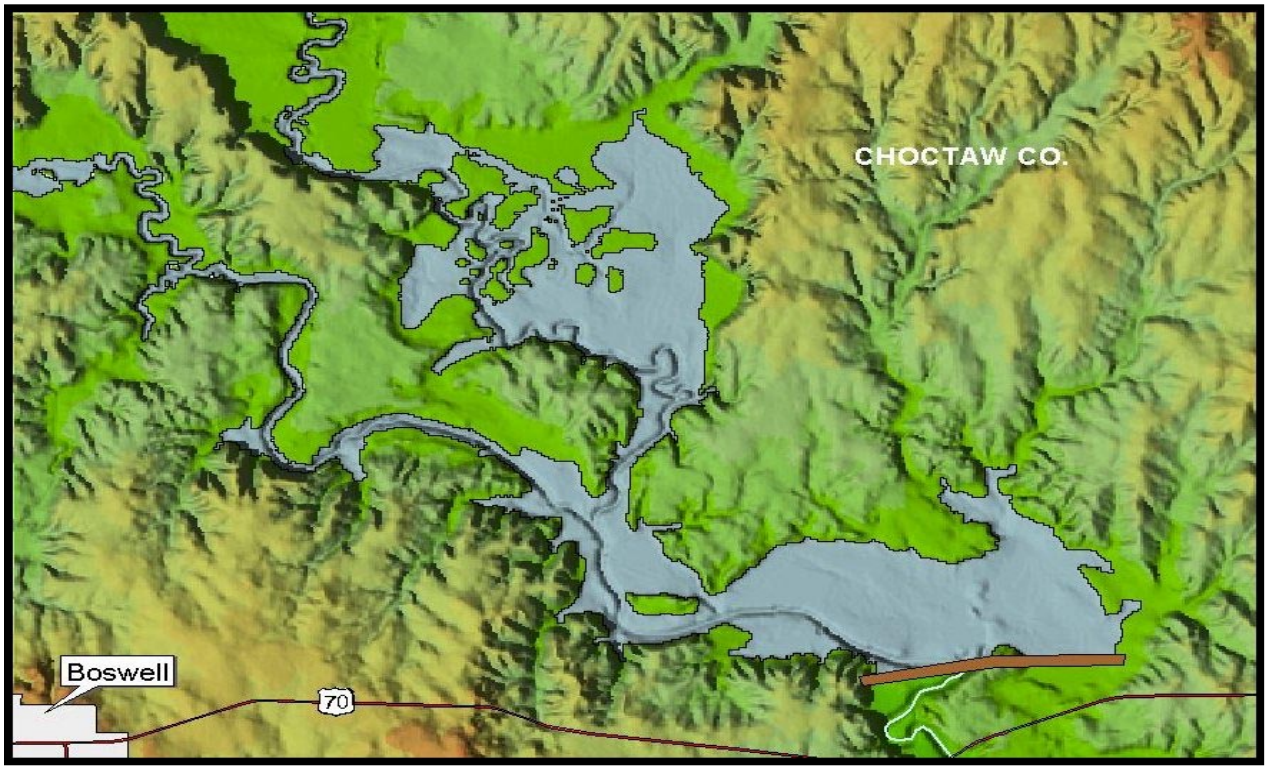
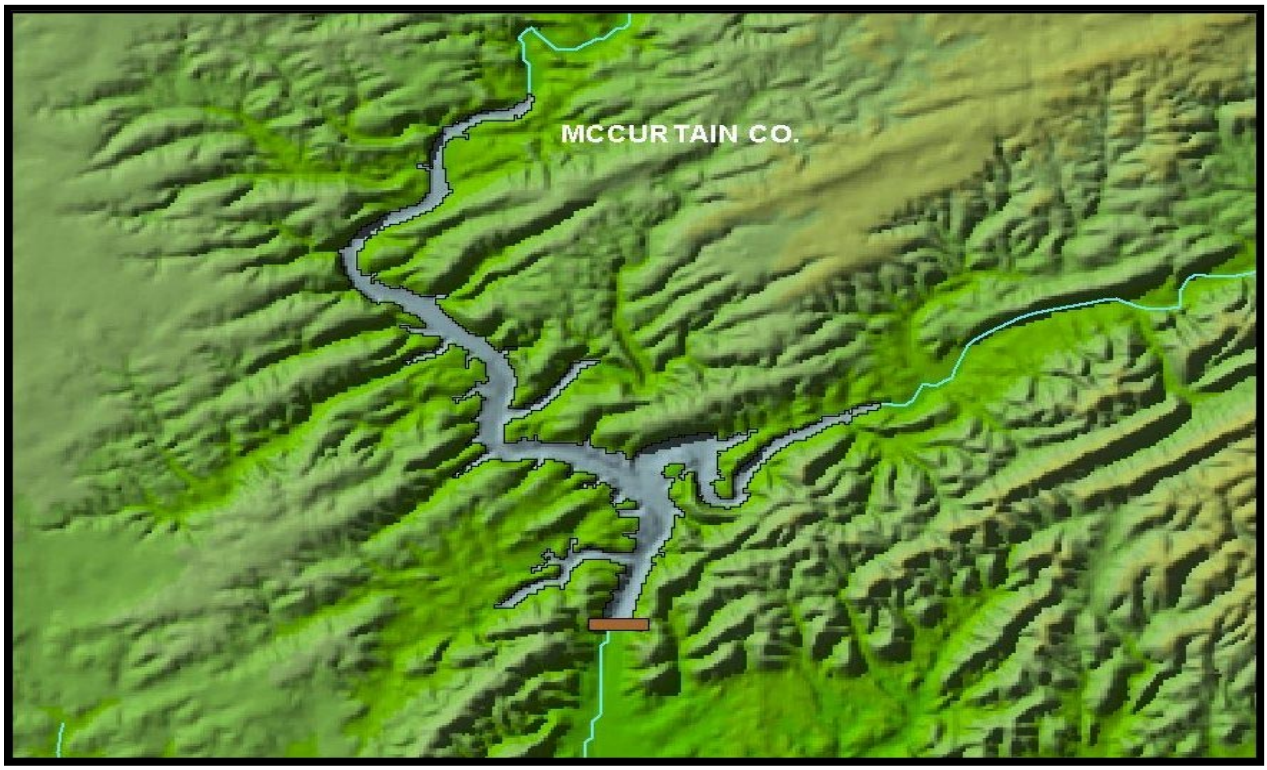


Figure 15
Lukfata Lake (proposed)



Protecting Future Local Water Use Requirements

"Future use of water by local citizens and entities shall be protected by setting aside a sufficient amount of water from Sardis Reservoir for users within the Kiamichi River Basin Region."

"Protect future water supply in the Hugo area."

Protection and preservation of water supply in the Kiamichi River Basin for future local use, growth and economic development was a primary consideration of the Kiamichi River Basin Working Group which investigated current water usage and general anticipated growth in the Basin.

The OWRB, the state's water use permitting agency, has on file 44 active permits for the use of 84,112 ac-ft/yr of stream water from the Kiamichi River, its tributaries and impoundments (Table 5; figures do not include domestic uses from Sardis and Hugo Lakes, approved by the Corps of Engineers). Stated uses include public water supply, irrigation, agriculture, power, industrial, commercial and recreation (including fish and wildlife purposes). The latest reported surface water use in the basin is 9,751 ac-ft/yr, or 11.6 percent of the total water appropriated from surface sources.

In Sardis, four permits for 7,038 ac-ft -- including 6,000 ac-ft allocated to the Sardis Lake Water Authority, which is under development -- are on file at the OWRB, leaving 149,762 ac-ft of the lake's yield for appropriation. Five additional permits for a total of 486,424 ac-ft -- more than three times the reservoir's dependable yield -- are pending. The applicants are all local entities. Reported water use in 1998 was 3.1 ac-ft.

In Hugo Lake, six permits for 63,723 ac-ft are on file, leaving 1,237 ac-ft of water available for appropriation to other users from the water supply pool. There are no pending applications for the use of water from Hugo Lake. Reported water use in 1998 was 6,150 ac-ft.

Use of groundwater in the Kiamichi River Basin is largely insignificant compared to surface water use. Currently, 10 active permits allocate 3,926 ac-ft/yr of water (Table 6). The last reported groundwater use is only 115 ac-ft/yr (three percent of water appropriated). Stated water uses include irrigation, public water supply, industrial, recreation and agriculture.

Regarding individual water use (Figure 9), more than 88 percent of the Kiamichi River Basin's surface and groundwater rights are allocated to only four users – Western Farmers Electric Cooperative (including both a stream and groundwater use permit), Hugo Municipal Authority (two permits), Sardis Lake Water Authority (one permit) and the Talihina Public Works Authority (three permits). These four entities (including SLWA, which reports no use to date) account for 77 percent of the total water used in the basin. Western Farmers, the largest single user with a 34,420 ac-ft/yr allocation, reports usage of 5,540 ac-ft/yr. The second largest user, Hugo, uses only three percent (943 ac-ft/yr) of its total permitted amount (30,500 ac-ft/yr).

Of the total annual average flow of the Kiamichi River (1,594,248 ac-ft/yr, estimated from total average inflow into Hugo Lake), approximately 5.3 percent (84,112 ac-ft/yr) is appropriated to local users in the basin. Of the estimated 472,320 ac-ft of groundwater available in the basin (from OWRB groundwater basin studies), only 0.8 percent is appropriated. In all, less than 4.3 percent (88,038 ac-ft/yr) of the Kiamichi River Basin's

total estimated available surface and groundwater resources have been appropriated, leaving almost 96 percent of the area's total water currently available for future use.

Comparing water use and population in the basin with similar figures from southeast Oklahoma municipalities (Figure 10), the City of McAlester, with a population of approximately 17,000, uses slightly more than 5,000 ac-ft/yr of its allocated water. The entire Kiamichi River Basin, with a little more than double McAlester's population, uses less than 10,000 ac-ft/yr. When compared to the 20,000 ac-ft/yr of water set aside specifically for future use in the Kiamichi River Basin Lake area through the OWRB's recent rulemaking, these and the other water usage figures specified above appear to more than substantiate adequate protection for future local supply. The Kiamichi Group agrees, however, that similar measures – such as negotiating with Western Farmers or other water rights holders to free-up currently appropriated water at Hugo Lake -- should be taken to ensure future supply for the Hugo area.

Table 5
Surface Water Use Permits, Kiamichi River Basin

Permit #	County	Name	Amount (ac-ft/yr)	Used (ac-ft/yr)	Purpose
19520394	Choctaw	Leslie	600	100	Irrigation
19540795**	Choctaw	Hugo Municipal Authority	1700	943	Industrial
19540874	Pushmataha	City of Antlers	235	235	Public Water Supply
19560158	Pushmataha	Dept. Tourism & Recreation	10	10	Recreation
19560472	Choctaw	Dept. Wildlife Conservation	200	200	Recreation
19560642	Pushmataha	Evans	8	6	Irrigation
19570121	Pushmataha	Dept. Wildlife Conservation	100	100	Recreation
19570376	Pushmataha	Dept. Wildlife Conservation	130	130	Recreation
19610143	Pushmataha	Miller	25	11	Irrigation
19620079	Latimer	Talihina PWA	300	300	Public Water Supply
19620087	Pushmataha	Clayton PWA	50	50	Industrial
19640593	Pushmataha	Debolt, MD	30	5	Irrigation
19640844	Pushmataha	Talihina PWA	5000	0	Public Water Supply
19660510	LeFlore	Kelley	4	4	Irrigation
19660677	Choctaw	Dept. Wildlife Conservation	90	90	Recreation
19680415	LeFlore	Talihina PWA	1500	815	Industrial
19710003	Pushmataha	Gilbert	84	17	Irrigation
19710567	Choctaw	Leslie	1000	50	Irrigation
19720048**	Choctaw	Hugo Municipal Authority	28800	0	Public Water Supply
19720060**	Pushmataha	Antlers, City of	523	232	Industrial
19760079	Choctaw	Critchlow	60	14	Irrigation
19770160**	Choctaw	Western Farmers Elec. Coop.	32000	5454	Power
19780141	Choctaw	Easterwood	40	80	Irrigation
19800075	Pushmataha	Clayton PWA	400	284	Public Water Supply
19820018*	Pushmataha	U S Army Corps of Engineer	8	4	Recreation
19820134	Pushmataha	Redman	262	9	Irrigation
19830049	Pushmataha	Emery	636	97	Irrigation
19850010	Pushmataha	Corbin	100	5	Irrigation
19860023	Pushmataha	Redman	82	9	Irrigation
19880016	Choctaw	Foster Land & Cattle Co	180	11	Irrigation
19880022*	Pushmataha	Latimer Co RWD #2	1000	0	Public Water Supply
19910037*	Latimer	Addington	30	15	Commercial
19910054*	Latimer	Sardis Lake Water Authority	6000	0	Public Water Supply
19920022**	Pushmataha	Pushmataha Co RWD #3	400	464	Public Water Supply
19930017**	Pushmataha	Pushmataha Co RWD #3	300	0	Public Water Supply
19930039	Pushmataha	Decker Revocable Trust	428	0	Agriculture
19960001	LeFlore	Weatherford	10	5	Agriculture
19960028	Latimer	Kennedy	10	2	Agriculture
19970022	Pittsburg	Wilson	98	0	Irrigation
19980004	Pittsburg	Wilson	300	0	Irrigation
19980005	Pushmataha	Jackson	310	0	Irrigation
19980031	Latimer	Lockhart	295	0	Irrigation
19980032	Pushmataha	Ralston	228	0	Irrigation
19980044	Choctaw	Heddlesten	546	0	Irrigation
Total			**84112**	**9751**	

***Sardis Lake (7,038 ac-ft allocated; 149,762 available; pending applications = 486,424 ac-ft)**
****Hugo Lake (63,723 ac-ft allocated; 1,237 ac-ft available)**

Table 6
Groundwater Use Permits, Kiamichi River Basin

Permit #	County	Name	Amount (ac-ft/yr)	Used (ac-ft/yr)	Purpose
19690402	Pushmataha	Brents	100	0	Irrigation
19710047	Choctaw	Town of Fort Towson	40	2	Public Water Supply
19740127	Choctaw	Ouachita Mountains RC&D	680	25	Irrigation
19770876	Choctaw	Western Farmers Elec. Coop.	2420	86	Industrial
19810544	Pushmataha	Hutson	159	0	Irrigation
19820520	Pushmataha	Sardis Project Office	6	1	Recreation
19880535	Choctaw	American Rock Products Inc	351	0	Industrial
19890504	Pushmataha	Boykin	2	0	Industrial
19910563	Latimer	Addington	68	1	Public Water Supply
19950634	Latimer	Price	100	0	Agriculture
Total			**3926**	**115**	

Figure 9
Water Use, Kiamichi River Basin

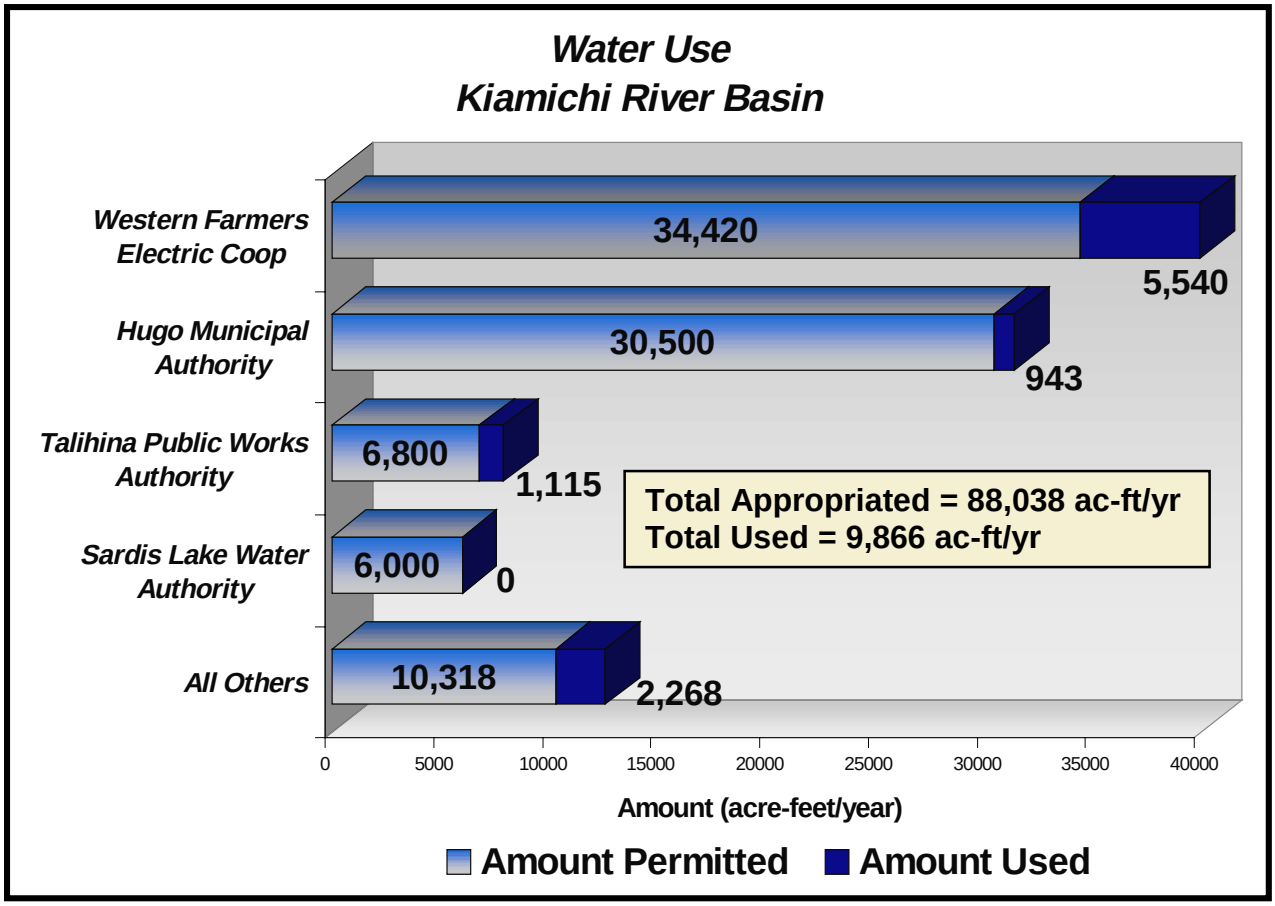
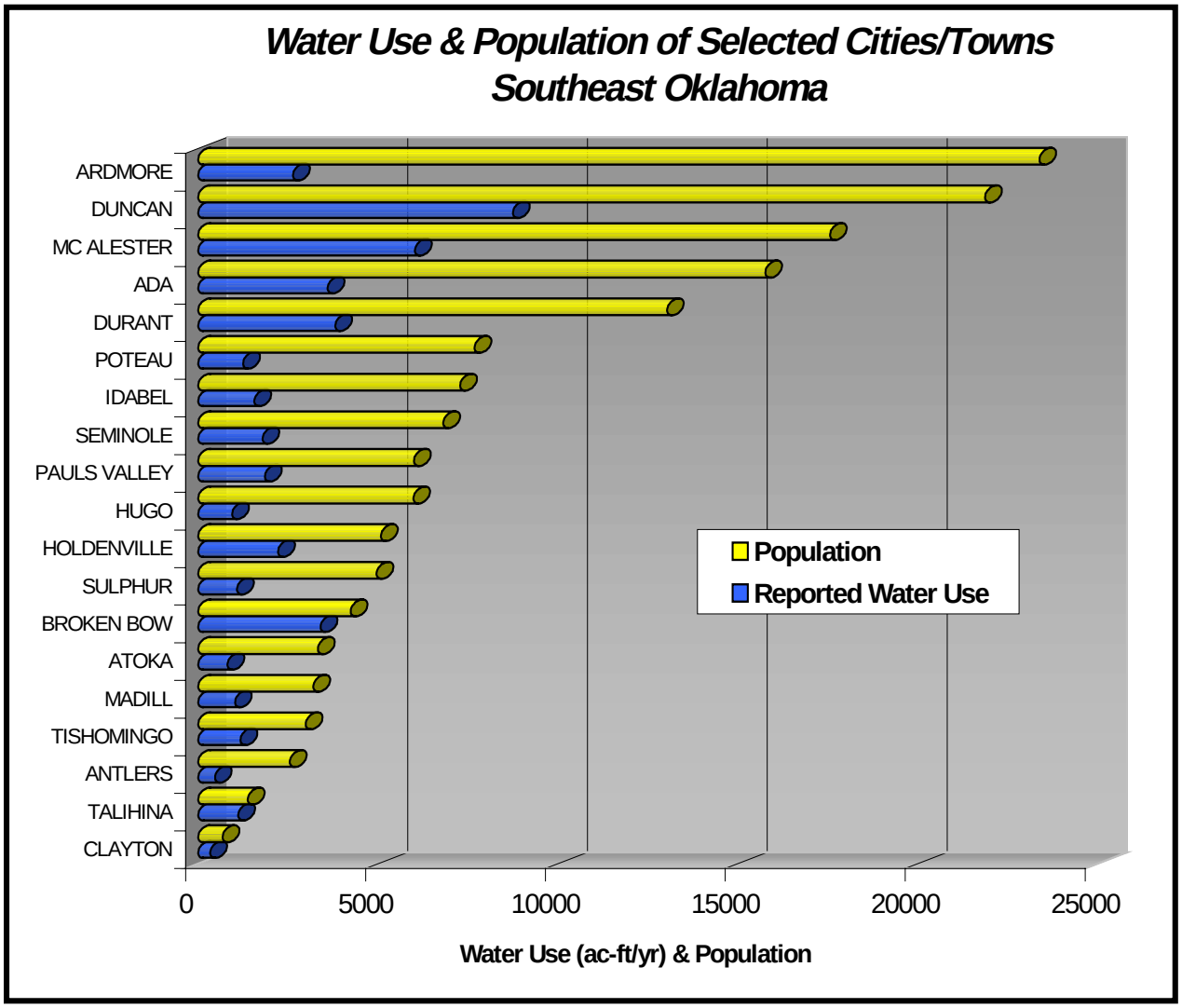


Figure 10
Water Use and Population of Selected Cities and Towns in Southeast Oklahoma



Implementing a Sardis Lake Level Management Plan

"An appropriate lake level management plan, developed by the Oklahoma Department of Wildlife Conservation, shall be implemented for the use of water from Sardis Reservoir."

To protect critically important fishery, wildlife and recreational interests within the Kiamichi River Basin, HCR 1066 directs that appropriate lake level management plans be implemented at both Sardis and Hugo Lakes. Utilizing the OWRB's Geographic Information System (GIS) and analyses conducted by the Corps of Engineers, the Kiamichi Group investigated the potential implementation of lake level management plans at each lake as well as related impacts of lake level fluctuations resulting from increased local water usage and/or water transfer.

Proposed Sardis Lake Operational Plan

Initially, the group discussed an informal Sardis Lake level management plan drafted by the Oklahoma Department of Wildlife Conservation (ODWC) in 1992. The recently modified plan (Figure 6), originally created in cooperation with the OWRB during water sale negotiations with Texas, was designed to enhance fish habitat and thus improve the economic and environmental benefits of the lake's fishery.

The proposed lake level management plan for Sardis revolves around the establishment of aquatic vegetation that will provide critical habitat during spawning periods as well as eventual protection for fish hatchlings from predators. Specifically, the plan recommends:

1. gradually increasing the lake water level to the approximate normal elevation in early spring (March 1-31);
2. maintaining a stable or slightly increasing level through the summer (April through August); and
3. reducing the level during the fall and winter (September through February) to allow revegetation of shoreline habitat, although limiting the drawdown to less than 4 feet.

Although Sardis Lake is relatively shallow (an average normal depth of less than 17 feet), the lake would experience only minor exposed shoreline as a result of the proposed plan during the fall and winter months when it would be reduced to elevation 595 feet. The exposed land would appear predominantly along the flatter, shallower areas on the northern shore of the lake while the southern and eastern reaches, where the Corps parks exist, would remain relatively stable. According to estimations calculated utilizing the OWRB's GIS, the total surface area lost as a result of the four-foot decrease would be 1,970 acres, from 13,565 (the normal surface area at elevation 599 feet) to 11,595 acres (Table 4, Figure 7).

Table 4 ***Potential Lake Level Variations, Sardis Lake***			
Lake Level Elevation ***(feet)***	***GIS Estimation of Surface Area*** ***(acres)***	***GIS Estimation of Total Storage*** ***(ac-ft/yr)***	***GIS Estimation of Depth*** ***(feet)***
595	11,595	189,985	16.4
599	13,565	238,742	16.8

Figure 6
Sardis Lake ODWC Operational Plan

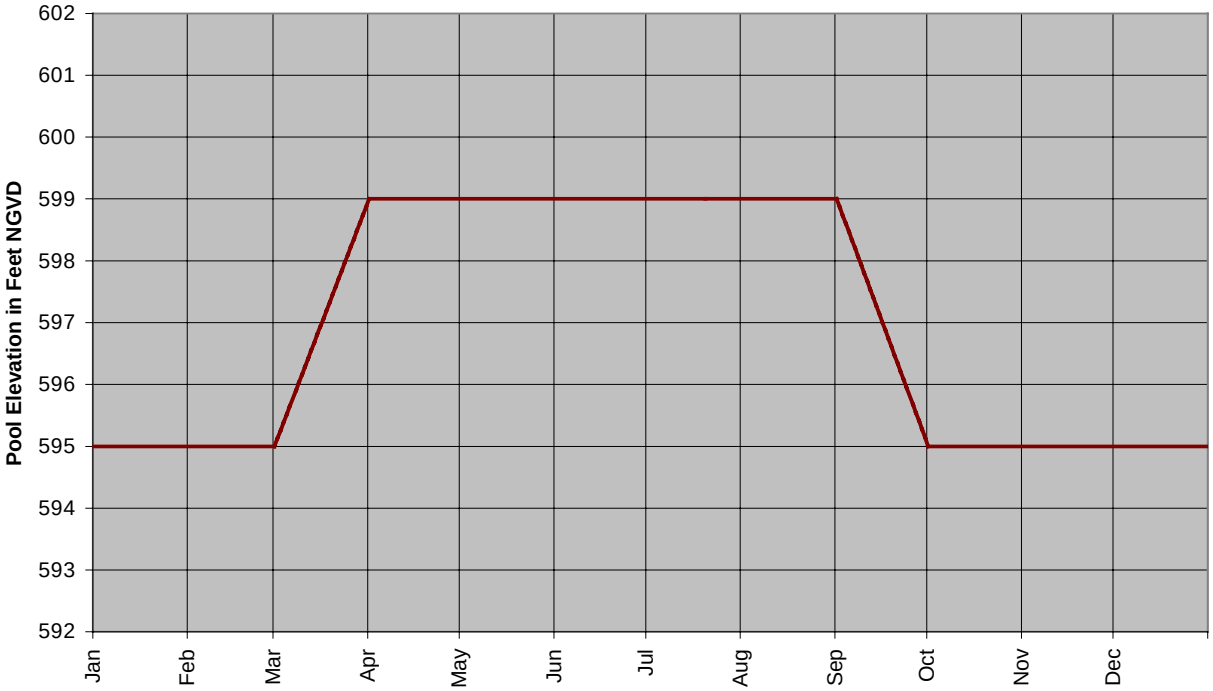
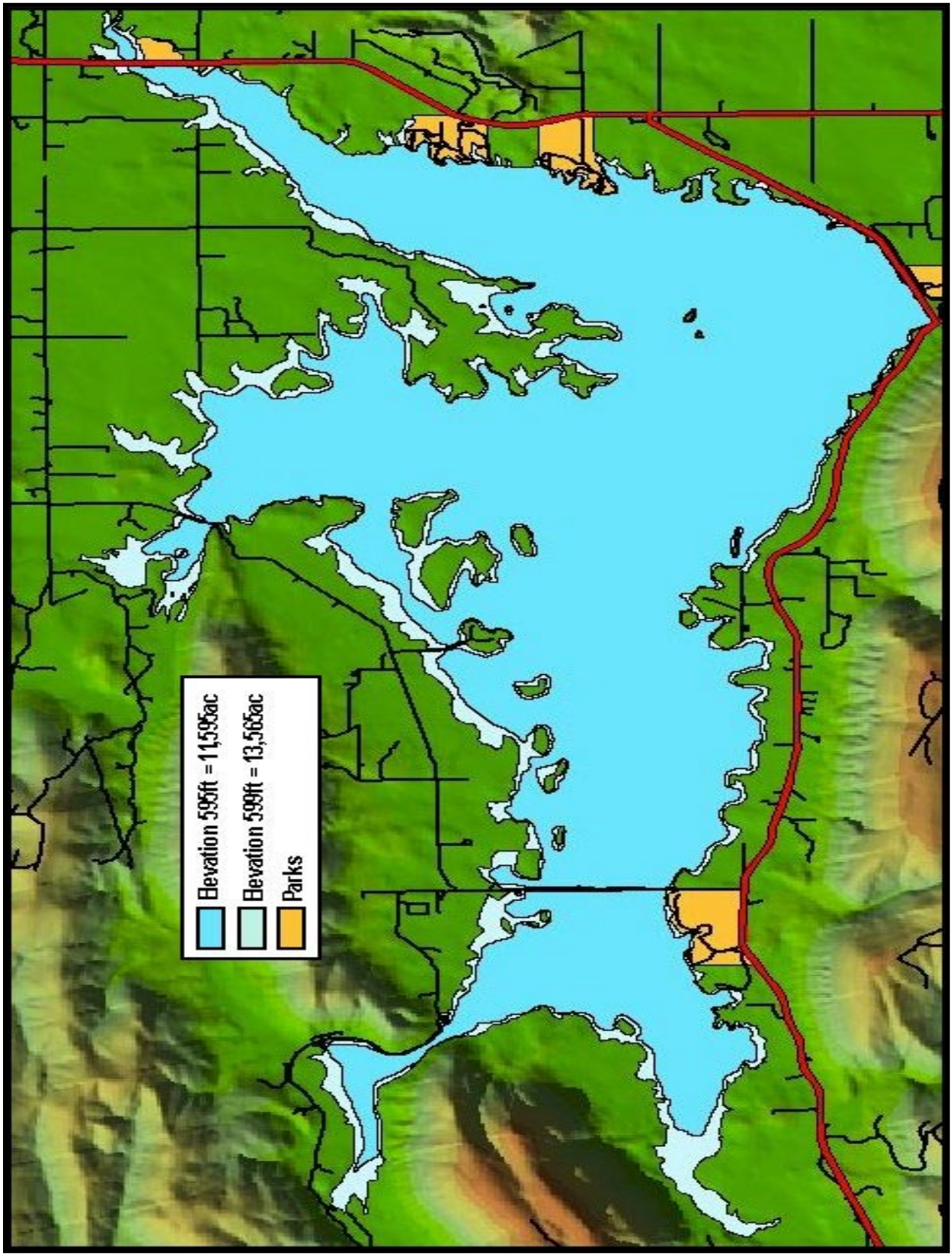


Figure 7
Sardis Lake Level Fluctuations



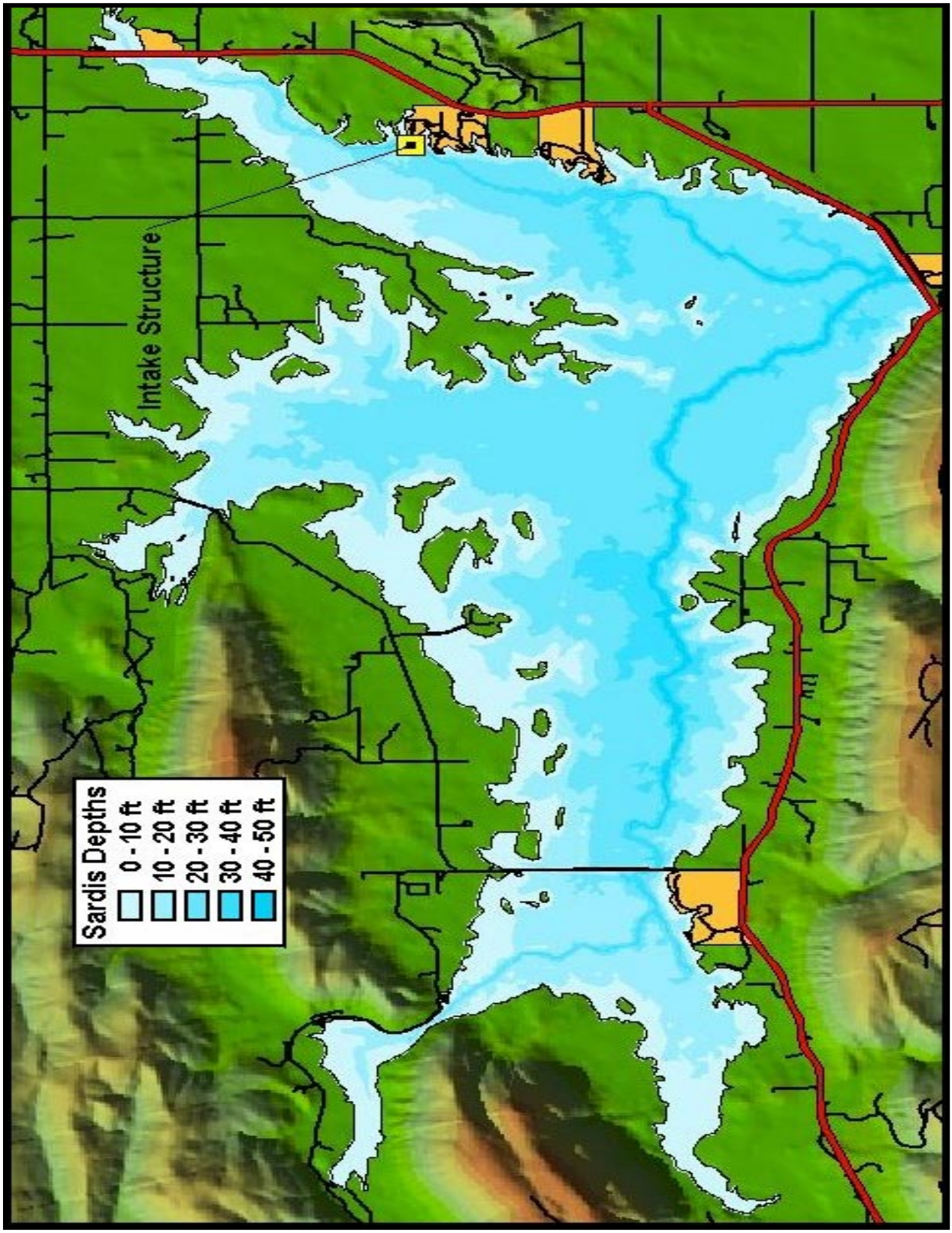
Sardis Lake Bathymetric/Sedimentation Study

As a result of concerns and comments expressed during the Kiamichi Group meetings, the OWRB conducted separate bathymetric mapping studies of Hugo and Sardis Lakes. Utilizing global positioning satellite (GPS) units, agency staff ran hundreds of transects at each lake to determine varying depths at specific geographic locations. Following the field data collection phase, staff verified the information then incorporated it into the OWRB's GIS for comparison with original (or the most recent) topographic maps for each project.

Results of the Sardis Lake study (Figure 8) determined that sedimentation is occurring at the rate anticipated according to the original project plans. Although the bathymetric data will prove more beneficial when compared to future bathymetric studies, the study gathered valuable information about lake depths for more immediate needs, such as in locating or relocating recreational or other facilities.

Members of the Sardis Lake Water Authority and other potential users have expressed much concern regarding placement of the intake structure at the lake's eastern end and that the shallowness of the area could preclude taking of the water in the event of a moderate lake level drop. The OWRB's study determined that lake depth at the structure, which is located in an old stream channel, is approximately 30 feet and would likely present few, if any, problems for potential users in obtaining water supply with the Sardis Lake level management plan in place.

Figure 8
Sardis Lake Bathymetric Study



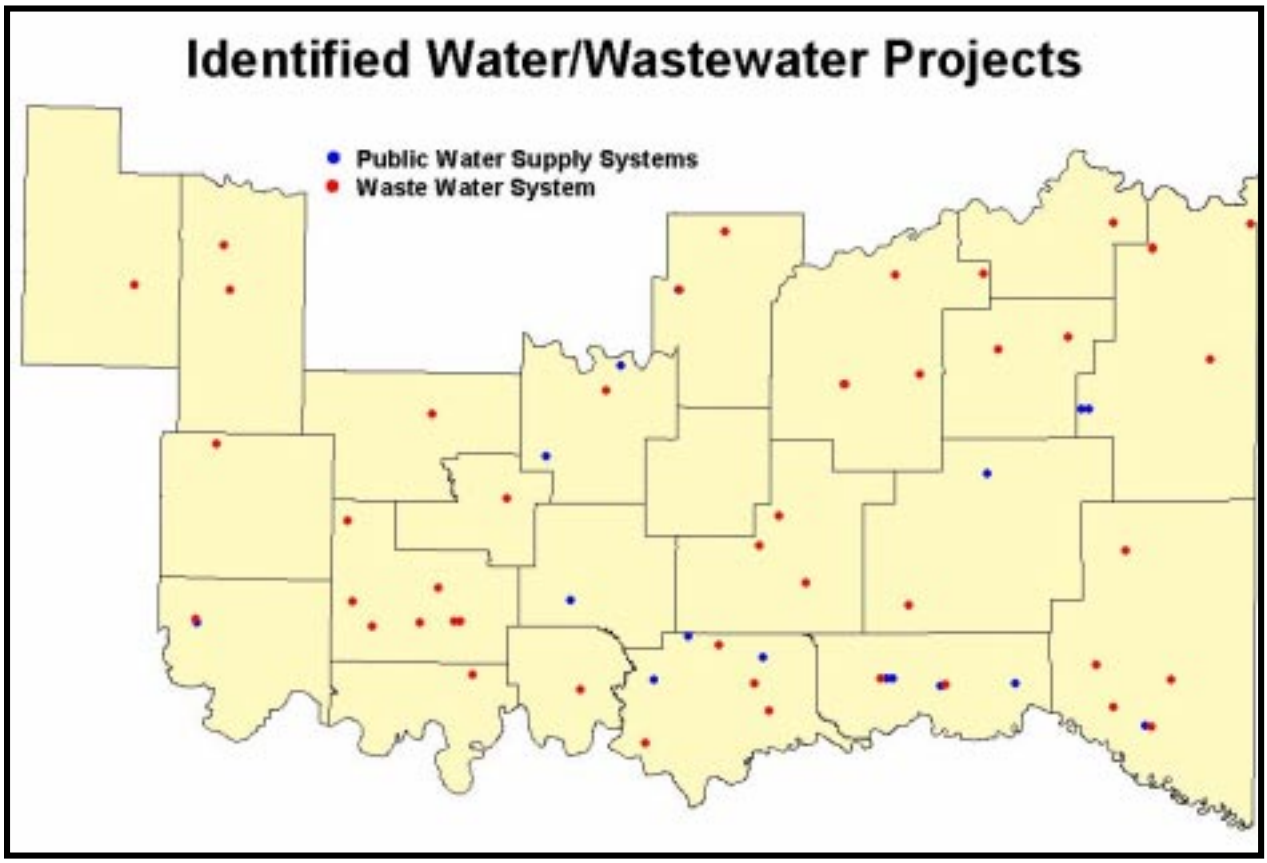
Maximizing Opportunities for Water and Wastewater Financing

"Financing opportunities for water and wastewater infrastructure and related economic development projects within the Kiamichi River Basin area shall be optimized."

During discussions of plans for potential benefits achieved through large-scale development and/or marketing of Kiamichi River water resources, options to finance water and wastewater infrastructure and establish local regional water supplies were considered a priority issue. According to the Oklahoma Department of Environmental Quality, 22 southeast and southern Oklahoma counties, including the entire Kiamichi River Basin region and lands within the Choctaw/Chickasaw Nation boundaries, require approximately $60 million to upgrade public water supply and wastewater infrastructure (Figure 11). Approximately $33 million dollars more in water/wastewater project improvements, beyond those obligated for funding or already under construction, have been identified by Rural Development.

The members of the Kiamichi River Basin Working Group who represent the southern portion of the Basin strongly believe that allowances for the use of proceeds generated through the development of Basin water resources remain flexible as long as they are used within the Basin for water/wastewater or related economic development projects.

Figure 11
Public Water Supply and Wastewater System Needs, Southeast and Southern Oklahoma (DEQ)



Resolving the Sardis Lake Water Supply Construction Cost Obligation

"The obligation of the state to the United States for repayment of construction costs of the water supply at Sardis Reservoir shall be addressed."

As mentioned, the state is currently in discussion with the federal government to negotiate a settlement of the Sardis Lake Water Storage Contract obligation. Recent federal legislation has directed the Office of Management and Budget to calculate a potential Sardis discount purchase amount.

The Kiamichi Group strongly encourages the state to pursue all options, including a potential discount purchase of Sardis water storage, to resolve the dispute and any potential water supply agreement and/or associated revenues should address repayment of disputed water supply storage costs, currently estimated at $40 million.

Protecting the Integrity of the Kiamichi River

"The integrity of the Kiamichi River shall be protected."

Satisfying endangered species concerns is a fundamental aspect in protecting the integrity of the Kiamichi River and its ecosystem. Any potential water marketing or transfer proposal must address requirements of the Endangered Species Act and related local environmental concerns, including potential impacts to the Kiamichi River.

Twenty species of endangered animals, including 12 mussel species, reside within the Kiamichi River Basin, one of the most environmentally diverse stream systems in the country. Of primary concern, according to the U.S. Fish and Wildlife Service, is the Ouachita Rock Pocketbook Mussel, which is particularly dependent upon river flows. A list of endangered species is presented in Table 8 while occurrences of these species, especially the Rock Pocketbook, is detailed in Figure 16.

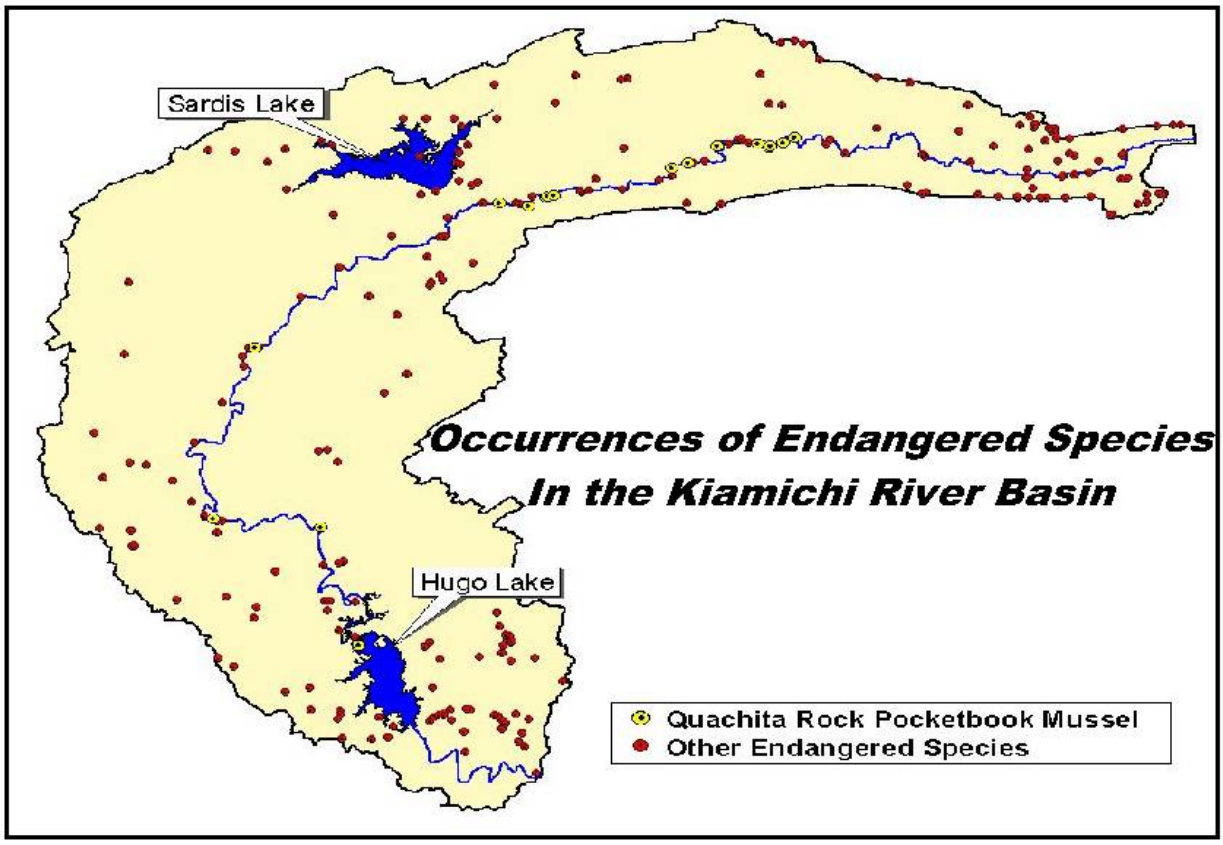
Yet to be determined is the specific impact of reduced Kiamichi River flows or a departure from the river's existing flow regime on the endangered Ouachita Rock-Pocketbook Mussel and other sensitive species downstream of the potential diversion point to central Oklahoma.

Also identified by the Kiamichi River Basin Working Group as a concern are potential impacts of water development projects and/or future lake level management plans on riparian landowners. The Working Group believes that impacts to these individuals should be minimized through mitigation or other appropriate protection measures.

Table 8
Endangered Animal Species, Kiamichi River Basin

Species Type	*Name*	*Common Name*
Fish	Notropis Atrocaudalis	Blackspot Shiner
Mussel	Villosa Iris	Rainbow
Mussel	Villosa Arkansasensis	Ouachita Creekshell
Mussel	Leptodea Leptodon	Scaleshell
Mussel	Ptychobranchus Occidentalis	Ouachita Kidneyshell
Mussel	Villosa Lienosa	Little Spectacle Case
Mussel	Obovaria Jacksoniana	Southern Hickorynut
Mussel	Ellipsaria Lineolata	Butterfly
Fish	Etheostoma Parvipinne	Goldstripe Darter
Reptile	Graptemys Kohnii	Mississippi Map Turtle
Mussel	Lampsilis Hydiana	Louisiana Fatmucket
Fish	Crystallaria Asprella	Crystal Darter
Fish	Notropis Perpallidus	Peppered Shiner
Mussel	Quadrula Metanevra	Monkeyface
Mussel	Strophitus Undulatus	Squawfoot
Mussel	Arkansia Wheeleri	Ouachita Rock Pocketbook
Fish	Hybopsis Amnis	Pallid Shiner
Graminoid	Calamovilfa Arcuata	Sandgrass
Mussel	Obliquaria Reflexa	Three-Horned Wartyback
Fish	Notropis Ortenburgeri	Kiamichi Shiner

Figure 16
Occurrences of Endangered Animal Species, Kiamichi River Basin



Implementing an Appropriate Hugo Lake Level Management Plan

"Investigate implementation of a Hugo Lake level management plan."

"Protect Hugo Lake's wildlife management and waterfowl areas."

Under consideration by the Kiamichi River Basin Working Group were several lake level management plans proposed for Hugo Lake, which already undergoes major fluctuations due to the enormous inflow received from its 1,434 miles of contributing drainage (Figure 17). Of particular concern to lower basin citizens, especially those in the Hugo Lake area, is the impact and potential benefits that these plans would have on the lake's wildlife management and waterfowl areas, as well as local recreation opportunities.

Proposed Hugo Lake Operational Plans

The often conflicting requirements of fishery and waterfowl resources/habitat, as well as boating and related recreational uses of the lake, have prompted the recent study and recommendation of several lake level management plans by the ODWC, Tulsa District of the U.S. Army Corps of Engineers and local leaders. In addition to the existing plan (Figure 18, implemented as part of an ongoing study, which calls for raising the lake level from 404.5 to 409.0 feet from mid-April through mid-July) and a Corps plan implemented from 1986 to 1995 (Figure 19), at least three plans remain under consideration at Hugo Lake:

1. The initial operational plan developed by the Oklahoma Department of Wildlife Conservation (Figure 20), following the Kiamichi Group's request at the meeting in Antlers, which primarily seeks to minimize impacts on the lake's fishery.
2. The ODWC compromise plan (Figure 21) which seeks to balance the often conflicting impacts of lake level fluctuations on the lake's fishery, wildlife and waterfowl resources.
3. A two-year local operational plan (Figure 22) which incorporates seasonal management for recreational concerns along with fishery, wildlife and waterfowl issues.

Both ODWC plans build upon a recent cooperative five-year study between ODWC and the Corps of Engineers which investigated the affects of the study plan, mentioned previously, on Hugo's fishery, wildlife and waterfowl habitat. Each plan seeks to strike a delicate balance between improved management of the lake's fishery and preserving habitat in the waterfowl refuge at the lake's shallow northern end and the wildlife management areas which, to a large extent, also occupy the northern reach of Hugo. Waterfowl and habitat at both land areas are and would continue to be impacted by fluctuating lake levels. However, as with the Sardis plan, an intelligent operational plan at Hugo could actually enhance the habitat for their respective resident species. The local plan, which spans two years, also considers the waterfowl/wildlife areas, but also emphasizes management aimed at improving conditions for boating and related recreational activities.

Hugo Lake, like Sardis, is relatively shallow with an average depth of 13.2 feet at elevation 404.5. However, unlike Sardis, the lake experiences frequent and substantial

lake fluctuations due to its sizable inflow and, as a result, facilities have been constructed above 409 feet, the upper limits of the lake's seasonal elevation. Increases in the lake's surface area from 404.5 feet to 409 feet are fairly significant, especially in the northern waterfowl and wildlife areas. According to OWRB estimations, the total land area inundated as a result of a four-and-one-half-foot increase from 404.5 to 409 feet is approximately 1,555 acres (Table 9, Figure 23).

Table 9
Potential Lake Level Variations, Hugo Lake

Lake Level Elevation ***(feet)***	***GIS Estimation of Surface Area*** ***(acres)***	***GIS Estimation of Total Storage*** ***(ac-ft/yr)***	***GIS Estimation of Depth*** ***(feet)***
404.5	11,675	156,777	13.2
409.0	13,230	214,587	16.2

Figure 17
Hugo Lake Annual Inflow

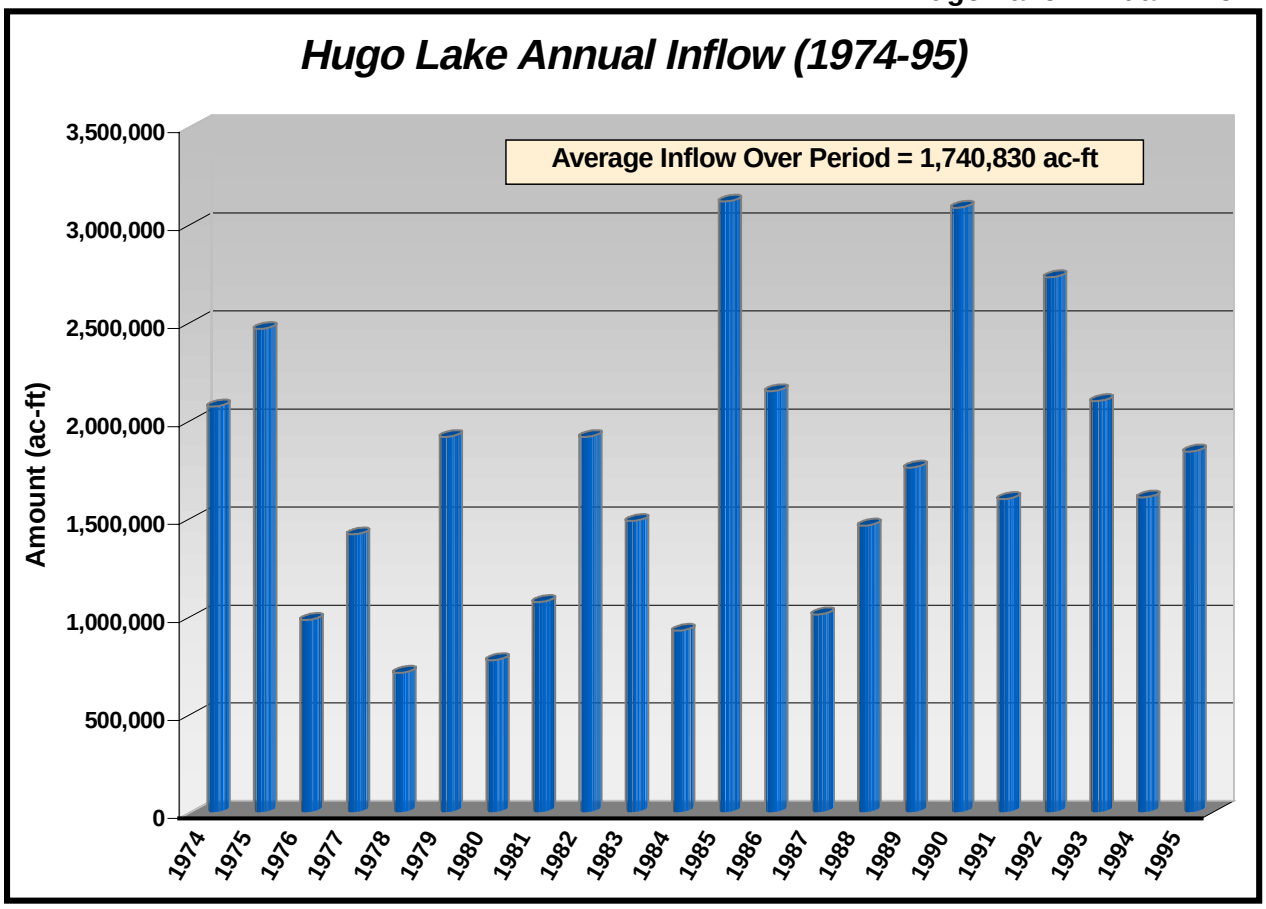


Figure 18
Hugo Lake Existing Seasonal Pool Plan

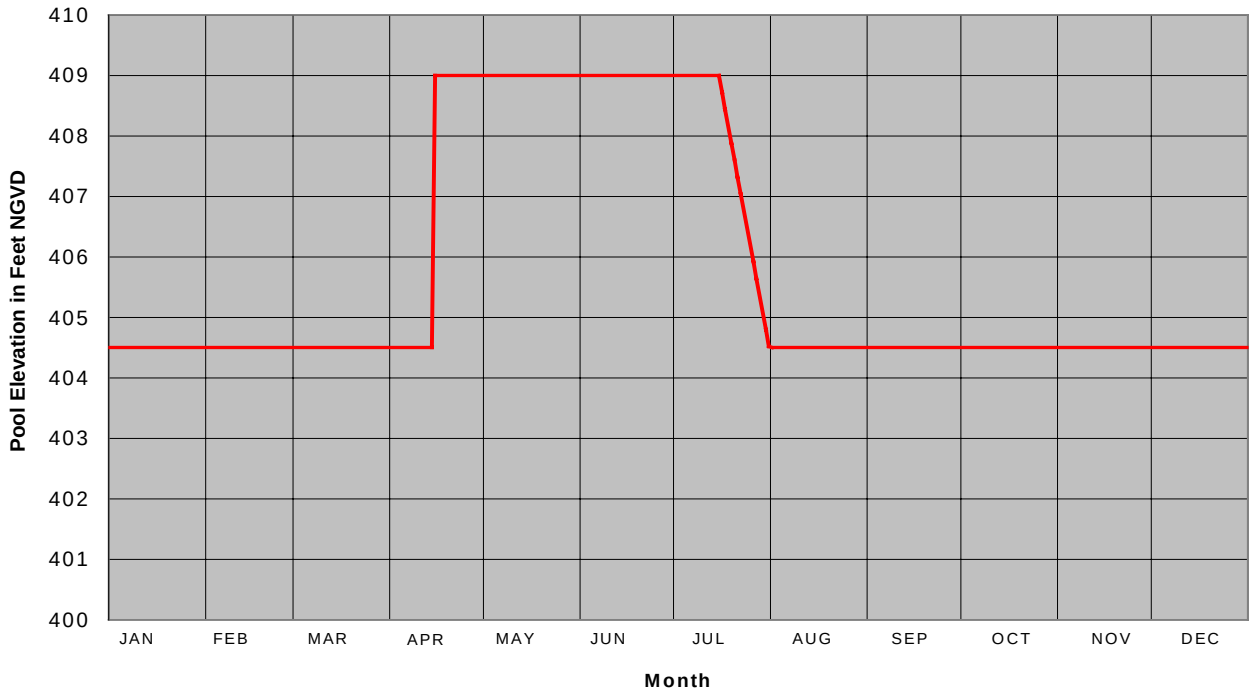


Figure 19
Hugo Lake Existing Conditions Plan (1986-95)

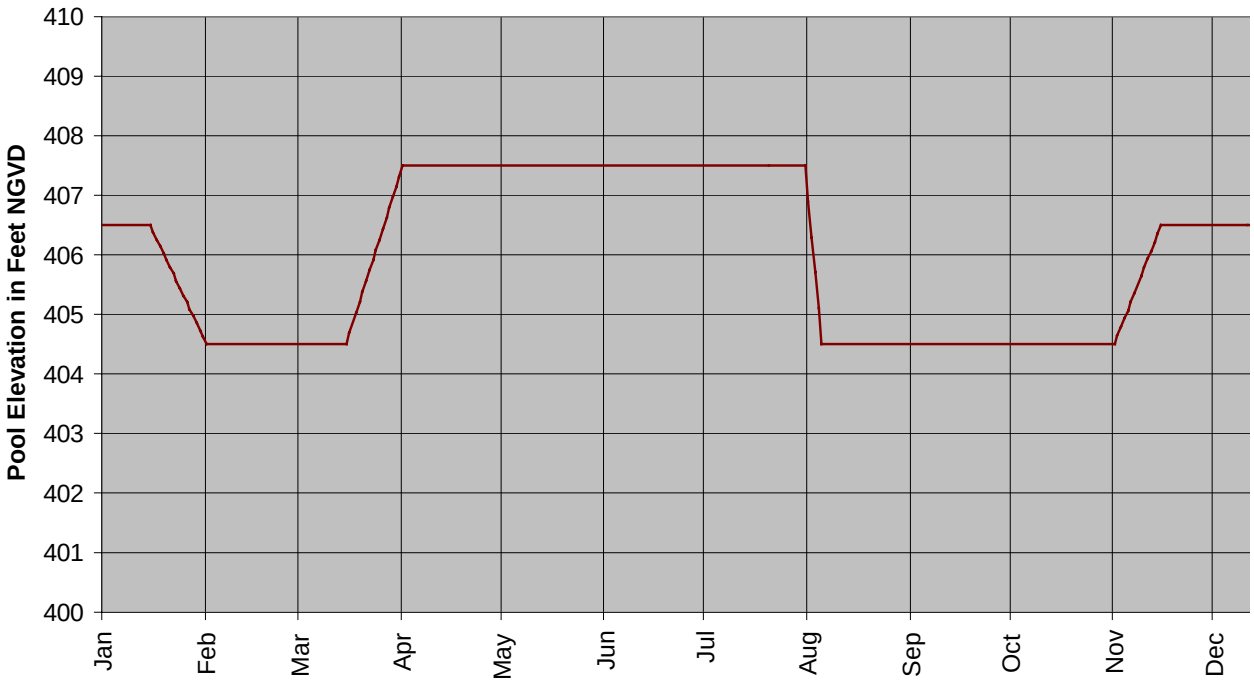


Figure 20
Hugo Lake ODWC Operational Plan

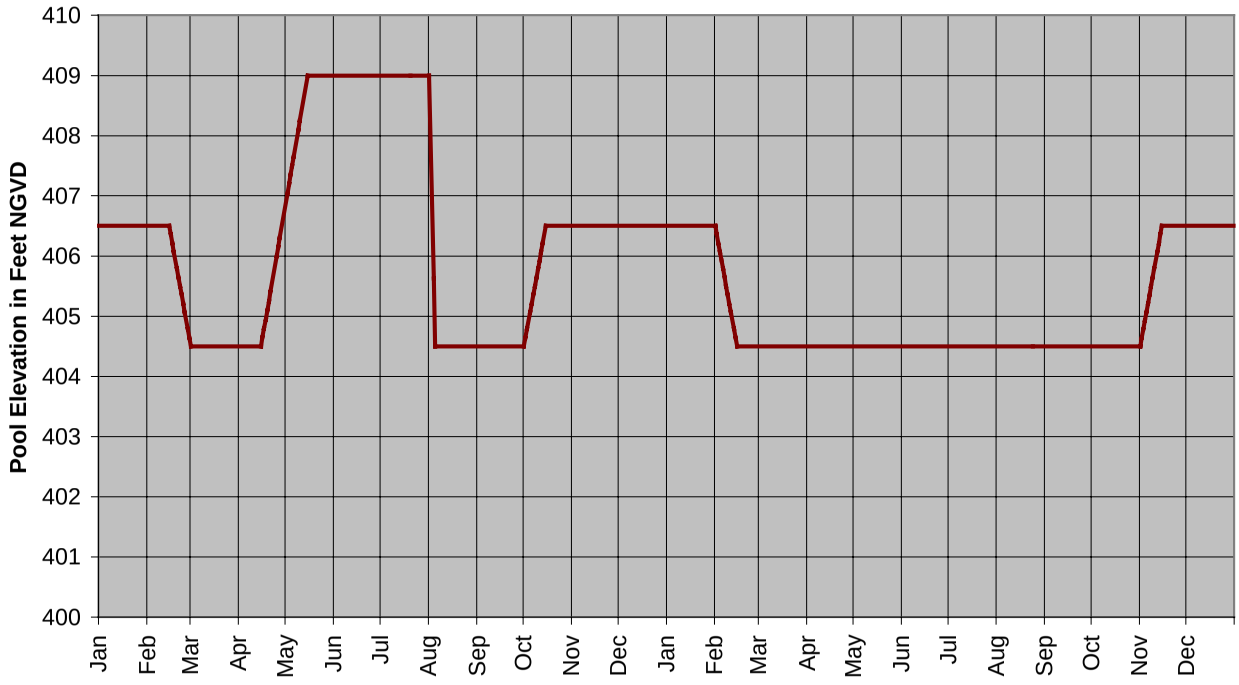


Figure 21
Hugo Lake ODWC Compromise Operational Plan

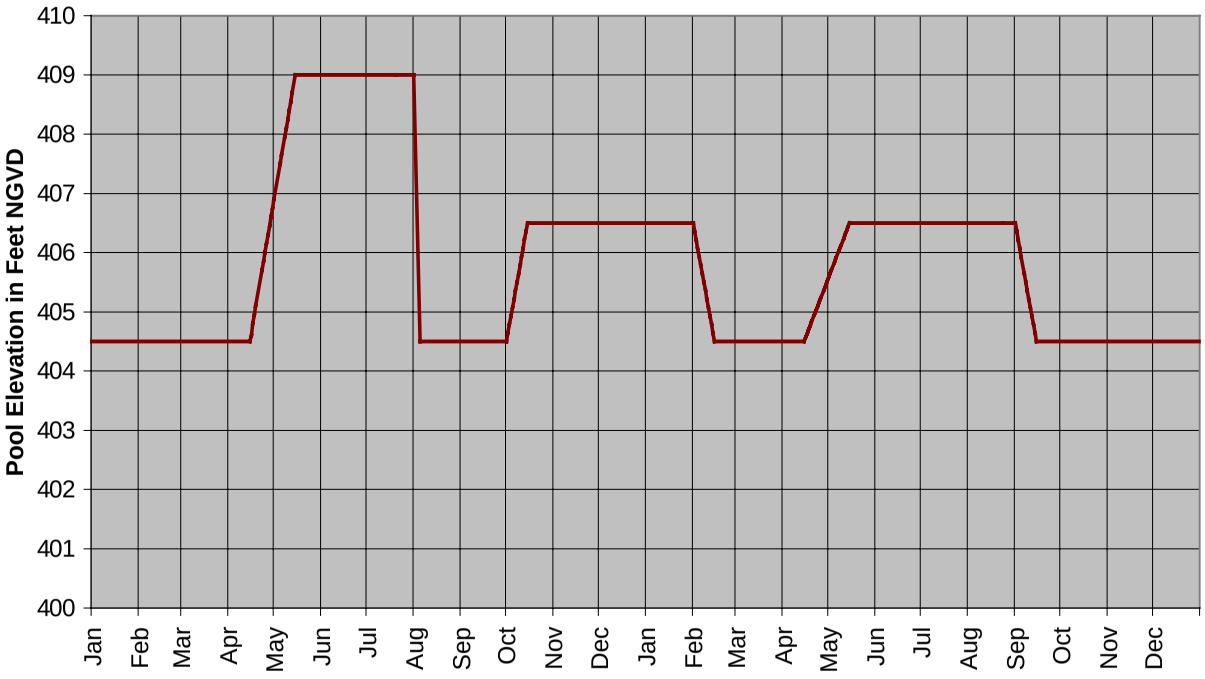


Figure 22
Hugo Lake Local Operational Plan

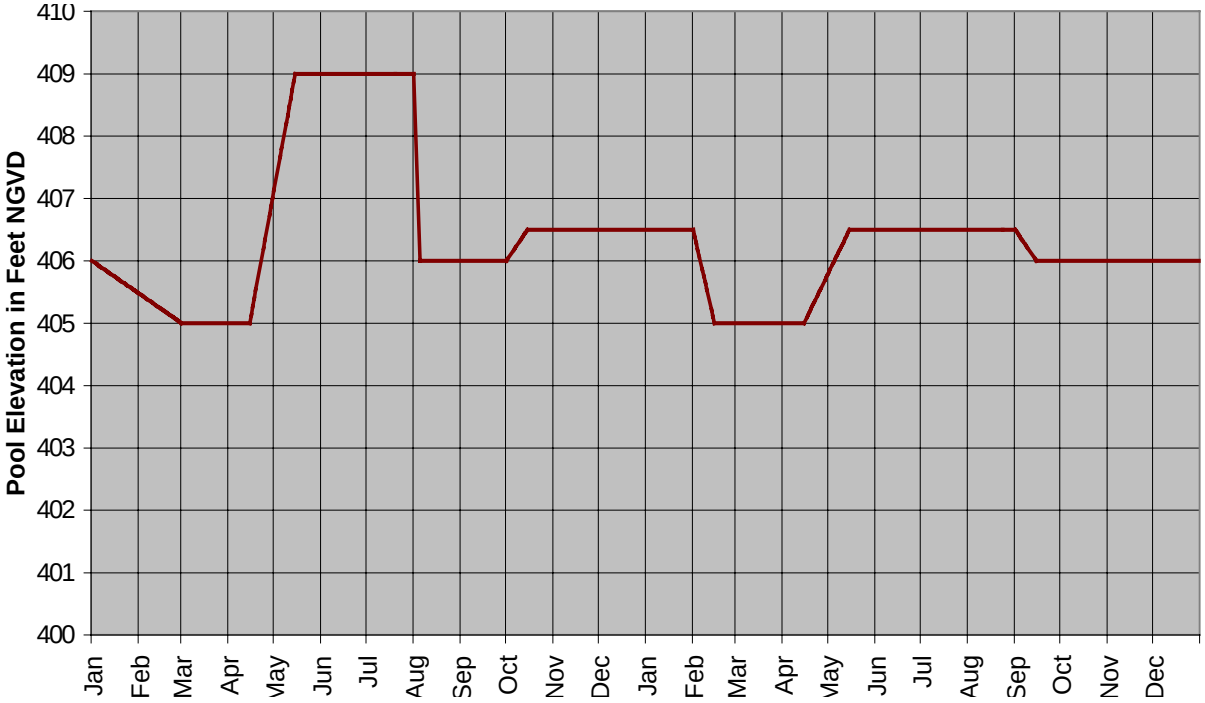
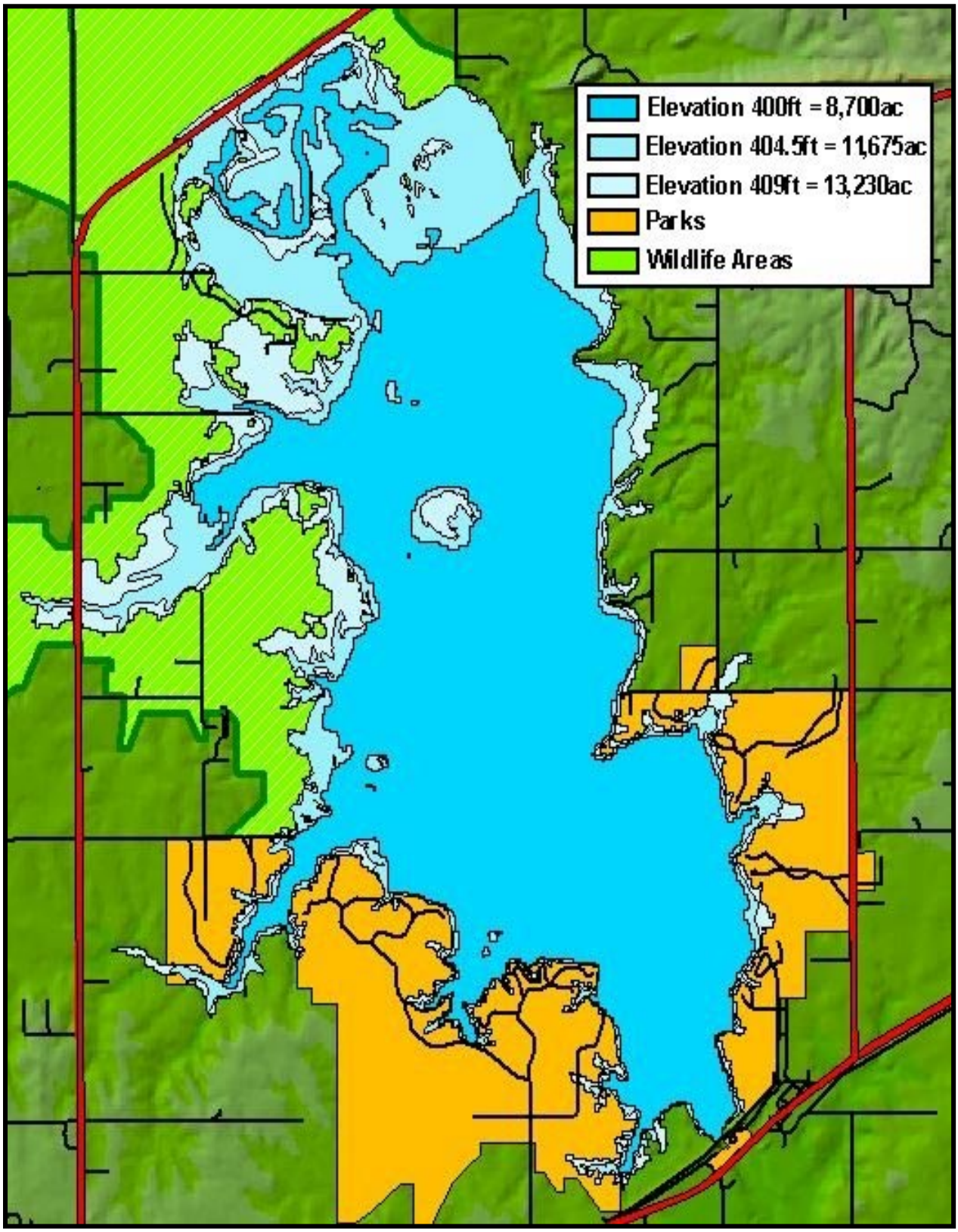


Figure 23
Hugo Lake Level Fluctuations

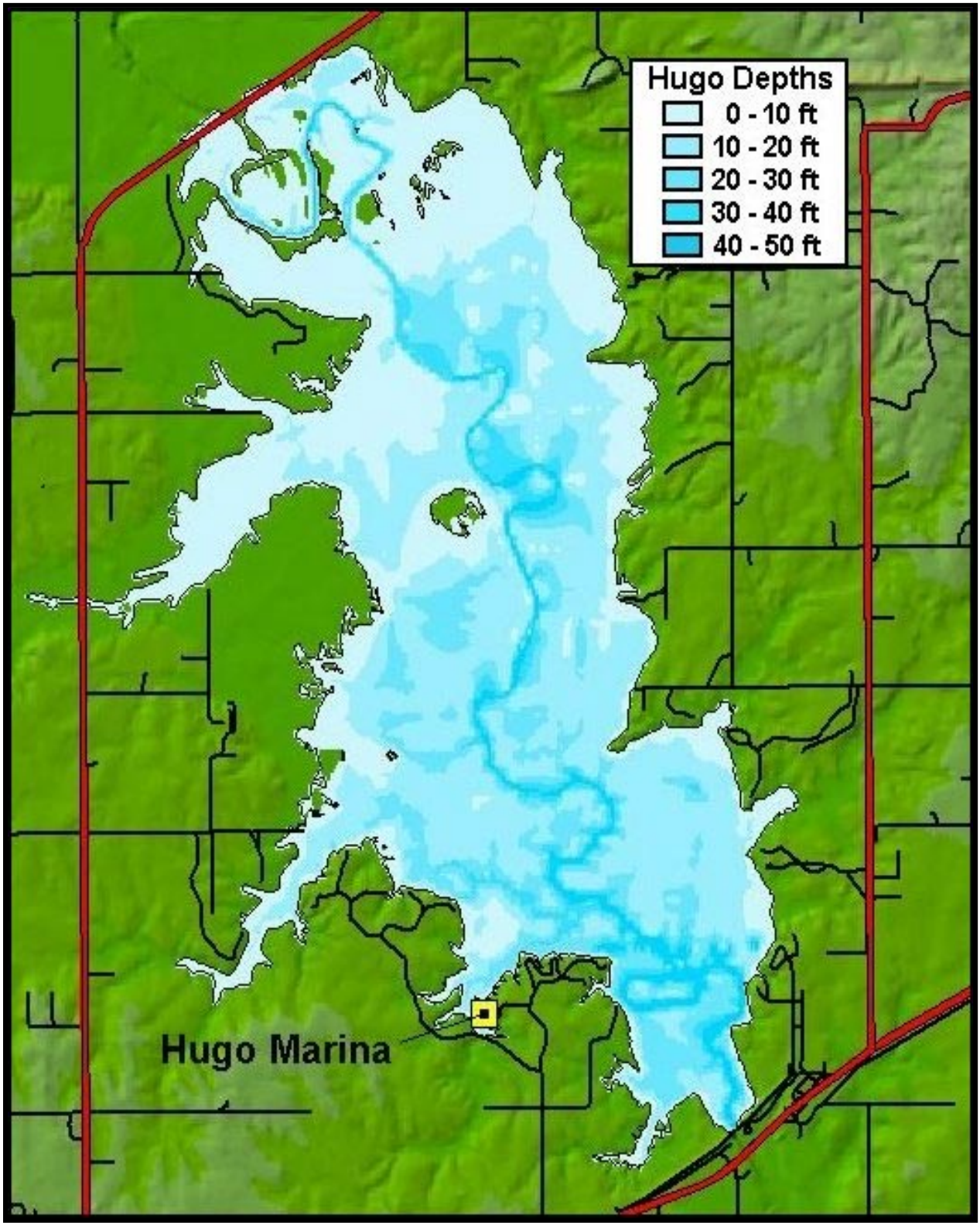


Hugo Lake Bathymetric/Sedimentation Study

As at Sardis, the OWRB conducted a bathymetric mapping study of Hugo Lake and results showed that sedimentation is occurring at the anticipated rate (Figure 24). Similar concerns were expressed about the shallowness of Hugo Lake at the marina, which regularly limits boating and related recreational opportunities in the area. Data resulting from the bathymetric study confirmed that, at the lake's normal level, depths near the marina are only a few feet in many areas.

The Kiamichi River Basin Working Group also agreed that Hugo Lake sedimentation must be considered in all future lake level management plans.

Figure 24
Hugo Lake Bathymetric Study



Impacts of Lake Operational Plans on Potential Water Diversion

Responding to a request from the Kiamichi Group, the Corps of Engineers conducted an exhaustive hydrologic investigation to determine how the potential lake level management plans at Sardis and Hugo would impact the amount and timing of water taken from the Kiamichi River at a point near Antlers, Oklahoma. This location would likely be the most advantageous and economical point to take water for eventual diversion through the Oklahoma City Water Utility Trust's Atoka/McGee Creek Pipeline, approximately 18 miles west, for use in central Oklahoma.

Points of interest identified by the Corps for the period of record basin simulations were:

1. How would each of the three seasonal pool plans (the ODWC preferred plan, ODWC compromise plan and the local users preferred plan) affect the lake levels at both Sardis and Hugo and what are the potential downstream impacts of withdrawal of water at Antlers?
2. How would each of the three plans affect the water supply yield at Hugo Lake?
3. How do the three seasonal pool plans affect the available flow at the Antlers control point and what amount of flow would be available for out-of-basin diversion at that point?

In their analysis, the Corps also included the proposed Sardis operational plan, the original authorized operational plan at Hugo Lake and the plan implemented at Hugo from 1986 to 1995. All simulations utilized period of record (1938 to 1990) flow figures for the Kiamichi River as well as a maximum pumping rate of 200 cfs (almost 130 mgd). Several protection measures, or assumptions, were included in the Corps model scenarios. They were:

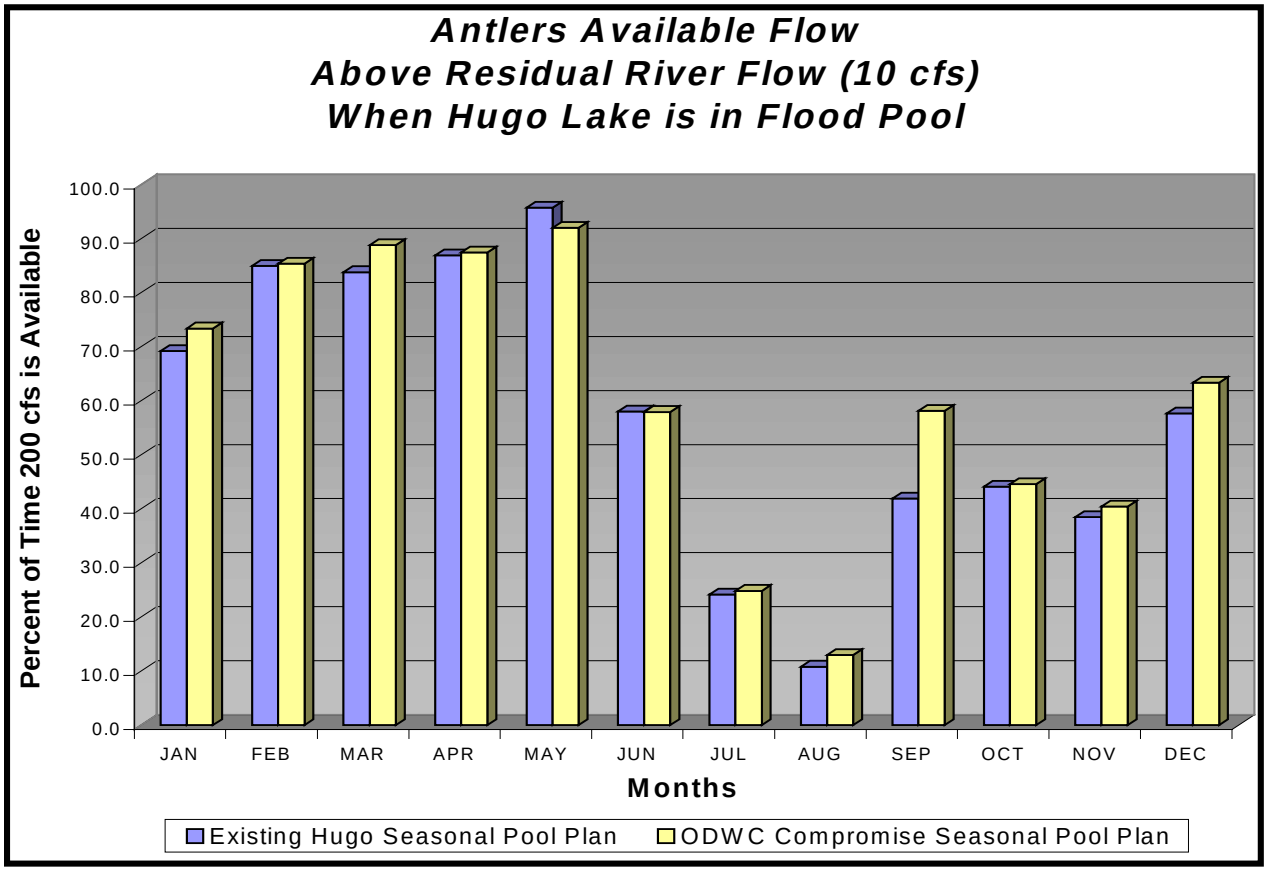
1. a base Kiamichi River flow of 10 cfs;
2. existence of the ODWC's Sardis seasonal pool plan;
3. a Sardis water supply demand of 20,000 ac-ft/yr (27.6 cfs), the amount set aside for future local use, with no additional demands;
4. a Hugo water quality storage demand of 90 mgd (140 cfs); and
5. pumping at Antlers only when the water level at Hugo is above the top of the current conservation pool elevation (404.5 feet), thereby protecting the lake's entire water supply.

Initial results of the study determined that removal of 200 cfs from the river system would have only a nominal impact on the average flow of the Kiamichi River. Regarding the timing of diversions, 200 cfs would be available slightly more often with the ODWC compromise plan than with the existing seasonal pool plan at Hugo (Figure 25). From February through May, that amount would be available at least 80 percent of the time with either plan in place. In the typically driest summer months (July and August), the water would be available only about 10 to 20 percent of the time.

In summary, the Corps' hydrologic study determined that while this "seasonal" source of water supply directly from the Kiamichi River does not offer the dependability of a reservoir source, it is potentially ideal for entities -- such as Oklahoma City (Oklahoma City Water Utilities Trust) through its central (Hefner, Overholser and Stanley Draper), northwest (Canton) and southeast (Atoka and McGee Creek) water supply systems -- who utilize multiple storage/reservoir sites. These reservoir systems can be balanced and "topped-off" during wet periods or during the winter months, such as December and January when 200 cfs would be available approximately 55 to 70

percent of the time. This allows augmentation of reserve supply for usage during peak, high water demand periods that typically occur during the heat of summer.

Figure 25
Available Flow at Antlers, Corps of Engineers Study



Satisfying the Hugo Municipal Authority's Water Storage Contract

"Satisfy the Hugo Public Works Authority's water supply storage contract with the Corps of Engineers."

Among tasks facing the Kiamichi River Basin Group in its directive under HCR 1066 was investigation of measures to satisfy the Hugo Municipal Authority's (formerly, the Hugo Public Works Authority) water storage contract with the U.S. Army Corps of Engineers, especially future use storage costs concerns. Under terms of the agreement, Hugo has contracted for 20,520 ac-ft/yr of water supply storage in the lake, including the present use of 1,640 ac-ft/yr and future use of 18,880 ac-ft/yr. Currently, the Hugo Municipal Authority uses less than five percent (942 ac-ft/yr) of the total contracted amount.

The Kiamichi Group emphasizes that any potential water development proposal must provide opportunities that allow the Hugo Municipal Authority to resolve these contractual concerns.

WATER DEVELOPMENT PROPOSAL EVALUATION CRITERIA

Soliciting public comment during the Group's five meetings and utilizing the 10 cornerstone principles as a guide, the Kiamichi River Basin Working Group has identified seven "water development proposal evaluation criteria" which they determine must be satisfied prior to approval of any proposed plan or project for the use, development and/or transfer of Kiamichi River Basin water resources. Furthermore, in the selection of a proposal(s) or plan(s), primary consideration should be afforded to the needs of citizens residing within the Basin followed by the various needs of state citizens in general. Selection of a plan that involves the transfer of water resources out of the Basin should be considered only after these needs are comprehensively addressed.

These criteria, which are consistent with the objectives of HCR 1066, are:

1. Is the proposal consistent with the cornerstone principle which grants Oklahomans the highest priority related to protection of present and future water needs?
2. Does the proposal protect future local uses of Sardis Lake water and does the proposal protect future water supply in the Hugo area?
3. Does the proposal include implementation of a lake level management plan at Sardis Lake to protect fishery and recreational interests and is the proposal compatible with existing and potential Hugo Lake management plans to protect Hugo's wildlife and waterfowl management areas?
4. Does the proposal optimize water/wastewater financing opportunities in the Kiamichi River Basin?
5. Does the proposal address the state's obligation for federal construction costs at Sardis Lake?
6. Does the proposal include measures to satisfy the Hugo Municipal Authority's water storage contract with the Corps?
7. Does the proposal protect the integrity of the Kiamichi River, especially regarding endangered species and riparian landowners residing in the Basin?

Additional, more detailed study is required prior to application of these criteria to both formal and informal water development proposals for the use, development and/or transfer of Kiamichi River Basin water supplies and a subsequent decision on the plan which provides the greatest benefits to the citizens of Oklahoma.

KIAMICHI WATER DEVELOPMENT PROPOSALS

The Kiamichi River Basin Working Group has identified eight existing formal and informal proposals for the use, development and/or inter-basin transfer of water resources in the Kiamichi River Basin. During further study of water development options, each proposal should be applied to the water development criteria established by the Kiamichi Basin Group and thereby judged according to its ability to produce revenue that would satisfy the Sardis water storage obligation, boost local economic development and satisfy much-needed water/wastewater infrastructure needs, protect local recreation and fish and wildlife interests, and ensure water supply for future users in the region. The Kiamichi Group determined, however, that none of the considered proposals appear to satisfy all identified water development criteria.

Below is a list of these proposals, including the sponsoring parties and a brief description of each plan's known aspects, presented to the Kiamichi Basin Group in its cursory examination conducted under the direction of HCR 1066:

Sardis Lake Water Authority
SLWA has a pending water use application with the OWRB for the use of 44,750 ac-ft/yr of Sardis Lake water for proposed public water supply purposes. Authority officials plan a four-phase expansion of the district's service area, with the final phase including a water sale to central Oklahoma.

Clayton Chamber of Commerce
The Chamber has a pending water use application with the OWRB for the use of 75,000 ac-ft/yr of Sardis Lake water for proposed power, industrial and recreation, fish and wildlife purposes.

Sardis Water Resources Board
The Board has a pending water use application with the OWRB for the use of 221,000 ac-ft/yr of Sardis Lake water for production of food and fiber, recreation, fish and wildlife, agriculture, power, commercial, aquaculture, drilling of gas and oil wells, stock-raising and artificial recharge of groundwater.

Oklahoma City Water Utilities Authority
The OCWUT has unofficially offered approximately $40 million for an unknown quantity of Kiamichi River Basin water. OCWUT representatives have stated that they would not anticipate utilizing the supply or providing appurtenant infrastructure for approximately 25 years. The agreement would reportedly involve creation of a local water trust in southeast Oklahoma.

Central Oklahoma Water Authority
An organization known as the Central Oklahoma Water Authority, through a local engineer representative, has submitted a water use application to the OWRB for the interbasin transfer of 390,000 ac-ft/yr of water from the Kiamichi River as part of a 100-year plan to supply central Oklahoma water needs. The proposal includes the potential construction of additional reservoirs/facilities with identified net proceeds of up to $49 million.

Central Oklahoma Communities (Association of Central Oklahoma Governments)
ACOG, a sub-state planning organization, is currently assessing the interests of numerous central Oklahoma communities regarding their potential involvement in a cooperative effort to purchase at least 130 mgd of Kiamichi River Basin water to supply the long-range water needs of those communities, including the City of Norman which has expressed a need for 30 mgd.

North Texas I
A Texas land/water developer has proposed a plan for the sale or lease of water from the Kiamichi River Basin, supplemented through construction of one or more upstream reservoirs on major tributaries of the Kiamichi River, to the North Texas area. Economic development through creation of private recreation/tourism ventures appears to be a primary goal of the plan.

North Texas II (McGraw-Hill)
The McGraw-Hill engineering firm has proposed the sale or lease of water from the Kiamichi River, Sardis Reservoir and the Boggy River to the north Texas area. This plan includes the potential development of the Tuskahoma and Boswell reservoir sites and the potential generation of approximately $325 million in net revenue.

North Texas III (North Texas Municipal Water District)
Though offering no formal proposal at this time, the NTMWD, which serves a large region north of the Dallas/Ft. Worth metroplex, has expressed a dire need to secure a large amount of water supply for their rapidly growing service area in north Texas whose population is expected to double by the year 2020. The District, which is also investigating the construction of several reservoirs in Texas to supply their needs, was originally involved in water marketing negotiations with the State of Oklahoma as a result of SJR 31, passed in 1992 but voided by an Attorney General's decision the following year.

RECOMMENDATIONS

The extensive hydrologic data and information reviewed by the Kiamichi River Basin Working Group, including the results of associated studies conducted by supporting agencies and organizations, indicates that there is available water resources in the Kiamichi River Basin to consider for large-scale use, development and/or inter-basin transfer. In addition, existing proposals reviewed by the group indicate that there is sufficient interest from various parties and entities to warrant further investigation by the state into various, existing water development projects.

Through submittal of this Kiamichi River Basin Water Development Plan, as directed under HCR 1066, the Kiamichi River Basin Working Group provides the following official recommendations to the State Legislature for proposed action and approval prior to the conclusion of the Second Session of the 48th State Legislature:

1. ***The State of Oklahoma should continue to pursue formal development of a compact or other agreement with the Choctaw and Chickasaw Tribes that will facilitate the development and best uses of water resources in the Kiamichi River Basin and incorporate the cornerstone principles and water development criteria identified by the Kiamichi River Basin Working Group.***
2. ***The State of Oklahoma and Choctaw and Chickasaw Tribes should invite comment from informed individuals, citizens and the public into any process that allows water to be transferred out of the Kiamichi River Basin.***

Water Quantity Conversion Table & Land Measures

To convert from one water quantity measurement to another, multiply the existing measurement number by the number contained in the appropriate column at right.	**CFS**	**GPM**	**MGD**	**AC-FT/YR**	**AC-FT/DAY**
CFS (cubic feet/second)	---	450	.646	724	1.98
GPM (gallons per minute)	.00222	---	.00144	1.61	.00442
MGD (millions gallons/day)	1.55	695	---	1120	3.07
AC-FT/YR (acre-feet/year)	.0014	0.62	.00089	---	.00274
AC-FT/DAY (acre-feet/day)	.504	226	.326	365	---

For example, to convert 140 million gallons per day (mgd) to cubic feet per second (cfs), you would multiply 140 times 1.55 to come up with the desired conversion, 217 cfs.

1 acre = 43,560 square feet 1 acre = 0.0015625 square miles

1 square mile = 640 acres

ATTACHMENTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
222 S. Houston, Suite A
Tulsa, Oklahoma 74127

RECEIVED
SEP 16 1999
Oklahoma Water Resources Board

September 15, 1999

Mr. Duane A. Smith
Executive Director
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, Oklahoma 73118

Dear Mr. Smith:

Since early July of this year, the U.S. Fish and Wildlife Service (Service) has had opportunity to meet with you and others of the Kiamichi Basin Working Group regarding an interest in formulating a comprehensive water development plan for the Kiamichi River basin. In addition to offering our expertise to the working group, we have performed initial coordination with the Oklahoma Department of Wildlife Conservation (Department), in order to help identify needs of fish and wildlife resources to be addressed in the Department's lake level management plan. We expect to continue such coordination, as well as provide direct input regarding needs for protecting the ecological integrity of the Kiamichi River, as required by Oklahoma House Concurrent Resolution No. 1066.

To date, discussions of development have been largely conceptual and tentative in nature. This limits the extent and detail of comments the Service is able to provide at this point. However, certain conceptual features that have been discussed pose significant potential impacts to the biota of the Kiamichi River basin. We believe it would be helpful to identify such impacts for the working group, which is the purpose of this letter.

1. **Water conveyance.** Although discussions to date have largely proposed conveying flows from Sardis Lake to Hugo Lake using the Kiamichi River channel, an option has been mentioned of piping flows directly from Sardis. It is important to the river biota that as much water as possible (i.e., all that not retained for local use) be conveyed down the river channel in a manner consistent with Item 3 below, rather than taken out at Sardis. Thus, development discussions should continue to rely on use of the river channel to convey flows as much as possible.

2. **Takeout points.** One predominant development scenario involves taking some water out in the area of Moyers, Oklahoma, and the remaining quantity out at Hugo Lake. We foresee serious impacts resulting from withdrawing any significant quantity of water in the area of Moyers. This reach of the river provides important habitat for the endangered Ouachita rock-pocketbook mussel (*Arkansia wheeleri*) and also supports a high diversity of mussel species in general. The values of high quality mussel habitat, a high diversity of mussel species, and presence of the Ouachita rock-pocketbook continue downstream, approximately to the vicinity of the Oklahoma Highway 3 bridge west of Rattan. Therefore, to avoid impacting these values, we recommend that all water be withdrawn from Hugo Lake, or that any second withdrawal point be located no farther upstream than the Oklahoma Highway 3 bridge.

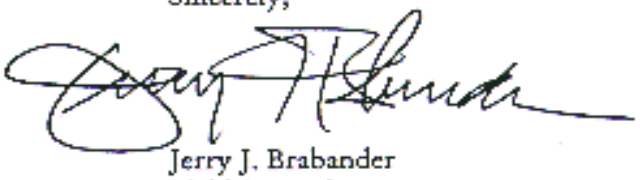
3. **Timing of flows.** Timing of flows can drastically affect mussel survival, through such mechanisms as alteration of natural substrate and sediment conditions, alteration of natural temperature regimes, dilution of gametes and glochidia, effects on food organisms, effects on host fishes, and emersion. By similar or additional mechanisms, flow conditions influence the ability of the Kiamichi River to support its exceptionally high number and diversity of other native species. Consequently, it is important that modifications of river flows be managed to (1) maintain minimum instream flow needs for native species, (2) avoid flows damaging to habitat conditions or reproductive processes, and (3) avoid abrupt fluctuations in instream flows. Many unknown aspects of the Kiamichi River ecosystem prevent development of a final set of recommendations regarding flow management; however, we believe a sound interim approach would involve timing releases from Sardis Lake to more closely simulate natural (i.e., pre-impoundment) flows down the river, to the extent possible. We are prepared to develop recommendations along these lines once given more specific details regarding water quantities to be held at Sardis and those to be passed downstream. Any resulting water management plan would need to remain flexible as additional knowledge is gained of instream flow needs. However, assuming sold water can be stored at Hugo Lake or other storage facilities, timing of flows to protect the river ecosystem should not pose an insurmountable problem for development interests.

4. **Lake level fluctuations.** Increased water fluctuations and a general increase in the level of Hugo Lake will result in the effective loss of many acres within the Hugo Wildlife Management Area (WMA), as well as losses of improvements to those acres in the form of roads, dikes, fencing, and other facilities and structures. These lands were dedicated to fish and wildlife resource management as partial mitigation for habitat impacts resulting from the Hugo Lake project. In addition, public use of the WMA is very important to the region economically. Therefore, we would expect that any impacts to the WMA resulting from a development plan would need to be fully compensated in terms of habitat acres and associated improvements.

As indicated, these comments constitute an initial attempt to provide helpful input to the Kiamichi Basin Working Group. We will provide continued assistance by direct communication with the group, by coordination with the Department, and by consultation with other federal and state agencies that will become involved as the plan progresses. We encourage you and the working group to furnish us with any specific details under consideration, as this will aid our ability to provide prompt and thorough assistance.

Should you have any specific questions or needs, please feel free to contact me or Mr. David Martinez of this office.

Sincerely,



Jerry J. Brabander
Field Supervisor

cc: Director, Oklahoma Department of Wildlife Conservation, Oklahoma City, OK

ADM:ag:KRISSUES

MARK COLEMAN
Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

FRANK KEATING
Governor

October 19, 1999

MEMORANDUM

TO: Duane A. Smith, Executive Director
Oklahoma Water Resources Board

FROM: Jon L. Craig, Director
Water Quality Division

RE: Kiamichi River Watershed

The following information is provided to assist the Oklahoma Water Resources Board in fulfilling its legislative mandate under the Enrolled House Concurrent Resolution No. 1066, which requires the submission of a Kiamichi River Basin Water Resources Development Plan by February 1, 2000. This memorandum includes and provides additional information to that contained in our August 2, 1999, memorandum.

The following is a summary of municipal enforcement actions and improvement activities related to public water supplies and wastewater collection and treatment systems in the 22 county area within the original Choctaw/Chickasaw Nations tribal boundary (south of the Canadian River from Arkansas line to 98th meridian). The estimated costs contained herein were provided by consulting engineers, by the systems' personnel, or from other sources. These estimated costs should be used for project development purposes only. Engineer's estimates are required for project funding and bidding.

cc: Dean Couch
Paul Hodge
Glen Jones
Carl Parrott
Wayne Craney

707 NORTH ROBINSON, P.O. BOX 1677, OKLAHOMA CITY, OKLAHOMA 73101-1677

Public Water Supply Systems

McCurtain:

Idabel – PWSID 1010203 – water treatment plant improvements. Cost estimate from their engineer, Jay Updike, PE, Holloway, Updike, & Bellen, is $360,000. Not under a Consent Order. Improvements due to a Comprehensive Performance Evaluation (CPE) being conducted by EPA Region 6 and the DEQ.

LeFlore:

Talahina – PWSID 1010304 – water treatment plant improvements. The cost estimate from the engineer, Dudley & Associates, P.C., is $470,000. The cost estimate for a waterline to serve the new Indian Hospital is $213,000.

Pushmataha:

Clayton – PWSID 1010301 – water treatment plant improvements. The cost provided by their engineer, Dudley & Associates, P.C. is $150,000.

Choctaw

Hugo – PWSID 1010314 – water treatment plant improvements. The cost provided by their engineer, Roger Ford, PE, NRS Consulting Engineers, is $2,113,000

Soper – PWSID 2001201 – water storage tank replacement and treatment for iron and manganese. Cost estimates, provided by their engineer, Dudley & Associates, for the tower is $139,900 and for the treatment facility is $151,000. The tower project has gone out for bids.

Fort Towson – PWSID 2001207 – replace waterline to the Lake Raymond Gary area and construct a filtration plant. Their engineer is Roger Ford, PE, NRS Consulting Engineers. A NOV has been sent and the Consent Order is being drafted. The engineer has not provided a preliminary engineering report; therefore, a cost estimate is not available.

Hughes

Holdenville PWSID 1020803 – water treatment plant and water lines. The cost estimate provided by their engineer, Spear & McCaleb Co. is $4,177,000

Bryan

Kenefic PWSID No 2000701 – new water storage tank. Cost provided by their engineer, Charles Sullivan, PE, is $60,000. Construction has started.

Bryan County RWD # 6 PWSID 3000725 – construction of a new tower and chlorination facility. Their engineer, Spear & McCaleb Co., Inc. did not provide cost estimates.

Bryan County RWD # 2 PWSID NO. 3000701 – water treatment plant improvements. Cost estimate provided by their engineer, Fox & Dreschler, Inc., is $697,000.

Johnston

Ravia PWSID 2003504 – two new wells and transmission lines. Their engineer is Dudley & Associates. There are no cost estimates provided by the engineer for this project.

Pontotoc

Francis PWSID 2006205 – new wells, transmission lines, and ozone treatment plant. Cost provided by their engineer, Skip Landes, is $401,000

Roff: PWSID 2006206 – new pump house, wiring and controls. No engineering report or cost estimate available.

Jefferson

Waurika PWSID #1011201 – construction of new water treatment Plant, 1.2 MGD capacity. Financing has been obtained and bids should go out in January 2000. The original estimate in 1996 was $2,070,000, but Waurika decided they needed a smaller plant and the plans were revised from a 2.0-MGD plant to a 1.2-MGD plant. Estimated cost for the smaller plant is not available. The engineer is Myers Engineering Corporation.

Wastewater Systems

McCurtain

Battiest School – repair of a leaking lagoon is required. Cost estimate from the engineer, Dudley and Associates, is $99,000.

Broken Bow – project involves changing the wastewater treatment process from a conventional activated sludge system to a sequencing batch reactor system and addition of a storm water holding basin. Cost estimate from the engineer, SBC Consulting Engineers, is $175,000.

Garvin – project involves repairing lagoon dikes and installing a land application system. Cost estimate from the engineer, Pat Patterson, is $289,000.

Idabel – (Note: Oklahoma does not have delegation from EPA for this city.) Project involves modification to the wastewater treatment plant and repairs to collection system. Cost estimate from the engineer, Holloway, Updike, and Bellen, Inc., is $7,800,000.

Wright City – project involves repairs to the wastewater collection system. Cost estimate is $188,000 based on contractor bids. The engineer is Brown Engineering.

LeFlore

Bokoshe – Scope of the project: a 4-cell flow through lagoon. Consulting engineer is D.V. Morris. Cost estimate: $340,000.

Panama City – Scope of the project is replacing the existing sewer lines and lift station to reduce I&I. Consulting engineer is Wyatt, Doyle & Butler. Cost estimate is $1.6 million.

Pocola – Scope of the project is I&I reduction, lift station improvement, and wastewater plant modifications to meet permit discharge limits and eliminate sewer bypasses. Consulting engineer is Dudley & Associates. Cost estimate: $690,000.

Heavener – Scope of the project is modification of lagoon and over land flow system. The consulting engineer is Search, Inc. The cost estimate is $827,000.

Latimer

Red Oak – Scope of the project is a two-cell aerated lagoon. Consulting engineer is Landes Engineering. Cost estimate from Community & Economic Development is $250,000.

Wilburton – Scope of the project is construction of a new SBR system and I&I reduction. Consulting Engineer is Wyatt, Doyle & Butler. Cost estimate is $ 5,000,000.

Pittsburgh

Crowder – Scope of the project is a new two-cell flow through lagoon with rock filter and chlorination system, replacement of the damaged sewer lines, and installation of a new lift station. Consulting engineer is POE & Associates, Inc. Cost estimate: $914,000.

Haileyville – Scope of the project is I&I reduction and replacement of a lift station. Consulting engineer is Dudley & Associates. Cost estimate is not available.

Quinton – Scope of the project is installation of new sewer lines and manholes. Consulting Engineer is D.V. Morris. Cost estimate: $1,144,000.

Savanna – Scope of project is: Phase I - replacing LF, now complete; Phase II - I&I study and reduction; Phase III - sludge removal from the lagoons and lagoon repair to meet BOD and TSS limits. Consulting engineer is Dudley & Associates. Cost estimate is Phase II: $250,000, Phase III - $642,000.

Pushmataha

Antlers – project involves repairs to the wastewater collection and treatment systems. The cost estimate has not been developed yet. The engineer is NRS Engineers.

Haskell

Keota – Scope of the project is to build a new secondary lagoon with rock filter and chlorination system, a new lift station and replacement of over 1,300 ft of sewer lines to eliminate bypasses. Consulting Engineer is Wyatt, Doyle & Butler. Cost estimate: $303,000.

Choctaw

Soper – project involves repairs to the wastewater collection system. A preliminary cost estimate for the grant application from the engineer, Dudley and Associates, is $99,000.

Hugo – (Note: Oklahoma does not have delegation from EPA for this city.) project involves decommissioning one wastewater treatment plant, major modification to another wastewater treatment plant, and major repairs to the wastewater collection system. Cost estimate from the engineer, NRS Engineering, is $4,000,000.

Atoka

Atoka – project involves repairs to the wastewater collection system. Cost estimate is not available. The engineer is Fox and Drechsler, Inc.

Stringtown – project involves point repairs to the wastewater collection system. Cost estimate is not available.

USDA South Central Agricultural Research Laboratory (Wes Watkins) – project involves repairs to wastewater treatment lagoons. Cost estimate from the engineer, CRC & Associates, is $86,000.

Hughes

Holdenville – Scope of the project is I&I reduction and installation of a new bar screen at the wastewater treatment plant. Consulting engineer is SMC. Cost estimate is $300,000.

Wetumka – Scope of the project has not determined yet: Consulting engineer is John Puppy. Cost estimate is not available.

Bryan

Bokchito – project involves modification of the wastewater treatment lagoons. Cost estimate is not available. The engineer is Fox and Drechsler, Inc.

Bryan Co. RSD #8 – project involves construction of new wastewater treatment lagoons and connection of residences in the homeowners association to the wastewater collection system. Cost estimate from the engineer, Brown Engineering, is $150,000.

Caddo – project involves repairs to the wastewater collection system and modification to the wastewater treatment plant. Cost estimate from the engineer, Charles Sullivan, is $263,000.

Colbert – project involves modifications to the wastewater treatment system. Cost estimate from the engineer, Dudley & Associates, is $99,000.

Marshall

Kingston – project involves modifications to wastewater treatment plant. The engineer is Tomlinson & Associates Engineering.

Pontotoc

Ada – project involves major repairs to wastewater collection system and modifications to wastewater treatment plant. Cost estimate from the consultant, Merco Consultants, is $14,200,000.

Hill and Dell HOA – project involves connecting homeowners association to the City of Ada's wastewater collection system and closure of wastewater treatment lagoons. The engineer for Ada is Dudley & Associates. Cost information is not available.

Garvin

Pauls Valley –a new lift station and collection system to serve the Wal-Mart Distribution Center west of town. Cost estimate is $1.3 million. The engineer is SBC Consultants. They are about to begin construction.

Murray

Sulphur – project involves repairs to the wastewater collection system. The engineer is Sequoyah Engineering. Cost information is not available.

Carter

Ardmore Central WWTP – conducting a mercury elimination program, which they are doing in-house. Cost information is not available.

Ardmore Air Park WWTP – This is a wastewater land application project. The engineer is Fox and Dreschler. Cost estimate is $55,000.

Golden Oaks HOA – Project scope and cost information not available.

Healdton. Project scope and cost information not available.

Lake Murray State Park Lodge – Project scope and cost information not available.

Wilson. Project scope and cost information not available (new).

Lone Grove – Rebuilding a lift station. Engineer is Dudley and Assoc. Cost estimate: $50,000.

Ratliff City – Enlarging lagoons. Engineer is SBC Consultants. Cost estimate: $150,000.

Grady

Daily MHP – Repairing a leaking lagoon is required. However, owner is awaiting a decision by OTA/ODOT on the location of the new H.E. Bailey Turnpike / HWY 9 interchange. If OTA/ODOT takes this property, the lagoon will no longer be needed. No cost estimate is available.

Pocasset – Project requires repairing erosion to lagoon dike and constructing an all weather access road. A land application system is proposed. Cost estimate from the engineer, Landes Engineering, is $36,000.

Stephens

Marlow (East, West, and Northwest) – Plant improvements required include lagoon rehabilitation, sewer line replacement, pump station installation, construction of a new lagoon, and addition of irrigation fields. Construction has begun. Cost for this project is estimated to be $5,000,000. The engineer is Landmark Engineering.

Jefferson

Waurika – Project requires completing an I/I study and submitting an engineering report for work necessary based on a capacity evaluation. The I/I study has been completed. No cost estimate is available. The engineer is Meyers Engineering.