FINAL
ENVIRONMENTAL ASSESSMENT

LAKE TEXOMA
STORAGE REALLOCATION STUDY,
LAKE TEXOMA, OKLAHOMA AND TEXAS

May 2006

ENVIRONMENTAL ASSESSMENT ORGANIZATION

This Environmental Assessment (EA) evaluates the environmental effects of the U.S. Army Corps of Engineers, Tulsa District's Proposed Action to reallocate water supply storage at Lake Texoma, Oklahoma. This EA will facilitate the decision process regarding the Proposed Action and alternatives.

SECTION 1	*PURPOSE, NEED, AND SCOPE* summarizes the purpose of and need for the Proposed Action, provides relevant background information, and describes the scope of the EA.
SECTION 2	*ALTERNATIVES* examines the alternatives to implementing the Proposed Action.
SECTION 3	*PROPOSED ACTION* describes the recommended action.
SECTION 4	*AFFECTED ENVIRONMENT* describes the existing environmental and socioeconomic setting.
SECTION 5	*ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION* identifies the potential environmental and socioeconomic effects of implementing the proposed action and alternatives.
SECTION 6	*RELEVANT OPERATIONAL PLANS* reference certain plans implemented at Lake Texoma associated with the regulation of flows on the Red River.
SECTION 7	*FEDERAL, STATE, AND LOCAL AGENCY COORDINATION* provides a listing of individuals and agencies consulted during preparation of the EA.
SECTION 8	*REFERENCES* provides bibliographical information for cited sources.
SECTION 9	*APPLICABLE ENVIRONMENTAL LAWS AND REGULATIONS* provides a listing of environmental protection statutes and other environmental requests.
SECTION 10	*LIST OF PREPARERS* identifies persons who prepared the document and their areas of expertise.
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FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act of 1969, including guidelines in 33 Code of Federal Regulations, Part 230, the Tulsa District has assessed the environmental impacts of reallocating 300,000 acre-feet of hydropower storage to water supply storage at Lake Texoma, Oklahoma and Texas. The Water Resources Development Act of 1986 (Public Law 99-662), authorized the Secretary of the Army to reallocate this water for municipal, industrial, and agricultural water users in both Oklahoma and Texas (a reallocation of 150,000 acre-feet for use by each state). This assessment was prepared in accordance with U.S. Army Corps of Engineers Regulations, Part 230, Policy and Procedures for Implementing the National Environmental Policy Act. It has been determined from the enclosed Environmental Assessment that the water reallocation will have no significant adverse effects on the natural or human environment. Therefore, an environmental impact statement will not be prepared.

24 MAY 06

Date

Miroslav P. Kurka
Colonel, U.S. Army
District Engineer

Enclosure: Environmental Assessment

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FINAL ENVIRONMENTAL ASSESSMENT

LAKE TEXOMA STORAGE REALLOCATION STUDY, LAKE TEXOMA, OKLAHOMA AND TEXAS

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U.S. Army Corps of Engineers
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ABBREVIATIONS AND ACRONYMS

Act	Water Resources Development Act of 1986
°F	degrees Fahrenheit
BA	Biological Assessment
BO	Biological Opinion
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Cfs	cubic feet per second
CWA	Clean Water Act
DWU	Dallas Water Utilities
EA	Environmental Assessment
GTUA	Greater Texoma Utility Authority
MSL	Mean Sea Level
NEPA	The National Environmental Policy Act
NTMWD	North Texas Municipal Water District
ODWC	Oklahoma Department of Wildlife Conservation
OKDEQ	Oklahoma Department of Environmental Quality
Service	United States Fish and Wildlife Service
SIP	State Implementation Plan
SWPA	Southwestern Power Administration
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency

1 Purpose, Need, and Scope

The U.S. Army Corps of Engineers, Tulsa District is proposing to reallocate storage in Lake Texoma, Oklahoma and Texas, from hydropower storage to water supply storage, pursuant to the Water Resources Development Act of 1986 passed by Congress (Public Law 99-662). The Act authorized the Secretary of the Army to reallocate 150,000 acre-feet each for Oklahoma and Texas for municipal, industrial, and agricultural water uses (a total reallocation of 300,000 acre-feet). The objective of this project is to comply with the intent of Section 838 of Public Law 99-662. The Lake Texoma Water Supply Reallocation Report, which provides information on the reallocation, is attached as Appendix F and is incorporated by reference in this EA. The U. S. Army Hydropower Analysis Center report on power benefits forgone is an appendix to the Reallocation Report.

This project is needed to meet the expanding municipal and industrial water supply demands that are a result of population growth in the region. The *2006 Region C Water Plan* relies heavily on the reallocation of water in Lake Texoma to meet the future needs of residents in the Dallas-Fort Worth and surrounding areas. According to the Texas Water Development Board, if the water is unavailable, the region will have a potentially substantial deficit in future water supply. Even though utilization of water from Lake Texoma for water supply is relatively limited at this time, the North Texas Municipal Water District is evaluating the option of a desalinization plant that would allow them to utilize water from Lake Texoma on a full time basis. Because of the salinity of Lake Texoma water they currently use their allocated storage as mixing water in Lake Lavon. However, they can only withdraw water when sufficient storage space is available in Lake Lavon to allow for a volume of water from Lake Texoma to be captured.

Denison Dam and Lake Texoma were authorized for construction by the Flood Control Act approved June 28, 1938, (Public Law 75-791) for flood control and generation of hydroelectric power (USACE 2003a). The dam, spillway, and outlet works were started in August 1939 and completed in February 1944. At that time, Denison Dam was America's largest rolled, earth-filled dam. The project was put into operation for flood control in January 1944. The first hydroelectric turbine was placed in operation in March 1945, while a second unit became operational in September 1949. Denison Dam is on the Red River in Bryan County, Oklahoma, and Grayson County, Texas, about 726 miles upstream from the mouth of the river. The dam site is approximately 5 miles northwest of Denison, Texas, and 15 miles southwest of Durant, Oklahoma (Figure 1). Lake Texoma is in Bryan, Marshall, Johnston, and Love counties, Oklahoma; and in Grayson and Cooke counties, Texas (USACE 2003a).

Lake Texoma is now the 12th largest lake in volume in the United States, with a current flood storage capacity of 2,544,830 acre-feet, and hydropower storage capacity of 1,467,283 acre-feet, which includes 150,000 acre-feet for water supply. The main embankment is 15,200 feet long with a maximum height of 165 feet above the streambed (Figure 2). The outlet works consist of three 20-foot diameter concrete conduits through the embankment and six 9-by-19-foot vertical lift gates (Figure 3). The power-intake structure will permit future installation of three additional power units (USACE 2003a, 2003b). Lake Texoma currently provides numerous services to communities in Oklahoma and Texas, including flood control, water supply, hydroelectric power, regulation of Red River flows, improvements to navigation, and recreation resources (USACE 1996a).

The National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) requires all Federal agencies to address the environmental impacts of any major Federal action on the natural and human environment. Guidance for complying with NEPA is contained in Title 40 of the Code of Federal Regulations (CFR), Parts 1500 through 1508, and in Engineering Regulation 200-2-2, *Procedures for Implementing NEPA*. The primary intent of NEPA is to ensure that as a part of the decision making

process, Federal agencies consider the potential environmental consequences of their proposal, document the analysis, and make the information available to the public for comment prior to implementation. This Environmental Assessment (EA) was developed to assure that the proposed storage reallocation project complies with the intent of NEPA. For the purposes of the NEPA public review the Lake Texoma Storage Reallocation Report is included as Appendix F. After the NEPA process has been completed the Environmental Assessment will be included as an appendix to the Reallocation Report when the Report is forwarded through the Corps of Engineers review process. Appendix F will then contain only the cover pages of the Reallocation Report to avoid duplication and reduce paperwork.

The Tulsa District issued a news release on August 6, 2003, announcing public information workshops for the Lake Texoma storage reallocation project. Paid display advertisements were published on September 2, 14, and 16, 2003, in the *Denison Herald Democrat*, and September 3, 14, and 17, 2003, in the *Durant Democrat*. The Tulsa District sent scoping and workshop announcements to state and Federal resource agencies. The advertisement and the announcements (Appendix A) initiated the NEPA scoping process.

The Tulsa District held workshops on September 16, 2003, (5:00 p.m.–8:00 p.m.) at the Denison Public Library and on September 17, 2003, (5:00 p.m.–8:00 p.m.) at the Durant Chamber of Commerce. Twenty persons attended the workshop including representatives from local, state, and Federal agencies; Native American tribes; congressional delegates; and private citizens. One attendee expressed concern about the striped bass (*Morone saxatilis*) fishery in the lake. Representatives from the Tulsa District explained that the purpose of establishing the seasonal pool in Lake Texoma was to help this fishery. Several attendees expressed concern about the potential for additional pool drawdown and shallow water depths near some of the marinas, docks, and boat ramps. One attendee in favor of reallocation expressed an interest in possibly acquiring future water rights on behalf of his entity, and one attendee opposed to reallocation expressed concern about lower lake levels rendering docks unusable.

2 Alternatives

During plan formulation the goal was to identify and perform an initial evaluation of preliminary alternatives for the reallocation of hydropower storage to water supply at Lake Texoma. Consideration of all reasonable alternatives is required under the National Environmental Policy Act (NEPA) to create a better decision-making process for implementing projects and programs that could adversely impact the environment. The NEPA requires Federal agencies to incorporate environmental considerations in their planning and decision-making process and requires the use of a systematic and interdisciplinary approach. The Planning Guidance Notebook, Engineering Regulation (ER 1105-2-100), dated April 2000, requires the formulation and evaluation of a full range of reasonable alternative plans. Alternative plans are formulated to take into account the overall problems, needs, and opportunities afforded by the proposed action. Those plans are assessed in a manner consistent with the national objective of contributing to National Economic Development (NED) and protecting the Nation's Environment, Federal laws, and regulations. The NED objective is to provide a cost-effective water supply source to meet the region's future municipal and industrial requirements. In this case, the proposed action is the reallocation of Lake Texoma storage from hydropower to water supply.

Economic development problems in the region under existing conditions include insufficient sources of municipal and industrial water at affordable costs to meet future municipal and industrial needs. The reallocation opportunity would provide a source of water supply of sufficient quantity and cost to

meet water demands in the near future as the need arises. However, the water available at Lake Texoma for water supply will not meet all the expected future demand for water throughout the region. Other sources of water supply would be required to meet future demands as well. In addition the lower quality of water in Lake Texoma will require blending or additional treatment before it is used for municipal and industrial water supply.

The basis for water supply evaluations in Texas is found in the *2006 Region C Water Plan*. This report discusses in detail the problems and needs for additional water supply in Region C by water user group, community, and water utility. Future water demands and the availability of existing and potential sources of water supply are presented and evaluated along with water management strategies of major water providers and communities in the North Texas region. These strategies relate to existing and future demand and use of all existing and potential sources of water supply, including Lake Texoma. For Oklahoma, water supply and demand information is taken from studies completed by the Tulsa District for the Oklahoma Water Resources Board (OWRB) in support of the Oklahoma State Water Plan. This study indicates that existing and potential sources of water supply are available to meet future municipal and industrial needs.

The identified need examined in the 2006 Reallocation Report is the request by the North Texas Municipal Water District (NTMWD) for additional water supply storage of 100,000 acre-feet in Lake Texoma. The letter request is shown as an appendix to the reallocation report. The Greater Texoma Utility Authority (GTUA) also desires reallocated water supply storage. The Water Resource Development Act (WRDA) of 1986 (Public Law 99-662) is the authorization that provides opportunity to address the need and allows the Secretary of the Army the authority to reallocate a total of 300,000 acre-feet of conservation storage to water supply.

The 'Denison Dam-Lake Texoma Restudy, Oklahoma and Texas, feasibility Report', completed by the Corps of Engineers in September 1990, evaluated whether Lake Texoma should be modified to deal with present and projected water resource problems and needs in the region with the focus on increased hydropower production. Although the Restudy focused on increasing hydropower production at Denison Dam, the Restudy is useful in the plan formulation and evaluation of alternative plans regarding changes in the size of the conservation pool and the flood pool.

2.1 No Action Alternative

The Council on Environmental Quality (CEQ) regulations implementing the provisions of NEPA requires Federal agencies to consider a No Action Alternative. These regulations define the No Action Alternative as the continuation of existing conditions and their effects on the environment, without implementation of, or in lieu of, a proposed action. The No Action Alternative represents the existing condition, would not result in any project-related environmental impacts, and serves as the baseline against which to compare the effects of the other alternatives. The Corps considers the option of "No Action" as one of the alternatives in order to comply with the requirements of the NEPA. The No Action alternative is the condition reasonably expected to prevail over the period of analysis, given current conditions and trends, and assuming that no project would be implemented by the Federal government to achieve the planning objectives. The No Action alternative, which is synonymous with the Without-Project Condition, forms the basis from which all other alternative plans are measured. This alternative would not address the intent of Public Law 99-662, Section 838, which authorized the Secretary of the Army to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 300,000 acre feet, for municipal, industrial, and agricultural water users in the States of Texas and Oklahoma. The No Action Alternative would not reduce the current need for additional water supply to meet the expanding municipal and industrial water supply demands that are a result of population growth in the region.

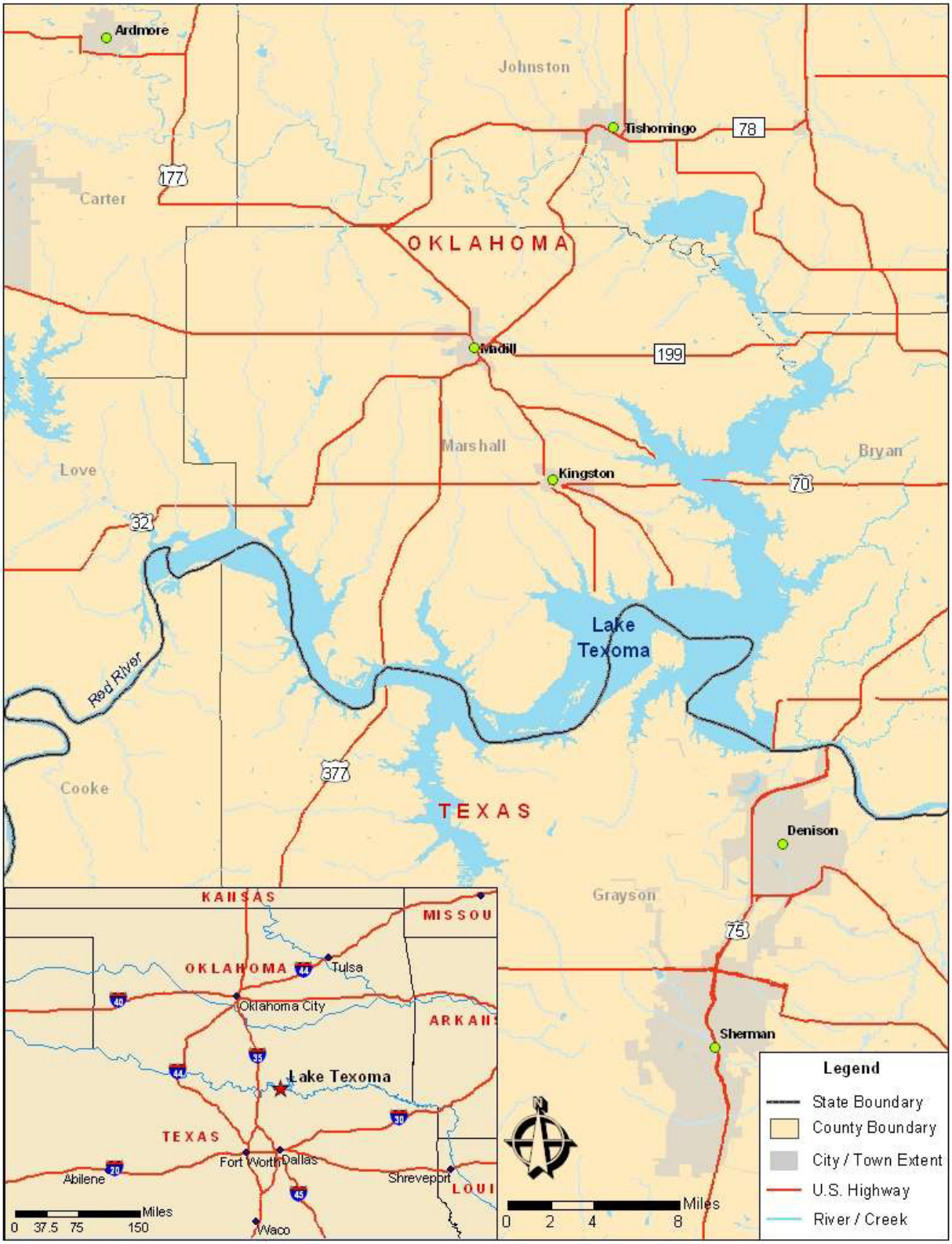

Figure 1. Vicinity Map, Lake Texoma Storage Reallocation Project

Figure 2. Denison Dam and Power Intake Structure

Figure 3. Hydropower Facility and Outlet Works at Denison Dam

Under the No Action Alternative, the storage allocation for all major purposes would be maintained at the current level. The reallocation of 300,000 acre-feet of additional storage from hydropower to water supply would not occur, and the existing allocation of 150,000 acre-feet for water supply would remain. Essentially all of the current water supply storage is being used and North Texas currently is in need of additional water. With the No Action Alternative, this need would not be met. In accordance with Section 4.04 of Article IV of the Red River Compact, division of the flows from the main stem of the Red River into Lake Texoma between the states of Oklahoma and Texas will continue to be in effect.

2.2 Action Alternatives

Potential non-structural solutions include those that would alter the demand for increased water supply in the future. These alternatives would at least partially address some of the problems and needs in the region. The non-structural alternative is to conserve water to reduce the need for additional sources of water supply. Water conservation can include altering the demand for water by water rationing and pricing methods. Communities and major water user groups, such as the NTMWD and the GTUA, already have plans to reduce water consumption as discussed in the *2006 Region C Water Plan*. Water reuse is also a viable non-structural alternative that has been implemented in many areas where permitted. The *2006 Region C Water Plan* shows a recommended supply from currently existing and proposed reuse projects of about 771,000 acre-feet per year in 2060. Even with significant conservation efforts, including the substantial development of reuse projects, the *2006 Region C Water Plan* shows that additional water supplies are needed from Lake Texoma and other new supply sources. Those communities and major water utilities that have undertaken steps to reuse water where feasible are shown in the Region C water plan. Where available, reuse water is utilized prior to development of other sources of water supply.

Potential structural and/or operational solutions to the need for additional water supply are:

1. **Change the upper and/or lower limits of the conservation pool to provide additional water supply.** This alternative was evaluated in the 1990 Restudy. Raising the upper limits of the conservation pool would allow higher operating heads for hydropower (when not used for water supply) and higher pool levels for recreation. The need for water supply storage still exists. To address the need for additional water supply, storage would have to be reallocated from hydropower. Recreation was added as a project purpose by the WRDA of 1986. In response to requests to provide a more reliable pool operation for recreation during the high recreation season, a seasonal pool operation was put into effect. Raising both the upper and lower limits of the conservation storage pool would benefit hydropower and water supply and recreation; however, reallocation of the flood control pool as proposed in the 1990 Feasibility Report would result in a reduction of storage in the flood pool of about 46 percent. Reallocation of 300,000 acre-feet of the flood pool would result in a reduction of about 12.6 percent by year 2044. Existing recreation and wildlife areas around the lake would be adversely impacted. Reduction in flood control storage at Lake Texoma by encroaching on the flood pool would not be acceptable to those in the floodplain downstream of Denison Dam. Although Lake Texoma now controls the 45-year flood event, cumulative flood damages prevented by Lake Texoma is about $178.4 million through Fiscal Year 2004. Raising the lower limits of the conservation pool would restrict hydropower operations and limit water supply although it might be beneficial to recreation users of the lake. The 1990 Restudy also found that enlarging the flood control capability of the existing project was not feasible due to its adverse in-pool impacts on recreation facilities, wildlife, and cultural resources.

2. **New reservoirs above Lake Texoma.** New reservoirs above Lake Texoma on the Red River and the Washita River were evaluated in the 1990 Restudy. Both the Marietta site on the Red

River and the Durwood site on the Washita River were found to be not economically feasible for development for flood control operation due to high costs relative to economic benefits and adverse environmental effects. These projects would compensate for loss of flood control storage at Lake Texoma if the upper limits of the conservation pool were increased for hydropower and /or water supply storage.

3. **New groundwater wells.** In some counties in Region C, current use of groundwater exceeds or is near the estimate of long-term reliable groundwater supply. The Region C water plan indicates that water suppliers will need to develop alternate sources of water supply since groundwater resources are overused by temporary over drafting. Some entities in the region rely on groundwater to meet existing and future water needs. These users tend to need smaller quantities of water. However, with large users, the quantity of water available from new groundwater wells would not be sufficient to meet long-term future needs for reliable water supply in the region. Temporary over drafting of groundwater can be used only as an interim measure until other supplies are developed.

4. **Existing surface water sources.** The Region C water plan, as a guide to utilization of existing sources of water supply, discusses all existing sources of surface water supply currently used and expected to be used in the region to 2060 to meet future water demands. The water management strategy in Region C is to use those sources of supply that are most cost effective and viable alternatives to meet expected municipal and industrial demands. Institutional considerations, such as joint use with other water using entities, also must be taken into account.

5. **New surface water sources.** The Region C water plan discusses all new sources of surface water supply currently used and expected to be used in the region to 2060 to meet future water demands. In addition, the water management strategy and institutional problems are presented by decade and source of supply for the major water users along with their estimated costs of development. In some cases, several water using entities combine their resources to develop a new source of water supply for a shared use. The reallocation report discusses the water management strategy for the NTMWD and the GTUA regarding existing and new surface sources of water supply.

6. **Downstream Red River Diversion.** The 1990 Restudy addressed pumped storage hydropower facilities at Lake Texoma with an afterbay dam constructed about 7 miles downstream of the existing dam. That study concluded that the afterbay pool would increase the tailwater elevation at the existing units and reduce their efficiency. Construction costs and loss of hydropower efficiency rendered this option not economically feasible. In addition, the North Texas Municipal Water District currently has pipelines and pumping facilities in-place to withdraw water directly from Lake Texoma. A downstream Red River Diversion alternative would require downstream storage with a re-regulation dam or off-site storage along with construction of expensive infrastructure to divert, control, pump, and distribute the water. Construction of a downstream dam was considered at the Kiamichi River but was removed from further study because evaporation and seepage would result in losses of up to approximately 25% between there and the Denison Dam. Releases of water from Lake Texoma would have to be increased by the amount lost to evaporation and seepage which would result in a faster drawdown of Lake Texoma. Water quality releases from Hugo Dam into the Kiamichi River could not be withdrawn for water supply without increased releases from Hugo to replace water quality flows. This would result in a faster drawdown of Hugo Lake. Withdrawal of water from the Red River below Denison would require communities located in the upper reaches of Lake Texoma to construct extensive pipeline facilities to transport water greater distances rather than withdrawing water from intake structures located much closer within the lake. Downstream water rights would also be an issue. Downstream Red River Diversions were removed from further study.

The following evaluation matrix displays the screening of preliminary alternatives. The matrix displays potential study alternatives. The alternative of reallocating storage from the existing conservation pool to water supply was found to be the only reasonable alternative. A complete evaluation of alternatives and assumptions used in this analysis can be found in the water supply storage reallocation report which accompanies this EA. This report and its findings are incorporated by reference.

Evaluation Matrix of Preliminary Alternatives.

Alternative	Potential Study Alternatives	Screening Results								Conclusion	Appropriate for Detailed Evaluation
		Meet Future Water Demands	Hydropower Impacts	Environmental Impacts	Flood Control Impacts	Recreation Impacts	Economic Costs	Legislative Direction (WRDA 1986)	Evaluated in Previous Studies		
	No-Action Alternative	No	None	None	None	None	None	No	Yes	The No Action Alternative would not satisfy the future water supply needs of the study area and meet legislative authorization.	No
1	Reallocation from Existing Conservation Pool	Yes	Yes	Low	None	None	Low	Yes	Yes	Legislative mandate to reallocate hydropower storage to water supply storage.	Yes
2	New Reservoirs above Lake Texoma	Yes	None	High	None	None	High	No	Yes	Difficult to justify based on high costs and environmental impacts	No
3	New Groundwater Wells	No	None	None	None	None	High	No	Yes	Production not sufficient to meet high municipal and industrial demands.	No
4	Existing Surface Water Sources	Yes	None	None	None	None	High	No	Yes	Accounted for in Texas State Water Plan, Region C	Yes
5	New Surface Water Sources	Yes	None	Mediu m	Yes	Yes	High	No	Yes	Accounted for in Region C water management strategy in Texas State Water Plan	Yes
6	Downstream Red River Diversion	Yes	Yes	Mediu m	None	Yes	High	No	Yes	Economically unfeasible, excessive water loss, extensive pipeline construction, water rights.	No

3 Proposed Action

The proposed action is to reallocate hydropower storage to water supply storage to provide water to meet the projected water needs in the region, as described in the *Texas 2006 Region C Water Plan*. Under the Proposed Action, pool elevations at Lake Texoma would not be changed. In accordance with the Water Resources Development Act of 1986, 300,000 acre-feet of water currently in hydropower storage would be reallocated to water supply storage, creating a total of 450,000 acre-feet of water supply. The reallocation would provide up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the state of Oklahoma and up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the state of Texas. This apportionment of the reallocation is consistent with Section 4.04 of Article IV of the Red River Compact, which states that water storage in Lake Texoma, as well as flow from the main stem of the Red River into Lake Texoma, will be divided equally between the states of Oklahoma and Texas.

Water supply at Lake Texoma was not an original project purpose. Several special congressional authorizations have made storage available to users throughout the years. When the Federal government realized that there was an increasing demand for water supply storage, studies were conducted (in 1983 and 1985) to reallocate a total of 150,000 acre-feet of storage from the hydropower purpose to water supply. The cost charged to the user for the storage is based on the highest either of benefits or revenues foregone, replacement costs (as a result of reallocating hydropower storage), or updated cost of storage. The cost of the storage that has been identified as being available for reallocation, but not currently under contract, will continue to increase in value annually until a water storage contract is signed. Storage is not considered to be reallocated from its original purpose until a water storage contract is entered into, and the user starts to pay for and use the storage.

The present value of the 300,000 acre-feet of water supply storage is considerably more than the benefits or present worth of hydropower revenues foregone. The 300,000 acre-feet of water supply storage is valued at $107,457,701 ($6,398,415 per year for 30 years based on FY 2006 interest rate of 4.625 percent). The total annual hydropower benefits foregone with a 300,000 acre-feet reallocation is $1,600,333.

Two requests for water supply storage are currently being considered if the reallocation is authorized. One is to the NTMWD for 100,000 acre-feet of water supply storage and the other is to the GTUA for 5,000 acre-feet of water supply storage. The cost of the allocation to the NTMWD for 100,000 acre-feet of storage is $35,831,294 based on an FY 2006 amortization schedule at 4.625 percent. The total annual cost for 100,000 acre-feet of storage for 30 years is about $2,198,850. This includes about $2,133,524 for the storage and about $65,326 for projected annual operation and maintenance costs. The cost of the allocation to the GTUA for 5,000 acre-feet of storage is $1,796,992 based on an FY 2006 amortization schedule at 4.625 percent. The total annual cost for 5,000 acre-feet of storage for 30 years is about $110,275. This includes about $106,999 for the storage and about $3,276 for projected annual operation and maintenance costs.

Benefits foregone, April 2006 (revised), prepared by the U.S. Army Corps of Engineers, Hydropower Analysis Center, is attached to this Environmental Assessment as Appendix F, and is included by reference. In accordance with P. L. 99-662, Section 838 (d)(3), the Southwestern Power Administration shall be provided credits for hydropower lost until the present contracts expire in 2015, as a result of the implementation of water supply contracts entered into as a result of this reallocation. The credits shall be of amounts equal to the replacement cost where replacement cost is defined as the cost to purchase power from existing alternative sources. Such credits shall be against

sums required to be paid by the Southwestern Power Administration for costs of the project allocated to hydropower. In each such case the Southwestern Power Administration shall reimburse each preference customer for an amount equal to the customer's actual replacement cost for hydropower lost as a result of implementation of such contract, less the cost such customer would have had to pay to the Southwestern Power Administration for such hydropower. Southwester Power Administration credit after current contracts expire in 2015 will be based on benefits forgone for the remaining 50 years of the analysis period (greater of either the remaining project life or 50 years).

The revenues foregone computation is explained in Section 6 of the HAC report which is an appendix to the Reallocation Report (Appendix F). Revenue foregone is hydropower energy and capacity loss multiplied by the SWPA contract rates used for current contracts (which expire in 2015). However, benefits foregone (Section 5 of the HAC report) are based on an analysis of the regional cost of production of replacement energy and the cost to construct replacement capacity. These values are not the same as market prices which fluctuate according to market forces such as inflation, supply and demand, and competition for resources.

Power benefits foregone, which are equivalent to replacement costs of power, and power revenues foregone were considered over a 50-year evaluation period in order to determine the cost of the storage reallocation being requested. The non-power related updated cost of storage was not evaluated in the benefits foregone report. The reallocation cost to the water supply customers will be the highest cost for each of these different components.

Data was developed summarizing power benefits foregone for 150,000 AF and for 300,000 AF as shown in Table 1. The replacement cost of power as used in determining the cost of the reallocation to the water supply customer is identical in each case to the hydropower benefits foregone. Summarizing the data developed in the benefits foregone report, the power revenues foregone are in Table 2 and the estimated SWPA credits are in Table 3.

Table 1: Annual Power Benefits Foregone

Allocation Alternative	**150,000 AF**	**300,000 AF**
Annual Energy Benefit Foregone	$499,284	$990,326
Capacity Benefit Foregone	$257,514	$610,007
Annual Benefit Foregone	**$756,798**	**$1,600,333**

Table 2: Annual Revenue Foregone

Allocation Alternative	150,000 AF	300,000 AF
Annual Energy Revenue Foregone	$98,358	$195,092
Capacity Revenue Foregone	$462,866	$1,027,658
Annual Revenue Foregone	**$561,224**	**$1,222,750**

Table 3: Annual SWPA Credit

Allocation Alternative	150,000 AF	300,000 AF
Energy Credit	$270,179	$535,899
Capacity Credit	$374,860	$848,669
Annual Credit to PMA	**$645,039**	**$1,384,568**

4 Affected Environment

4.1 Location

The Lake Texoma project study area consists of the main body of the lake as well as the various arms created by the Denison Dam. The lake is on the Red River between Texas and Oklahoma, approximately 5 miles north of Denison, Texas (see Figure 1). As mentioned previously, the lake spans numerous counties in both states, including Bryan, Marshall, Johnston, and Love counties, Oklahoma; and Grayson and Cooke counties, Texas. Lake Texoma receives water from the drainage area of the Washita and Red Rivers (approximately 39,719 square miles) (USACE 2003a).

4.2 Climate

Data in the region indicate that the climate in the project area is typified by long, hot summers and relatively short, mild winters. The average summer (June, July, and August) temperature for the Oklahoma counties of Bryan, Marshall, Johnston, and Love is 80.6 degrees Fahrenheit (°F). The average winter (December, January, and February) temperature is 42 °F. Average annual precipitation in these counties is about 43 inches, with an average of 27 inches usually falling during the period of April through October. As a result of squall-line thunderstorms, rains occur most frequently in the late spring with peak rainfall amounts in May. Average seasonal snowfall is 0 to 6 inches (OCS 2002).

The average summer temperature in the vicinity of Cooke and Grayson Counties, Texas is 80 °F, while the average winter temperature is 46.6 °F. Average annual precipitation in the vicinity of these

counties is about 35.2 inches, with an average of 23 inches falling during the period of April through October. Peak rainfall amounts occur in May, and the average seasonal snowfall is 0.55 inches (NCDC 2002).

The prevailing winds in the vicinity of Lake Texoma (as recorded in Sherman, Texas, approximately 15 miles south of Denison Dam) are from the south-southeast (NCDC 1998).

4.3 Socioeconomics

4.3.1 Study Area

Lake Texoma is within several Oklahoma and Texas counties. The primary communities in the vicinity of Lake Texoma are Denison, Texas, (approximately 5 miles south) and Durant, Oklahoma (approximately 15 miles north). The city of Durant and counties of Bryan, Marshall, Johnston, and Love, Oklahoma; and the city of Denison and the counties of Grayson and Cooke, Texas, are considered the social area where project-related impacts could occur.

4.3.2 Population

Tables 4 and 5 summarize population data from the 2000 Census for the communities and counties in the social area that could be affected by the proposed storage reallocation project at Lake Texoma.

Table 4. Area Population: City of Durant; Bryan, Marshall, Johnston, and Love Counties; and the State of Oklahoma

	Census 1990 Population	Census 2000 Population	Percent Growth
City of Durant	12,823	13,549	5.6%
Bryan County	32,089	36,534	13.9%
Marshall County	10,829	13,184	21.7%
Johnston County	10,032	10,513	4.8%
Love County	8,157	8,831	13.4%
State of Oklahoma	3,145,585	3,450,654	9.7%

Sources: U.S. Census Bureau 2003, 2004

Table 5. Area Population: City of Denison; Grayson, and Cooke Counties; and the State of Texas

	Census 1990 Population	Census 2000 Population	Percent Growth
City of Denison	21,505	22,773	5.9%
Grayson County	95,021	110,595	16.4%
Cooke County	30,777	36,363	18.1%
State of Texas	16,986,510	20,851,820	22.8%

Sources: U.S. Census Bureau 2003, 2004

4.3.3 Employment and Income

In 2000, there were 252,342 people in the social area for the Lake Texoma storage reallocation project. The majority of the workers in the social area are employed in the educational, health, and social services; manufacturing; and retail trade sectors. As petroleum is found extensively in the vicinity of Lake Texoma, oil and gas pumping plants, refineries, foundries, and associated industries for the processing of petroleum products are of major importance in northern Texas and portions of southern Oklahoma (USACE 1993a). Tables 6 and 7 present employment and income information for the social area.

4.3.4 Social Ecology

The social area contains a mix of residential areas; agriculture and livestock raising; retail, commercial, and concession operations, many of which provide recreation-related services (e.g., marinas, gas stations, lodging, restaurants, boat rentals, picnic areas) to lake users; and industrial activities. The growing communities of Durant, Oklahoma, and Denison, Texas, serve as centers for retail and service businesses, while Lake Texoma is a major recreation destination, especially for the residents of North Texas.

Table 6. Employment and Income: City of Durant; Bryan, Marshall, Johnston, and Love Counties; and the State of Oklahoma

	Census 2000 Per Capita Income[1]	Census 2000 Median Household Income[1]	July 2004 Unemployment Rate
City of Durant	$13,849	$25,328	3.2%[2]
Bryan County	$14,217	$27,888	3.2%[3]
Marshall County	$14,982	$26,437	4.6%[3]
Johnston County	$13,747	$24,592	5.0%[3]
Love County	$16,648	$32,558	5.2%[3]
State of Oklahoma	$17,646	$33,400	4.4%[3]

Sources: [1]U.S. Census Bureau 2004, [2]OKDOC 2004, [3]ORIGINS 2004

Table 7. Employment and Income: City of Denison; Cooke and Grayson Counties; and the State of Texas

	Census 2000 Per Capita Income[1]	Census 2000 Median Household Income[1]	August 2004 Unemployment Rate[2]
City of Denison	$17,685	$31,474	6.3%
Grayson County	$18,862	$37,178	5.6%
Cooke County	$17,889	$37,649	4.2%
State of Texas	$19,617	$39,927	5.8%

Sources: [1]U.S. Census Bureau 2004, [2]TWC 2004

4.4 Natural Resources

4.4.1 Terrestrial

The topography surrounding Lake Texoma varies from gently sloping flats to rocky and precipitous cliffs to steep, wooded hillsides (Figure 4). The terrain in the vicinity of the lake varies in elevation from about 850 feet above mean sea level (MSL) in Marshall County, Oklahoma, to approximately 500 feet above MSL at the base of the dam (USACE 1989, 2003a). The formation of the lake has influenced vegetation and habitat, creating shoreline environments that did not exist prior to filling the reservoir, and eliminating floodplain and riparian habitat that was supported along the Red River in this area.

The project area is located in the Prairie Parkland (Subtropical) Province of the Prairie Division (Bailey 1995). Lake Texoma is in a transitional zone between the Eastern Oak Forest and the Tallgrass Prairie. There are four basic vegetative types identified around the lake: marsh, bottomland forest, post oak-blackjack oak (*Quercus stellata-Q. marilandica*) forest, and tallgrass prairie (USACE 2003a). Marshes are areas generally inundated with water long enough to support emergent wetland vegetation. At Hagerman National Wildlife Refuge on the south side of Lake Texoma, marshes support vegetation such as wild millet (*Pennisetum americanum*), sedges (*Carex* spp.), and smartweed (*Polygonum* spp.) (USFWS 2004).

Radiating out from the shoreline to higher, better-drained sites, the vegetation community progresses from subclimax to climax bottomland forests. The mesic shoreline environment is dominated by vegetation including black and sandbar willow (*Salix nigra* and *S. exigua*), buttonbush (*Cephalanthus occidentalis*), and the exotic tamarisk (*Tamarix* spp.). The subclimax bottomland forest extending outward from the edge of the lake supports cottonwoods (*Populus* spp.), sycamore (*Platanus occidentalis*), and willows (USACE 1989).

The climax bottomlands around Lake Texoma are composed of a variety of large mature trees, including pecan (*Carya illinoensis*), black walnut (*Juglans nigra*), hackberry (*Celtis* spp.), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), red oak (*Q. rubra*), and black oak (*Q. velutina*). None of these species are dominant in the overstory, and are distributed variably throughout this climax bottomland forest community (USACE 1989).

The post oak-blackjack oak forests are found in upland areas around the lake. Other tree species found in this plant community include shumard oak (*Q. shumardii*), chinquapin oak (*Q. muehlenbergii*), black hickory (*Carya texana*), American elm, and eastern red cedar (*Juniperus virginiana*) (USACE 1989, 1996b).

Beyond these oak forests surrounding Lake Texoma is a tallgrass prairie plant community. The grasslands within the boundaries of the Lake Texoma project are managed by the Tulsa District primarily for grazing. King Ranch bluestem (*Bothriochloa ischaemum*) and Bermuda grass (*Cynodon dactylon*) have been planted in some of these areas to improve pasture conditions. The predominant native grasses supported in the tallgrass prairie community include big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). In many places, this prairie community is being invaded by grasses and forbs characteristic of overgrazed or disturbed sites (USACE 1989).

Figure 4. Shoreline Topography and Vegetation of Lake Texoma

4.4.2 Soils and Prime Farmland

Soils of the Lake Texoma storage reallocation project area are generally nearly level to sloping, loamy and clayey soils. Approximately 25 soil associations have been identified in the vicinity of Lake Texoma. These associations are listed and briefly described in Table 8.

Table 8. Soil Associations in the Vicinity of Lake Texoma

Soil Association	Description
OKLAHOMA[1]	
BRYAN COUNTY	
Muskogee-Boxville	Deep, nearly level to sloping, moderately well-drained or well-drained, loamy soils that have a loamy or clayey subsoil. Found on uplands. Makes up about 16 percent of soils in Bryan County.
Bernow-Romia	Deep, strongly sloping to moderately steep, well-drained, sandy or loamy soils that have a loamy subsoil. Found on uplands. Makes up about 11 percent of soils in Bryan County

Table 8. Soil Associations in the Vicinity of Lake Texoma

Soil Association	Description
JOHNSTON COUNTY	
Verdigris-Gracemont-Oklared	Deep, nearly level or very gently sloping, well-drained to somewhat poorly drained, loamy or sandy soils that have a loamy subsoil. Found on floodplains. Makes up about 8 percent of soils in Johnston County
Konawa-Dougherty	Deep, nearly level or very gently sloping, well-drained, loamy or sandy soils that have a loamy subsoil. Found on uplands. Makes up about 4 percent of soils in Johnston County.
Gasil-Stephenville	Deep or moderately deep, very gently sloping to strongly sloping, well-drained loam soils that have a loamy subsoil. Found on uplands. Makes up about 21 percent of soils in Johnston County.
Burleson-Durant-Ferris	Deep, nearly level to strongly sloping, moderately well-drained or well-drained, clayey or loamy soils that have a clayey subsoil. Found on uplands. Makes up about 18 percent of the soils in Johnston County.
LOVE COUNTY	
Dougherty-Eufaula	Deep, nearly level to gently rolling, well-drained, sandy soils that have a loamy subsoil. Found on uplands. Makes up about 23 percent of soils in Love County.
Teller-Minco	Deep, nearly level to moderately sloping, well-drained, loamy soils that have a loamy subsoil. Found on uplands. Makes up approximately 9 percent of the soils in Love County.
Windthorst-Stephenville	Deep, nearly level and gently rolling, well-drained loamy soils that have clayey or loamy subsoils. Found on uplands. Makes up approximately 34 percent of soils in Love County.
Miller-Yahola	Deep, nearly level, moderately well-drained to well-drained, clayey and loamy soils that have clayey and loamy subsoils. Found on bottomlands along the Red River. Makes up about 3 percent of soils in Love County.
San Saba-Durant	Deep, gently sloping to rolling, moderately well-drained, clayey soils that have clayey subsoils. Found on uplands. Makes up about 18 percent of soils in Love County
MARSHALL COUNTY	
Bastrop-Konawa	Deep, nearly level to sloping, well-drained soils with a loamy surface layer and loamy subsoil. Found on terraces along the Red River, Washita River, and some major streams. Makes up about 10 percent of the soils in Marshall County.
Dougherty-Konawa	Deep, nearly level to sloping, well-drained soils with a sandy and loamy surface layer and loamy subsoils. Found on terraces along the Red River and some major streams. Makes up about 8 percent of soils in Marshall County.
Ferris-Tarrant-Heiden	Deep and shallow, very gently sloping to moderately steep, well-drained soils that are clayey or cobbly and clayey throughout. Found on uplands. Makes up about 42 percent of soils in Marshall County.

Table 8. Soil Associations in the Vicinity of Lake Texoma

Soil Association	Description
Durant-Collinsville	Deep and shallow, very gently sloping to strongly sloping, moderately well-drained and somewhat excessively drained soils with a loamy surface layer and loamy and clayey subsoils. Found on uplands. Makes up about 17 percent of soils in Marshall County.
Frioton-Gracemont	Deep, nearly level, well-drained and somewhat poorly drained soils with a loamy surface layer over loamy sediments. Found on floodplains. Makes up about 3 percent of soils in Marshall County.
Konsil-Madill	Deep, nearly level to moderately steep, well-drained soils with a loamy surface layer and a loamy subsoil (on uplands), and a loamy surface layer over loamy sediments (on floodplains). Found on uplands and floodplains. Makes up about 18 percent of soils in Marshall County.
TEXAS[2]	
COOKE COUNTY	
Sanger-Slidell-San Saba	Deep and moderately deep, nearly level to sloping, well-drained, clayey soils that have clayey subsoils. Found on uplands. Makes up about 20 percent of soils in Cooke County.
Gaddy-Teller-Miller	Deep, nearly level, well-drained to somewhat excessively drained, loamy sands, and clayey soils that have sandy loam and clayey subsoils. Found on bottomlands and terraces. Makes up about 4 percent of soils in Cooke County.
Sanger-Maloterre-Venus	Deep and very shallow, gently undulating to hilly, well-drained to somewhat excessively drained, clayey and loamy soils that have loamy and clayey subsoils. Found on uplands and terraces. Makes up about 14 percent of soils in Cooke County.
GRAYSON COUNTY	
Normangee-Crockett-Wilson	Deep, nearly level to sloping, very slowly permeable loamy soils with clayey subsoils. Found on ridges and side slopes of uplands. Makes up about 27 percent of soils in Grayson County.
Sanger-Bolar	Deep and moderately deep, gently to strongly sloping, very slowly permeable to moderately permeable, clayey and loamy soils with clayey subsoils. Found on ridges and side slopes of uplands. Makes up about 2 percent of soils in Grayson County.
Callisburg-Crosstell-Gasil	Deep, gently sloping to sloping, moderately permeable to very slowly permeable, loamy and sandy soils that have clayey subsoils. Found on uplands. Makes up about 16 percent of soils in Grayson County.
Aubrey	Moderately deep, gently to strongly sloping, slowly permeable, loamy soils with sandy, loamy, and clayey subsoils. Found on ridgetops and on convex, strongly sloping, upper side slopes of ridges. Makes up about 2 percent of soils in Grayson County.

Table 8. Soil Associations in the Vicinity of Lake Texoma

Soil Association	Description
Bastrop-Okay-Oklared	Deep, nearly level to gently sloping, moderately permeable and moderately rapidly permeable, loamy soils with sandy, loamy, and clayey subsoils. Found on terraces. Makes up about 2 percent of soils in Grayson County.

[1]USDA 1977, 1978a, 1978b, and 1980b
[2]USDA 1979, 1980a

Soil that is prime or unique farmland as defined in the Farmland Protection Policy Act (7 United States Code [U.S.C.] 4201–4209) is classified as prime farmland. According to the U.S. Department of Agriculture, prime farmland soil is soil that is best suited for producing food, feed, forage, fiber, and oilseed crops. Those soils that could occur in the associations noted above and that have been classified as prime farmland are listed in Table 9.

4.4.3 Hydrology

Lake Texoma, formed by Denison Dam on the Red River, receives water from the drainage area (approximately 39,719 square miles) of the Red River and the Washita River, its main tributary upstream of the dam. The Red River arm of the lake is about 60 miles long and the Washita River arm is about 45 miles long. The gradient of the Red River is approximately 1.6 feet per mile for the entire length of Lake Texoma, while the channel capacity is approximately 45,000 cubic feet per

Table 9. Prime Farmland in the Vicinity of Lake Texoma

County, State	Soil Series
Bryan County, OK	Bernow, Boxville, Dennis, Durant, Freestone, Karma, Madill, Muskogee, Okay
Johnston County, OK	Burleson, Dale, Dela, Dennis, Durant, Frioton, Gasil, Gowton, Heiden, Kaufman, Konawa, Lula, Oklared, Ravia, Steedman, Stephenville, Verdigris
Love County, OK	Brewer-Vanoss Complex, Durant, Minco, Pulaski, Teller, Vanoss, Windthorst, Yahola
Marshall County, OK	Bastrop, Burleson, Counts, Durant, Frioton, Heiden, Konawa, Konsil, Madill, Teller
Cooke County, TX	Bolar, Miller, Minco, San Saba-Slidell Complex, Slidell, Slidell-San Saba Complex, Teller, Venus, Yahola
Grayson County, TX	Bastrop, Bolar, Callisburg, Gasil, Okay, Oklared, Sanger

Source: USDA 2000a, 2000b, 2000c, 2002, 2004

second (cfs) downstream of Denison Dam (Figure 5). From Denison Dam to Fulton, Arkansas, the river flows between high banks about 1,000 feet apart (USACE 1989, 1993a, and 2003a). Releases from the dam are adequate to provide minimum and surge flows that help support the aquatic habitat and wetlands downstream of Lake Texoma.

At normal pool, the lake encompasses more than 89,000 surface acres, which can increase to 143,000 acres at the top of the flood control pool, and more than 580 miles of shoreline. Water storage (for hydropower, water supply, and flood control purposes) occurs between 590 and 640 feet above MSL. A seasonal pool plan was implemented at Lake Texoma in 1992 at the request of the Lake Texoma Advisory Board. The seasonal pool plan provided benefits for recreation, downstream flood control, hydropower, and fish and wildlife. The plan includes the following (USACE 1993a):

- Drawdown of lake levels to 615 feet above MSL in the late winter and early spring
- Rise to 619 feet above MSL during May and through the summer
- Drawdown to 616.5 feet above MSL in the late summer and early fall
- Rise to 618.5 feet above MSL in late fall and early winter

Table 10 provides the elevations and storage capacity for the pools at Lake Texoma.

The lake inflow carries a large amount of sediment that mostly comes from the Red River. During periods of high flow, bank caving and erosion occur at many locations upstream of Lake Texoma, increasing the sediment load in the lake, and decreasing water storage capacity (USACE 1993a). Recently, a sediment study was completed by the Texas Water Development Board, which compared the total volume of water storage available in Lake Texoma from the original design in 1942 with the results of studies conducted in 1969, 1985, and 2002 (TWDB 2003). Table 11 summarizes the results, and illustrates the decrease in water storage capacity in the lake.

Figure 5. Red River Immediately Downstream of Lake Texoma and Denison Dam

Table 10. Water Storage Data for Lake Texoma and Denison Dam

Feature	Elevation (feet)	Reservoir Area (acres)	Reservoir Capacity (acre-feet)
Top of Dam	670	--	--
Top of Flood Control Pool	640	141,418	5,061,062[1]
Flood Control Storage	617 to 640	--	2,544,830[1]
Top of Power Pool	617	74,686	2,516,232
Conservation Storage	590 to 617	--	1,467,283[2]
Bottom of Power Pool	590	--	1,048,949

Source: USACE 2003a

Notes: [1]Includes dead storage in the Cumberland Pool.
[2]Includes 150,000 acre-feet of water supply storage.

Models using projected future sedimentation to the year 2044 (the end of the project life at Lake Texoma) have been run to estimate future water supply availability, assuming full use of the 150,000 acre-feet of existing water supply storage at Lake Texoma. The results of this modeling, which are presented in Appendix B, indicate that future water supply yield after the 300,000 ac-ft reallocation would be 685.2 cfs or 442 mgd.

Table 11. Comparison of Water Storage Capacity at Lake Texoma (1942–2002)

	1942[1]	1969	1985	2002
Total Volume (ac-ft)	3,132,293	2,688,411	2,580,389	2,516,232
Total Storage Lost (ac-ft) from Original Design	--	443,882	551,904	616,061
Total Storage Lost (%)	--	14.2%	17.6%	19.7%

Source: TWDB 2003

Note: [1]Original design

Appendix B also provides the results of modeling performed by the Tulsa District to determine baseline elevation duration (percent of time a particular lake level was equaled or exceeded), elevation frequency (percent of years a particular lake level was equaled or exceeded), discharge duration (percent of time a particular discharge was equaled or exceeded), discharge duration (percent of years a particular discharge was equaled or exceeded), and discharge frequency (percent of years a particular lake level was equaled or exceeded) at Lake Texoma for the period of 1938 to 2000. Discharge duration and discharge frequency model results are also presented for Arthur City, Texas, downstream of Lake Texoma.

In 1972, amendments to the Clean Water Act (CWA), specifically the establishment of Section 303(d), required states to develop lists of water bodies that do not meet water quality standards and to submit updated lists to the U.S. Environmental Protection Agency (USEPA) every 2 years. USEPA is required to review impaired water body lists submitted by each state and approve or disapprove all or part of the list (OKDEQ 2003).

For water bodies on the 303(d) list, the CWA requires that a pollutant load reduction plan or total maximum daily load (TMDL) be developed to correct each impairment. TMDLs must document the nature of the water quality impairment, determine the maximum amount of a pollutant load which can be discharged and still meet standards, and identify allowable loads from the contributing sources. The elements of a TMDL include a problem statement, description of the desired future condition (numeric target), pollutant source analysis, load allocations, description of how allocations relate to meeting targets, and margin of safety (OKDEQ 2003).

The states of Oklahoma and Texas have yet to develop TMDLs for waters of the Red River, Washita River, or Lake Texoma. The Oklahoma Department of Environmental Quality (OKDEQ) has identified several river segments in the Red and Washita river drainages, as well as the Upper Washita River Arm of Lake Texoma, on their 2002 303(d) list submitted to and approved by USEPA. The Upper Washita River Arm of the lake has been listed due to nonattainment with the warm water aquatic community beneficial use designation (OKDEQ 2002). OKDEQ has listed 2005 as its targeted date for development of TMDLs for all listed segments of the Red River, as well as the Upper Washita River Arm of Lake Texoma. TMDL development is scheduled for 2004 (three segments), 2005 (three segments), and 2009 (four segments) for the Washita River segments on the 303(d) list (OKDEQ 2002).

The Texas Commission on Environmental Quality (TCEQ) released a draft 303(d) list for 2004 on January 15, 2004. This list does not identify any waters of Lake Texoma or the Red River. However, the Upper Prairie Dog Town Fork of the Red River is on the draft 2004 303(d) list for Texas. More data and information are needed before the TCEQ will schedule the development of a TMDL for this segment (TNRCC 2004).

The National Wetlands Inventory of the U.S. Fish and Wildlife Service classified the majority of wetlands in the vicinity of Lake Texoma in the palustrine system; however, wetlands classified in the lacustrine and riverine systems are also present (USFWS 2004). Wetlands classified as palustrine are nontidal and are dominated by trees, shrubs, emergents, mosses, or lichens. Within these three systems (palustrine, lacustrine, and riverine), wetlands have been further classified as limnetic and littoral (lacustrine); emergent, forested, scrub-shrub, unconsolidated bottom, and unconsolidated shore (palustrine); and lower perennial (riverine). Many of the wetland types have been further classified as diked/impounded or excavated, indicating that they formed under conditions created by humans. The wetlands in the vicinity of Lake Texoma are also subject to different hydrologic regimes, including seasonally flooded, semipermanently flooded, and permanently flooded.

Dominant vegetation found in wetlands of the Tishomingo and Hagerman National Wildlife Refuges, which are adjacent to Lake Texoma, include boxelder (*Acer negundo*), black willow (*Salix nigra* var. *lindheimeri*), cottonwood, sedges, saltgrass (*Distichlis* spp.), native millet (*Panicum miliaceum*), pondweed (*Potamogeton nodosus*), smartweed, arrowleaf (*Sagitaria* spp.), cattail (*Typha* spp.), rushes (*Juncus* spp.), and bulrush (*Scirpus pendulus*). Wetlands provide essential habitat for waterfowl as well as shore birds, wading birds, and several mammal and reptile species (USFWS 2000a, 2000b).

4.4.4 Wild and Scenic Rivers

There are no streams or rivers within the project area that are classified as wild and scenic pursuant to the Federal Wild and Scenic Rivers Act (Public Law 90-542).

4.4.5 Fish and Wildlife

The aquatic, wetland, and upland habitats at Lake Texoma support a diversity of fish and wildlife. The Oklahoma Department of Wildlife Conservation (ODWC) and the Texas Parks and Wildlife Department (TPWD) have the responsibility to manage, regulate, and control fish and wildlife resources for Lake Texoma. There is a cooperative agreement with the U.S. Fish and Wildlife Service to preserve and improve wildlife habitat for the 13,450 acres in Tishomingo National Wildlife Refuge and 11,400 acres in Hagerman National Wildlife Refuge (USACE 2003a). The following four subsections provide a listing of fish and wildlife species that could occur at Lake Texoma.

4.4.5.1 Fish

Management of the fishery resources at Lake Texoma is the responsibility of the ODWC and TPWD. Lake Texoma provides habitat for at least 70 species of fish, several of which were introduced by the ODWC and TPWD (USACE 2003). These agencies maintain a supplemental stocking program to improve the fishery resource. Those species popular for recreational fishing include channel (*Ictalurus punctatus*), blue (*I. furcatus*), and flathead catfish (*Pylodictis olivaris*); largemouth (*Micropterus salmoides*), spotted (*M. punctulatus*), white (*Morone chrysops*), smallmouth (*Micropterus dolomieui*) and striped bass; and white crappie (*Pomoxis annularis*). The smallmouth bass is increasing in abundance and popularity and Lake Texoma has held the past five Oklahoma smallmouth bass state records since 1988. The striped bass fishery at Lake Texoma is extremely popular and is considered one of the most successful striped bass fisheries in the nation. In addition, downstream of the dam is a tailwater fishery that supports striped bass, as well as channel, blue, and flathead catfish. The spawning of striped bass in the Red and Washita rivers is the key to the continued success of this sport fishery (USACE 1989).

Gizzard shad (*Dorosoma cepedianum*), threadfin shad (*D. petenense*), and Mississippi silverside (*Menidia audens*) are considered important forage species in the lake. Freshwater drum (*Aplodinotus grunniens*), carp (*Cyprinus carpio*), gar (*Lepisosteus* spp.), buffalo (*Ictiobus* spp.), and river carpsucker (*Carpiodes carpio*) make up the bulk of rough fishes in the lake (USACE 1989).

4.4.5.2 Amphibians and Reptiles

Numerous amphibians and reptiles are known to occur at Lake Texoma. Species of amphibians that are supported include salamander (*Ambystoma* spp.), plains and eastern spadefoot toad (*Scaphiopus bombifrons* and *S. holbrookii*, respectively), gray tree frog (*Hyla versicolor*), chorus frog (*Pseudacris* spp.), bullfrog (*Rana catesbeiana*), and the southern leopard frog (*R. pipiens*). Reptile species at Lake Texoma include snapping turtle (*Chelydra sepentina*), box turtle (*Terrapene* spp.), eastern fence lizard (*Sceloporus undulatus*), Texas horned lizard (*Phrynosoma cornutum*), water snake (*Natrix* spp.), Texas brown snake (*Storeria dekayi*), common garter snake (*Thamnophis sirtalis*), eastern hognose snake (*Heterodon platyrhinos*), black rat snake (*Elaphe obsoleta*), copperhead (*Agkistrodon contortrix*), western diamondback rattlesnake (*Crotalus atrox*), and the western pigmy rattlesnake (*Sistrurus miliarius*) (USACE 2003a).

4.4.5.3 Birds

The variety of habitats at Lake Texoma support numerous species of migratory waterfowl and wading birds, upland game birds, raptors, and songbirds. These include mallards (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), blue-winged teal (*A. discors*), pintail (*A. acuta*), great blue heron (*Ardea herodias*), little blue heron (*Florida caerulea*), turkey (*Meleagris gallopavo*), northern bobwhite (*Colinus virginianus*), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), crows (*Corvus brachyrhynchos*), killdeer (*Charadrius vociferous*), yellow-billed cuckoo (*Coccyzus americanus*), red-bellied woodpecker (*Centurus carolinus*), purple martin (*Progne subis*),

barn swallow (*Hirundo rustico*), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*P. bicolor*), Eastern bluebird (*Sialia sialis*), Northern mockingbird (*Mimus polyglottos*), European starling (*Sturnus vulgaris*), lark sparrow (*Chondestes grammacus*), Northern cardinal (*Richmondena cardinalis*), painted bunting (*Passerina ciris*), dickcissel (*Spiza americana*), red-winged blackbird (*Agelaius phoeniceus*), Eastern meadowlark (*Sturnella magna*), brown-headed cowbird (*Molothrus ater*), scissor-tailed flycatcher (*Muscivora forfic*), and American robin (*Turdus migratorius*) (USACE 2003a).

4.4.5.4 Mammals

A variety of small mammals, bats, carnivores/omnivores, and ungulates occur at Lake Texoma, including the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), opossum (*Didelphis marsupialis*), least shrew (*Cryptotis parva*), eastern harvest mouse (*Reithrodontomys humulis*), deer mouse (*Peromyscus maniculatus*), eastern cottontail (*Sylvilagus floridanus*), red bat (*Lasiurus borealis*), evening bat (*Nycticeius humeralis*), striped skunk (*Mephitis mephitis*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), red fox (*Vulpes fulva*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*) (USACE 2003a).

4.4.6 Threatened and Endangered Species

Consultation was initiated in July 2003 (USACE 2003b) with the U.S. Fish and Wildlife Service (Service) regarding listed species with the potential to be affected by USACE activities on the Arkansas, Canadian, and Red Rivers in Arkansas, Oklahoma, and Texas; and on the McClellan-Kerr Arkansas River Navigation System in Arkansas and Oklahoma. A Biological Assessment (BA) was prepared by the USACE and submitted to the Service (USACE 2003b) as part of this consultation. In June 2005 the Service issued a Biological Opinion (BO) to the Corps that included the operation of Denison Dam. The BO is incorporated by reference in this EA.

The USACE narrowed the list of 16 species provided by the Service for the consultation down to seven species with the potential to occur at Lake Texoma or in the Red River System below Denison Dam. Table 12 provides the list of these species and their status.

Table 12. Threatened and Endangered Species with the Potential to Occur at Lake Texoma or in the Red River System Below Denison Dam.

Common Name	Scientific Name	Status: (T) Threatened, (E) Endangered
Bald eagle	*Haliaeetus leucocephalus*	T
Interior least tern	*Sterna antillarum*	E
Whooping crane	*Grus americana*	E
Piping plover	*Charadrius melodius*	T
American alligator	*Alligator mississippiensis*	T
Scaleshell mussel	*Leptodea leptodon*	E
American burying beetle	*Nicrophorus americanus*	E

The bald eagle and interior least tern are known to occur in the project area. Bald eagles are common winter residents along the shores of Lake Texoma and are also known to nest in this area (USACE 2003b). They use tall trees near water for foraging, roosting, and nesting, and are also known to nest

in cliffs. Downstream of Lake Texoma, interior least terns are common summer residents and utilize sandbar habitats for nesting and loafing and the adjacent shallow water habitat for feeding. Least terns are addressed at length in the BO and are the listed species most visible along the Red River.

The whooping crane and piping plover are considered migrants in the vicinity of Lake Texoma. Whooping cranes, which are considered rare spring and fall migrants in this area, use emergent vegetation along the edges of marshes, prairie pothole wetlands, or lakes for resting sites; croplands for foraging; and riverine wetlands for roosting. While it is possible that whooping cranes use the available habitat at Lake Texoma and along the Red River below Denison Dam, historical records indicate that they primarily use the habitat along the river upstream of the lake. Lake Texoma is located in the migration corridor of the piping plover, and it is possible that this species uses mudflats associated with the Red River in the vicinity of Lake Texoma. However, there are no records of locations used frequently by this species for the project area. (USACE 2003b).

The American alligator uses rivers, swamps, lakes, and marshes, digging dens in riverbanks or shorelines of lakes. Although this species is considered a possible transient in the lower portion of the Red River, it does not appear to be found near Lake Texoma (USACE 2003b).

The scaleshell mussel is found in larger creeks and small to medium size rivers with good water quality, in riffles with moderate to high gradients. In Oklahoma, recent surveys in the Red River basin failed to find this species. Although habitat for this species is likely to be supported in the project area, it does not appear that the scaleshell mussel is found near Lake Texoma (USACE 2003b).

The American burying beetle is known to occur in several counties along or near Lake Texoma. Little is known about the habitat requirements of this species, however, in Oklahoma, it has been found in habitats ranging from deciduous and coniferous forests to open pasture. Surveys for the American burying beetle have been conducted on the Washita River Arm of Lake Texoma, but have not resulted in collection of this species (USACE 2003b). Since it is known to occur in the vicinity of the lake, and because it is a highly mobile species, it could occur in suitable habitat at Lake Texoma.

4.5 Cultural Resources

In accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended), the appropriate agencies and Native American tribes were contacted via written correspondence (dated February 15, 2001) to discuss potential impacts on cultural resources. The Tulsa District mailed letters to the Oklahoma Historical Society State Historic Preservation Office, the Oklahoma Archeological Survey, and the Texas Historical Commission, as well as the Wichita and Affiliated Tribes of Oklahoma, the Choctaw Nation of Oklahoma, the Chickasaw Nation of Oklahoma, and the Caddo Indian Tribe of Oklahoma (Appendix C). In these letters, the Tulsa District established the position that there would be “no effect” on cultural resources as a result of the Lake Texoma storage reallocation project.

The Oklahoma Historical Society responded on March 6, 2001, indicating that this project is not subject to consultation requirements because there would be no construction or earth-moving activities. The Oklahoma Archeological Survey responded on February 28, 2001, that the project should have no impact on the prehistoric cultural or archeological resources of Oklahoma. Finally, the Texas Historical Commission responded on March 2, 2001, indicating their concurrence with the “no effect” determination and that the project may proceed. Each agency response is documented in Appendix C. None of the tribes contacted have provided comments on the project. Section 106 coordination is therefore complete for this project.

4.6 Air Quality

USEPA published a Conformity Rule on November 30, 1993, requiring all Federal actions to conform to appropriate State Implementation Plans (SIPs) that were established to improve ambient air quality. National Ambient Air Quality Standards exist for six pollutants: carbon monoxide, ozone, respirable particulate matter (including particulates equal to or less than 10 microns in diameter [PM_{10}] and particulate matter equal to or less than 2.5 microns in diameter [$PM_{2.5}$]), sulfur dioxide, nitrogen oxides, and lead). In July 1997, the 8-hour ozone standard was promulgated and the existing 1-hour ozone standard was remanded for all areas, except those designated nonattainment with the 1-hour standard when the 8-hour standard was adopted. Implementation of this new standard was delayed due to legal challenges; however, on April 15, 2004, USEPA promulgated the Final Implementation Rule and designated as nonattainment those areas that exceeded the 8-hour ozone standard throughout the country.

These "criteria pollutants" are the only pollutants for which standards have been established. USEPA assigns designations, based on an area's meeting, or "attaining" these standards. At this time, the Conformity Rule only applies to Federal actions in nonattainment areas. A nonattainment area is an area that does not meet one or more of the National Ambient Air Quality Standards for the criteria pollutants designated in the Clean Air Act (CAA).

The project area is within the Oklahoma counties of Love, Bryan, Marshall, and Johnston; and the Texas counties of Grayson and Cooke. According to maps in the USEPA “Green Book” (for criteria pollutant nonattainment areas), all counties within Oklahoma have been designated as attainment areas for criteria pollutants and air toxins, including the 8-hour ozone standard (USEPA 2004) The TCEQ maintains information on SIPs related to air quality in Texas’ nonattainment areas. Grayson and Cooke counties have been designated attainment areas for all criteria pollutants and air toxins, including the 8-hour ozone standard (TNRCC 2002).

A conformity analysis based on air emissions analysis is required for any proposed Federal action within a nonattainment area. Since the geographical region potentially affected by the Lake Texoma storage reallocation project is in attainment and meets the National Ambient Air Quality Standards for the criteria pollutants designated in the CAA, a conformity determination is not required.

4.7 Hazardous, Toxic, and Radiological Wastes

Potential pollution sources in the vicinity of Lake Texoma include sewage disposal/treatment systems (septic tanks and other subsurface disposal systems, as well as municipal sewage treatment plants), private cabins and concession operations, boats, sanitary landfills, open dumps, water treatment plants, animal production facilities, and oil production facilities (USACE 1996a, 2003a).

Of these potential sources, oil production facilities present the greatest threat to Lake Texoma. Several active oil fields are on or surrounding government property, while hundreds of transport pipelines cross government property and surface waters that feed Lake Texoma. To date, none of these sources have had a significant effect on Lake Texoma (USACE 1996a, 2003a).

4.8 Noise

Noise sources at Lake Texoma are primarily affiliated with recreation activities and include motor boats, motor vehicles, hunting, and people at the marinas, campgrounds, and other recreational

facilities surrounding the lake. Operation of the hydropower facilities represents another source of noise at the lake.

5 Environmental Impacts of the Proposed Action

According to screening criteria described in Section 2.2, only one action alternative was suitable for further, more detailed evaluation: the proposed action as described in Section 3. A summary of environmental impacts is presented in Table 13 (page 29).

5.1 Socioeconomics

5.1.1 No Action Alternative

5.1.1.1 Population

Under the No Action Alternative, population trends of the past decade would continue. Population dynamics would be influenced by economic and recreational opportunities in the counties surrounding Lake Texoma, while the demand for residential lands would continue to be linked to future population dynamics. The 150,000 acre-feet of water currently in water supply would continue to be available to help service current and future populations of southern Oklahoma and northern Texas.

5.1.1.2 Employment and Income

The employment rate in the social area would remain similar to the state levels for both Oklahoma and Texas. The educational, health, and social services; manufacturing; and retail trade sectors would be expected to continue as an important part of the economy in this area. Recreational services and oil and gas exploration would be expected to increase in their importance for the local economy. With respect to water supply from Lake Texoma, municipal, industrial, and agricultural opportunities would continue to be limited to the 150,000 acre-feet of water currently available in water supply storage at Lake Texoma.

Income in the defined social area would continue to be near or below the state averages. The current allocation of water supply storage at Lake Texoma would not be expected to influence income in the counties surrounding Lake Texoma.

5.1.1.3 Social Ecology

The area would continue to be primarily a mix of residential, agricultural lands, and business. Demand for new residential developments would increase the transition of agricultural lands into residential areas. The area would continue to be a center for recreation.

5.1.2 Proposed Action

5.1.2.1 Population

Reallocation of 300,000 acre-feet from hydropower to water supply storage could have an effect on the population of the social area. Although it would not directly affect overall population growth trends in southern Oklahoma and northern Texas, this additional water supply would be available for new industrial, agricultural, and municipal users in this area. This could promote growth of business-related opportunities and residential development in the social area, which could cause small, local changes in population.

5.1.2.2 Employment and Income

The employment rate in the social area would continue to remain similar to the state levels for both Oklahoma and Texas. Some new job opportunities might become available associated with new opportunities from the additional water supply storage. These would likely be in the residential development (e.g., construction), recreation (e.g., golf courses), retail (e.g., restaurants), agricultural, and oil and gas industries.

The educational, health, and social services; manufacturing; and retail trade sectors are expected to continue to be an important part of the economy in this area. New business opportunities in the social area would not appreciably affect income because they would be similar to existing enterprises (e.g., construction, recreation, retail, agricultural, and oil and gas).

5.1.2.3 Social Ecology

The reallocation of hydropower storage to water supply storage would reinforce the social ecology of this area as primarily a mix of residential, agricultural, and business. Increased demand for new residential developments could increase the transition of agricultural lands into residential areas. The area would continue to be a center for recreation.

5.2 Natural Resource Impacts

5.2.1 No Action Alternative

Under the No Action Alternative, conditions at Lake Texoma would remain status quo. There would be no impacts on terrestrial resources, soils, and prime farmland; hydrology; fish and wildlife; or threatened or endangered species.

5.2.2 Proposed Action

5.2.2.1 Terrestrial

Construction and earth-moving activities would not be directly associated with the storage reallocation project at Lake Texoma. Reductions in elevation duration, elevation frequency, discharge duration, and discharge frequency (see Section 5.2.2.3, Hydrology) would not be expected to have effects on terrestrial resources such as upland plant communities. Because the Proposed Action does not involve raising lake levels, there is no concern for additional flooding or backwater effects that would have an impact on terrestrial resources upstream of Lake Texoma.

5.2.2.2 Soils and Prime Farmland

Although soils classified as prime farmland do exist in the project area, there would be no direct effects from the storage reallocation at Lake Texoma. None of these soils would be converted to different uses (i.e., taken out of agricultural production), nor would they be affected by the reductions in elevation duration, elevation frequency, discharge duration, or discharge frequency.

5.2.2.3 Hydrology

Reallocation of storage in Lake Texoma would result in very minor changes to elevation duration, elevation frequency, discharge duration, or discharge frequency at Lake Texoma. Using data from the period of record (1938 to 2000), model outputs for the Proposed Action (see Appendix B) indicate that elevation frequency, or the percent of years in which a given lake elevation is equaled or exceeded, would not change perceptibly (reduced by less than 1 percent) with implementation of the

Proposed Action (see Figure 2 in Appendix B). All model outputs reflect actual drought and flood periods within the period of record. These models also indicate that elevation duration, or the percent of time for which a given lake elevation is exceeded, would not change perceptibly (reduced by less than 1 percent) when lake elevations are approximately 617 feet above MSL or higher (see Figure 3 in Appendix B). Below this elevation, elevation duration would decrease by approximately 3 to 8 percent under the Proposed Action. For example, under current conditions, elevations of approximately 613 feet are exceeded approximately 85 percent of the time; under the Proposed Action, this elevation would be exceeded approximately 80 percent of the time.

There will be some negative hydropower impacts. These impacts would impact hydropower in the future only after the water is contracted for and used. Because of negative impacts, hydropower losses will be compensated. Public Law 99-662 requires that, with respect to any water supply contract entered into by the Secretary of the Army under this reallocation after June 1, 1985, the amount of hydropower lost, as a result of the contract, shall be determined. Credits shall be provided to the Southwestern Power Administration for the replacement cost of hydropower lost. In each such case the Southwestern Power Administration shall reimburse each preference customer for an amount equal to the customer's actual replacement cost for hydropower lost as a result of the implementation of such water supply contract, less the cost such customer would have had to pay to the Southwestern Power Administration for such hydropower.

The Corps calculates benefits foregone by using National Economic Development standards as specified in Corps of Engineers policy and guidance. Southwestern Power Administration measures the benefits lost based on market-based benefits lost. The Hydropower Analysis Center has prepared an appendix to their report acknowledging this difference and illustrating the market based benefits lost. The calculation of power benefits foregone will follow existing Corps regulations using National Economic Development standards.

These changes will reduce the amount of water available in hydropower storage and ultimately the water available for generation. In addition, reallocating 300,000 acre-feet from hydropower storage would reduce water available to the hydropower pool by approximately 23 percent, from 1,317,283 acre-feet to 1,017,283 acre-feet. The water lost as a result of reallocation from hydropower to water supply storage would no longer be available to run through the turbines of the hydropower operation, and would represent a reduction in downstream discharges. Based on the results of the modeling, however, discharge frequency, or the percent of years in which a given discharge would be equaled or exceeded, would not change perceptibly (reduced by approximately 1 to 2 percent) for discharges

Table 13. Impact Assessment Matrix

Name of Parameter	Magnitude of Probable Impact						
	Increasing Beneficial Impact			No Appreciable Effect	Increasing Adverse Impact		
	Significant	Substantial	Minor		Minor	Substantial	Significant
SOCIAL EFFECTS							
Noise Levels				X			
Aesthetic Values				X			
Recreational Opportunities				X			
Transportation				X			
Public Health and Safety			X				
Community Cohesion (Sense of Unity)				X			
Community Growth and Development			X				
Business and Home Relocations			X				
Existing/Potential Land Use			X				
Controversy					X		
ECONOMIC EFFECTS							
Property Values				X			
Tax Revenues				X			
Public Facilities and Services			X				
Regional Growth			X				
Employment			X				
Business Activity			X				
Farmland/Food Supply			X				
Flooding Effects				X			
Hydropower					X		

Table 13. Impact Assessment Matrix (cont'd)

Name of Parameter	Magnitude of Probable Impact						
	Increasing Beneficial Impact			No Appreciable Effect	Increasing Adverse Impact		
	Significant	Substantial	Minor		Minor	Substantial	Significant
NATURAL RESOURCE EFFECTS							
Air Quality				X			
Terrestrial Habitat				X			
Wetlands					X		
Aquatic Habitat					X		
Habitat Diversity and Interspersion				X			
Biological Productivity					X		
Surface Water Quality				X			
Water Supply		X					
Groundwater				X			
Soils				X			
Threatened and Endangered Species				X			
CULTURAL RESOURCES							
Historic Architectural Values				X			
Prehistoric & Historic Archeological Values				X			

above 3,500 cfs (see Figure 4 in Appendix B). The frequency of discharges below this rate would be reduced slightly further, but not by more than 5 percent, with implementation of the Proposed Action. The model results also show that discharge duration, or the percent of time for which a given discharge would be equaled or exceeded, would also be only slightly reduced. This change would be the most pronounced for discharges between 600 and 7,000 cfs, where discharge duration would be reduced by approximately 3 to 8 percent under the Proposed Action (see Figure 5 in Appendix B). For example, under current conditions, discharges of 2,000 cfs are equaled or exceeded approximately 52 percent of the time. Under the Proposed Action, these discharges would be equaled or exceeded approximately 45 percent of the time. Outside of this 600 to 7,000 cfs range, changes in discharge duration are imperceptible (reduced by approximately 2 percent or less). The changes seen in this lower range of discharges reflect changes in hydropower generation due to the reduction in storage available to hydropower. This will be slightly more pronounced during dry times.

In addition, modeling of discharge duration and frequency at Arthur City, Texas, approximately 95 miles downstream of Lake Texoma, indicates that the effects of the Proposed Action are reduced the further one travels below the lake. According to the model results, there would be imperceptible changes in discharge frequency (see Figure 6 in Appendix B) and discharge duration would be reduced by less than 5 percent (see Figure 7 in Appendix B).

Elevation duration and elevation frequency would be affected less than 1 percent above 617 feet above MSL. Below that elevation, elevation duration would decrease approximately 3 to 8 percent under the proposed action. The 3 to 8 percent reduction is in percent of time that the pool elevation would be equaled or exceeded or a specific flow is equaled or exceeded. The slight reduction in elevation duration at Lake Texoma below elevation 617 feet above MSL would have only minor and insignificant adverse affects on aquatic or wetland habitat. It could result in the creation of mudflats and emergent wetlands during drought years in areas that were previously lacustrine. Backwater effects (e.g., flooding) on aquatic and wetland habitat at and upstream of the lake are not anticipated.

The potential minor reduction in discharge duration and frequency could slightly affect aquatic and wetland habitat downstream of Lake Texoma and wetland habitat downstream of Lake Texoma and Denison Dam (e.g., pools along the Red River that provide aquatic habitat could be shallower at times, and wetlands dependent on periodic inundation might receive less water as a result of lower flows). However, as the model results for Arthur City indicate, the effects would be reduced as one travels further downstream from the lake. Additionally, regulation of flows below Texoma on the Red River for fish and wildlife is an authorized project purpose, although no lake storage is provided. Low flow releases, in combination with normal discharges for hydropower generation, generally ensure that some water passes through aquatic and wetland habitat of the Red River downstream of Lake Texoma. These low flow releases to support aquatic habitat below the project are voluntary and are not considered dependable. However, all project purposes will share proportionally with any releases deemed necessary to meet short term, critical fish and wildlife needs Finally, during drought conditions, drought contingency plans would be implemented (see Section 6.0, Relevant Operational Plans) to ensure that adequate water is available for conservation purposes, including downstream discharges to maintain minimum water flows in the Red River, which in turn support aquatic habitat and wetlands.

Because the Proposed Action does not involve raising lake levels, there is no concern for additional flooding or backwater effects that would have an impact on aquatic and wetland habitat upstream of Lake Texoma.

Although water supply could come from a slightly lower level in the lake when compared to current withdrawals, this would not have an appreciable effect on water quality at Lake Texoma. Effects on

thermal gradients, as well as chemical water quality parameters (e.g., total dissolved solids, dissolved oxygen), are not anticipated, and would be imperceptible if they did occur. The reductions in discharge duration and frequency could adversely affect dissolved oxygen levels just downstream of Lake Texoma. However, low-flow releases and discharges for hydropower generation would help maintain dissolved oxygen, as well as reduce periods of no flow and stagnation even further downstream in the Red River. The Proposed Action would not change the potential for erosion and sedimentation at Lake Texoma or in the Red River. Overall, water quality would not be affected in the lake or the Red River, and the Proposed Action would not affect the designation of 303(d) waters or the development of TMDLs in the states of Oklahoma or Texas.

No wetland or water quality permits would be required for implementation of the Proposed Action (see Appendix D).

5.2.2.4 Fish and Wildlife

Construction and earth-moving activities are not necessary to implement the storage reallocation project at Lake Texoma, and upland wildlife habitat and species would be unaffected. Reductions in elevation duration, elevation frequency, discharge duration, and discharge frequency (as discussed in Section 5.2.2.3, Hydrology) could have impacts on wildlife that use the aquatic and wetland habitat available in the lake and the Red River. A reduction in elevation duration and frequency at the lake could result in the formation of new wetlands, which would provide important wildlife habitat (especially for fish and amphibians) in areas that were previously inundated. Although this could result in the loss of shoreline aquatic habitat for wading birds/waterfowl, fish, and amphibians, the effects would be imperceptible given the extent of this habitat at Lake Texoma. In addition, the implementation of seasonal pool plans that benefit wildlife would continue to cause periodic inundation of these areas, temporarily restoring such habitat. Therefore, the Proposed Action is not anticipated to significantly affect wildlife or their habitat at the lake.

Under the Proposed Action, reductions in discharge duration and frequency from the lake are not expected to significantly affect wildlife or their habitat downstream of Lake Texoma. These reductions could, at times, cause pools that provide habitat for fish along the Red River to be shallower; however, impacts would be negligible. Wetlands dependent on periodic inundation might receive less water as a result of lower flows. However, the effect diminishes as one travels further from the lake, as indicated in the modeling results for Arthur City, Texas discussed in Section 5.2.2.3. In addition, low-flow releases and discharges for hydropower generation would ensure that some water passes through the aquatic and wetland habitat of the Red River downstream of Lake Texoma.

Because the Proposed Action does not involve raising lake levels, there is no concern for additional flooding or backwater effects that would have an impact on wildlife upstream of Lake Texoma.

5.2.2.5 Threatened and Endangered Species

Reductions in discharge duration and frequency are not anticipated to significantly affect the hydrologic conditions that create sandbar habitats used by interior least terns downstream of Lake Texoma. In addition, modified releases from the dam are made to enhance or maintain interior least tern habitat, and would continue under the Proposed Action as necessary (USACE 2002). Because there would be no construction-related activities that could impact interior least terns (e.g., heavy equipment noise or habitat loss) and because potential changes to downstream discharges would have minimal impacts, the Proposed Action would have no measurable effect on interior least terns downstream of Lake Texoma. This action is covered in the comprehensive biological opinion (BO) issued by the U.S. Fish and Wildlife Service in June of 2005.

Reductions in elevation duration and frequency at Lake Texoma would not result in the loss of shoreline habitat (e.g., large trees near the water) that supports bald eagles. In addition, there would be no direct construction-related activities that could impact bald eagles (e.g., noise from heavy-equipment or tree removal). There would be no changes in water quality that could affect the prey base of the bald eagle under this alternative. Therefore, the Proposed Action would have no effect on bald eagles at Lake Texoma.

Although habitat for the whooping crane and piping plover is supported in the project area, historical records indicate that they occur primarily as migrants in the vicinity of Lake Texoma. Regardless, reductions in discharge duration and frequency are not anticipated to significantly affect the hydrologic conditions that create the wetland and mudflat areas downstream of the lake that may be used by these species. The modified releases for least tern management would also ensure that the hydrology downstream of Lake Texoma is maintained, as necessary. Reductions in elevation duration and frequency at Lake Texoma would not significantly affect the shoreline habitat that may be used by whooping cranes. In fact, a reduction in elevation duration and frequency at the lake could result in the formation of new wetlands, which could provide additional rest areas for whooping cranes. Because there would be no construction-related activities that could impact whooping cranes and piping plovers (e.g., heavy equipment noise or habitat loss), because potential changes to discharge or elevation duration and frequency would have no impact on their habitat, and because there would be no changes in water quality that could affect the prey base of either species, the Proposed Action would have no effect on these species.

Impacts on the American alligator and scaleshell mussel are not anticipated under the Proposed Action, as these species are not likely to occur in the project area. In addition, changes in discharge or elevation duration and frequency at Lake Texoma are not anticipated to alter the potential habitat for these species. There would be no changes in water quality that could affect the prey base of these species under this alternative. Therefore, the Proposed Action would have no effect on the American alligator or scaleshell mussel.

Although the American burying beetle has the potential to occur at Lake Texoma, the Proposed Action would not affect the terrestrial environment in which this species is supported (upland plant communities). Therefore, the Proposed Action is not anticipated to have significant effects on this species.

Because the Proposed Action does not involve raising lake levels, there is no concern for additional flooding or backwater effects that would have an impact on threatened or endangered species that might occur upstream of Lake Texoma.

In a letter dated October 5, 2004 (Appendix A), the Service concurred with these determinations, indicating that they do not anticipate any federally-listed species to be adversely affected by the proposed storage reallocation. They stated that the Proposed Action was covered in the USACE BA (USACE 2003b) and that compliance with Section 7 of the Endangered Species Act has been addressed in the subsequent biological opinion issued by the Service.

5.3 Cultural Resources

5.3.1 No Action Alternative

Under the No Action Alternative, there would be no impact on cultural resources.

5.3.2 Proposed Action

As outlined in Section 4.5, Section 106 coordination under the National Historic Preservation Act is complete; no impacts on cultural resources are expected as a result of the Proposed Action. Refer to Appendix C for cultural resources coordination.

5.4 Air Quality

5.4.1 No Action Alternative

Under the No Action Alternative, conditions at Lake Texoma would remain status quo. There would be no impact on air quality.

5.4.2 Proposed Action

The Proposed Action would not result in any direct effects on air quality.

5.5 Hazardous, Toxic, and Radiological Wastes

5.5.1 No Action Alternative

Under the No Action Alternative, conditions at Lake Texoma would remain status quo. There would be no impacts on hazardous, toxic, and radiological wastes.

5.5.2 Proposed Action

The proposed storage reallocation at Lake Texoma would not result in any effects on hazardous, toxic, and radiological wastes in the project area.

5.6 Noise

5.6.1 No Action Alternative

Under the No Action Alternative, conditions at Lake Texoma would remain status quo. There would be no impacts on the noise environment.

5.6.2 Proposed Action

The proposed storage reallocation at Lake Texoma would not result in any effects on noise in the project area.

5.7 Indirect and Cumulative Impacts

No significant indirect or cumulative environmental impacts are expected to occur as a result of the reallocation Indirect and cumulative impacts associated with the proposed action could include localized areas of soil disturbance and related impacts associated with future construction of water intake structures and similar facilities for water supply users around Lake Texoma. If Federal funds are involved in the construction of intake structures or related facilities, NEPA documentation will be prepared at that time. In addition, alternate energy sources to hydropower generation, if required,

could result in increased emissions of air pollutants in areas where these sources are employed. While uncertainties regarding numbers, location, and design of these structures preclude detailed impact analyses, implementation of these features would be subject to appropriate permitting requirements and compliance with all applicable environmental laws and regulations for their construction and operation. This should ensure that an appropriate level of environmental protection accompanies future development of these features.

6 Relevant Operational Plans

Regulation of flows on the Red River is an authorized project purpose at Lake Texoma. Normally, low-flow and hydropower releases are made through the turbines. In the late summer, dissolved oxygen levels can become too low to support certain species of fish. If dissolved oxygen monitoring indicates that levels are at a critical point, a low flow release of 50 cfs is discharged through one of the flood-control conduits. Water released in this manner becomes highly aerated, and has proven effective in maintaining dissolved oxygen levels to prevent fish kills (USACE 1993b).

During drought conditions, a Drought Contingency Plan is implemented at Lake Texoma (USACE 1993b). This plan is designed to provide coordination and intensify actions as drought increases in severity, with four levels of response to be progressively initiated as the drought intensifies. This plan ensures that all of the project purposes, including flood control, water supply, hydroelectric power, downstream flow regulation, improvement to navigation, and recreation, are not compromised during drought conditions.

A Biological Opinion (BO) was issued by the U. S. Fish and Wildlife Service (Service) by letter dated June 28, 2005 that placed specific requirements on the U. S. Army Corps of Engineers pertinent to endangered species and the operation of Denison Dam and its affects on the Red River downstream to Index, Arkansas. Specifically the BO placed requirements on the Corps for flood control releases, hydropower releases, low flow releases, and lake level manipulation to address needs of the interior population of the least tern which nests in good numbers on the Red River below Denison Dam. The BO requires the Corps to coordinate frequently and in a timely manner with the Service when it has determined that increased flow releases may flood terns (flood releases) or decreased flows may land-bridge tern nesting sites. During these flood events or low flow events, the Corps must provide to the Service for discussion, its recommendations to reduce flooding or land-bridging of nests. The Service requires that the maintenance of least tern nesting habitat shall be a priority of the Corps and operational activities modified and implemented to meet or exceed tern reproductive requirements established by the Service.

Different types of releases for interior least tern management are made during the nesting season as opposed to the non-nesting season. While lake levels are maintained for implementation of the Seasonal Pool Plan, hydropower generation, and flood control, minimum-flow releases are made throughout the nesting season (June and into or through August) to protect interior least tern nesting sites. During the 2001 nesting season, the average flow requirement to protect interior least terns below Lake Texoma was 5,000 cfs. There is no contractual storage for water released to comply with Service requirements so this water will be equally proportioned from all users.

7 Federal, State, and Local Agency Coordination

The draft EA was coordinated with the following agencies having legislative and administrative responsibilities for environmental protection. Copies of the correspondence from those agencies that

provided comments and planning assistance for preparation of the draft EA are in the appendices. The mailing list for the 30-day public review period for this EA is in Appendix A.

U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Department of Agriculture
Oklahoma Water Resources Board
Oklahoma Department of Environmental Quality
Oklahoma Department of Wildlife Conservation
Oklahoma Historical Society State Historic Preservation Office
Oklahoma Archeological Survey
Texas Water Development Board
Texas Parks and Wildlife Department
Texas Commission on Environmental Quality
Red River Authority
Texas Historical Commission
Wichita and Affiliated Tribes of Oklahoma
Choctaw Nation of Oklahoma
Chickasaw Nation of Oklahoma
Caddo Indian Tribe of Oklahoma
Quapaw Tribe of Oklahoma

8 References

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9 Applicable Environmental Laws and Regulations

Table 14. Relationship of Plans to Environmental Protection Statutes and Other Environmental Requirements

Federal Policies	Compliance of Alternatives
Archeological and Historic Preservation Act, 1974, as amended, 16 U.S.C. 469, et seq.	Full compliance
Clean Air Act, as amended, 42 U.S.C. 7609, et seq.	Full compliance
Clean Water Act, 1977, as amended (Federal Water Pollution Control Act, 33 U.S.C. 1251), et seq.	Full compliance
Endangered Species Act, 1973, as amended, 16 U.S.C. 1531, et seq.	Full compliance
Farmland Protection Policy Act, 7 U.S.C. 4201, et seq.	Full compliance
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1-12, et seq.	Full compliance
Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq.	Full compliance
Land and Water Conservation Fund Act, 1965, as amended, 16 U.S.C. 4601, et seq.	Full compliance
National Historic Preservation Act, 1966, as amended, 16 U.S.C. 470a, et seq.	Full compliance
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq.	Full compliance
Native American Graves Protection and Repatriation Act, 1990, 25 U.S.C. 3001-13, et seq.	Full compliance
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	Not applicable
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Not applicable
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq.	Not applicable
Water Resources Planning Act, 1965	Not applicable
Water Resources Development Act of 1986 , Public Law 99-662	Full compliance
Environmental Justice (Executive Order 12898)	Full compliance
Floodplain Management (Executive Order 11988)	Full compliance
Protection of Children From Environmental Health Risks and Safety Risks (Executive Order 13045)	Full compliance
Protection of Wetlands (Executive Order 11990)	Full compliance

Note: "Full compliance" means that all requirements have been met of the statutes, Executive Orders, or other environmental requirements for the current stage of planning.

10 List of Preparers

This EA has been prepared under the direction of Mr. Jerry Sturdy and Ms. Jan Hotubbee of the U.S. Army Corps of Engineers, Tulsa District. Individuals from engineering-environmental Management, Inc. (e^2M) who contributed to the preparation of this document are listed below.

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APPENDIX A

COORDINATION/CORRESPONDENCE

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Mailing List for Lake Texoma Water Reallocation EA

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Federal Region VI Administrator
Environmental Protection Agency
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Dallas, TX 75202

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State Conservationist
USDA Agri-Center Bldg
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Anadarko, OK 73005

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Choctaw Nation of Oklahoma
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Durant, OK 74720

Mr. Bill Anoatubby, Governor
Chickasaw Nation of Oklahoma
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Ada, OK 74821

Ms. Stacy Halfmoon
Caddo Indian Tribe of Oklahoma
P.O. Box 487
Binger, OK 73009

Mr. John Berrey, Chairman
Quapaw Tribe of Oklahoma
P.O. Box 765
Quapaw, OK 74363

Mr. John H. Butts, Manager
Tex-La Electric Cooperative of Texas, Inc.
P.O. Box 631623
Nacogdoches, TX 75963-1623

Mr. Ted Coombs, Executive Director
Southwestern Power Resources Association
P.O. Box 471827
Tulsa, OK 74147

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Brian C. Drumm
Brickfield, Burchette, Ritts & Stone, PC
1025 Thomas Jefferson Street, N.W.
Eighth Floor, West Tower
Washington, D.C. 20007

James M. Parks, Executive Director
North Texas Municipal Water District
P.O. Box 2408
Wylie, TX 75098-2408

Mr. John Kirkland, President
Rayburn Country Electric Cooperative, Inc.
980 Sid's Rd
Rockwall, TX 75087

US Army Corps of Engineers
Tulsa District

DRAFT
NEWS RELEASE

For Immediate Release

To: News Directors, Assignment Editors, and Editors

Synopsis: The U.S. Army Corps of Engineers will host a public workshop to discuss the Lake Texoma Reallocation Study.

Release No. 03-xx
September 2003

Workshops to present the Lake Texoma Reallocation Study

TULSA, Okla. -- The Tulsa District, U.S. Army Corps of Engineers will host public information workshops on Tuesday, September 16, and Wednesday, September 17th 2003, to provide information to the public and solicit comments and questions about the Lake Texoma Reallocation Study.

The Corps of Engineers study will evaluate the water supply storage alternatives to address the increased demand in the area. The goal is to determine the best method to provide the necessary storage. The purpose of the study is to address the need in the area for additional water supply storage, formulate a variety of alternatives, and select a recommended plan of action or non-action.

On September 16, the workshop will be held at Denison Public Library, 300 W. Gandy, Denison, Texas, and on September 17 the workshop will be held at the Durant Chamber of Commerce, 215 N. 4th Street, Durant, Oklahoma. Each workshop will be held from 5:00 p.m. to 8:00 p.m. and will be an open house format with no set or formal presentations. Everyone is invited to attend, visit information tables and discuss the project with representatives from the Corps' Tulsa District.

The workshop and comment solicitation are part of the environmental documentation (scoping), conducted in compliance with the National Environmental Policy Act. Scoping is the process of identifying potential environmental impacts of proposed Federal actions by soliciting comments and questions from the public and government agencies.

For more information on this study, contact Mr. David Combs in the Tulsa office, 918-669-7660.

--30--

Paid Advertisement

~Announcing~

PUBLIC INVOLVEMENT WORKSHOP
as related to the
Lake Texoma Reallocation Study
in compliance with
The National Environmental Policy Act

Open House

The U.S. Army Corps of Engineers will host two public workshops to provide the public information about the Lake Texoma Reallocation Study and to solicit comments and questions on the project. The workshop will be open house format, with no set or formal presentation. Interested persons may arrive anytime between 5:00 - 8:00 p.m., visit the information tables, discuss the study with Corps personnel, and make comments. The workshops will be held at the following locations:

Denison Open House	**Durant Open House**
Denison Public Library	**Durant Chamber of Commerce**
300 W. Gandy	**215 N. 4th Street**
Denison, Texas	**Durant, Oklahoma**
Tuesday, September 16, 2003	**Wednesday, September 17, 2002**
5:00 - 8:00 p.m.	**5:00 - 8:00 p.m.**

Scoping Process

The workshop is part of an effort by the Corps to inform the public about the reallocation study in progress. The purpose of the study is to address the need in the area for additional water supply storage, formulate a variety of alternatives, and select a recommended plan of action or non-action. This public workshop is in compliance with the National Environmental Policy Act. As part of the scoping process, the Corps of Engineers requests that the public, interested parties, Federal, State and local agencies take part in the planning process by identifying issues related to the study and provide input in the development of alternatives to address the water supply storage issues. The Corps will include this input as it develops reallocation alternatives for Lake Texoma. Comments and questions can be forwarded to:

Mr. David Combs
U.S. Army Corps of Engineers, Tulsa District
ATTN: CESWT-PE-E
1645 S. 101st East Avenue
Tulsa, OK 74128-4609
Phone: 918-669-7660
E-mail: David.L.Combs@usace.army.mil

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Darrel Dominick
State Conservationist
USDA Agri-Center Bldg
100 USDA, Suite 206
Stillwater, OK 74074-2655

Dear Mr. Dominick:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

Under the Proposed Action, pool elevations at Lake Texoma would not be changed. In accordance with the Water Resources Development Act of 1986, 300,000 acre-feet of water currently in hydropower storage would be reallocated to water supply storage. The reallocation would provide up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the State of Oklahoma and up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the State of Texas.

We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning this Proposed Action.

If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

for Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Richard E. Greene
Federal Region VI Administrator
Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202

Dear Mr. Greene:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

for

Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Mark S. Coleman
Executive Director
Oklahoma Department of Environmental Quality
1000 Northeast 10th Street
Oklahoma City, OK 73117-1212

Dear Mr. Coleman:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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Sincerely,

for Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Greg D. Duffy
Director
Oklahoma Department. of Wildlife Conservation
P.O. Box 53465
Oklahoma City, OK 73105

Dear Mr. Duffy:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning fish and wildlife species of concern that might occur in the project area.

If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

for Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Duane A. Smith
Executive Director
Oklahoma Water Resources Board
P.O. Box 150
Oklahoma City, OK 73101-0150

Dear Mr. Smith:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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Sincerely,

for Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Curtis W. Campbell
General Manager
Red River Authority of Texas
Hamilton Building
900 8th Street, Suite 520
Wichita Falls, TX 76301-6894

Dear Mr. Campbell:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

Under the Proposed Action, pool elevations at Lake Texoma would not be changed. In accordance with the Water Resources Development Act of 1986, 300,000 acre-feet of water currently in hydropower storage would be reallocated to water supply storage. The reallocation would provide up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the State of Oklahoma and up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the State of Texas.

We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning this Proposed Action..

If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

for Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Michael A. Deihl
Administrator
Southwestern Power Administration
One West Third Street
Tulsa, OK 74102

Dear Mr. Deihl:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning this Proposed Action.

If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Ms. Margaret Hoffman
Executive Director
Texas Commission on Environmental Quality
MC 109
P.O. Box 13087
Austin, TX 78711

Dear Ms. Hoffman:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning this Proposed Action.

If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Robert Cook
Executive Director
Texas Parks & Wildlife Department
4200 Smith School Road
Austin, TX 78744

Dear Mr. Cook:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning fish and wildlife species of concern that might occur in the project area.

If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

for Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Kevin Ward
Executive Administrator
Texas Water Development Board
P.O. Box 13231
Austin, TX 78711-3231

Dear Mr. Ward:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning this Proposed Action.

If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

April 26, 2004

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Jerry Brabander
Field Supervisor
U.S. Fish & Wildlife Service
222 South Houston, Suite A
Tulsa, OK 74127

Dear Mr. Brabander:

This is to inform you that the Tulsa District has begun studying the reallocation of water storage at Lake Texoma, Oklahoma and Texas. We are beginning the process of preparing an Environmental Assessment addressing the effect of reallocation to provide additional water supply storage. The study is being conducted under authority of the Water Resources Development Act of 1986 (Public Law 99-662). The Water Resources Development Act authorized the Secretary of the Army to reallocate 300,000 acre-feet of water at Lake Texoma for municipal, industrial, and agricultural water users in both Oklahoma and Texas.

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We are preparing documentation for compliance with the National Environmental Policy Act of 1969 and would appreciate comments from your agency concerning this Proposed Action.

Your comments are requested in accordance with the Fish and Wildlife Coordination Act and the Endangered Species Act. If you have any questions or require additional information, please contact Mr. Jerry Sturdy at 918-669-4397.

Sincerely,

for Larry D. Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
222 S. Houston, Suite A
Tulsa, Oklahoma 74127

In Reply Refer To:
FWS/R2/OKES/texomareallocationletter

October 5, 2004

Colonel Miroslav P. Kurka, District Engineer
Attn: Planning, Environmental, and Regulatory Division
U.S. Army Corps of Engineers
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Dear Colonel Kurka:

The U.S. Fish and Wildlife Service (Service) has reviewed a U.S. Army Corps of Engineers' (Corps) proposal to study the reallocation of water storage at Lake Texoma to increase the water supply storage, primarily for municipal use. The proposed study was included in your biological assessment dated November 20, 2003, and was considered part of the Corps' proposed action in the draft biological opinion for your actions on the Arkansas, Canadian, and Red Rivers. The list of species protected by the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*) provided for that formal consultation is still accurate and compliance with Section 7 of the ESA has been addressed in the draft biological opinion.

Assuming water demands for municipal use stay near current levels and Lake Texoma water levels will not be affected; we do not anticipate any federally-listed species to be adversely affected by the proposed reallocation of water storage. However, if demand for municipal water from Lake Texoma increases, we see potential for impacts to recreational use and fish and wildlife resources in the area near the reservoir and the Red River downstream. Municipal use usually has a very high priority relative to other uses and high demands during periods of low inflows could result in lower water levels and compromises for other uses. Management of national wildlife refuges, state wildlife management areas, and mitigation provided in compliance with the Fish and Wildlife Coordination Act and National Environmental Policy Act could be affected. If municipal water use is expected to increase, we recommend that the Corps address these potential impacts before approving any reallocations that may affect reservoir water levels. Consultation should be initiated with us and the state natural resource agencies to avoid any impacts to fish and wildlife resources.

Thank you for providing the opportunity to comment on the proposed study. Please coordinate any comments or information with Mr. Kevin Stubbs at 918-581-7458 ext 236.

Sincerely,

Jerry Brabander
Field Supervisor

cc: ARD-ES, Attn: Dean Watkins, U.S. Fish and Wildlife Service, Albuquerque, NM
Director, ODWC, Attn: Natural Resources Division, Oklahoma City, OK
Director, Texas Parks & Wildlife Dept., Austin, TX

TEXAS WATER DEVELOPMENT BOARD

E. G. Rod Pittman, *Chairman*
William W. Meadows, *Member*
Dario Vidal Guerra, Jr., *Member*

J. Kevin Ward
Executive Administrator

Jack Hunt, *Vice Chairman*
Thomas Weir Labatt III, *Member*
James E. Herring, *Member*

May 3, 2004

Larry D. Hogue, P.E.
Chief, Planning Environmental and Regulatory Division
Department of the Army
Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Re: Reallocation of water storage at Lake Texoma

Dear Mr. Hogue:

Thank you for your information on the progress of the study to reallocate water storage in Lake Texoma.

As demand for water in the state of Texas increases, it is important that we look for ways to increase supply while minimizing the impact to the environment. The Texas Water Development Board (TWDB) has a keen interest in this project as it may have implications across the state. Flood reallocation from reservoirs may be the most cost-effective and least environmentally disruptive way of meeting water demand in Texas. We look forward to the completion of the study and to the discussion of the findings.

The TWDB Hydrographic Survey crew surveyed this lake for the Corps of Engineers during the summer of 2002 and a final report was submitted in April 2003. If you have any questions regarding this work, or if the TWDB can be of any assistance, please do not hesitate to contact me, or the Director of the Surface Water Resources Division Director, Dr. Barney Austin (Tel: 512-463-8856).

Sincerely,

J. Kevin Ward
Executive Administrator

Our Mission
To provide leadership, planning, financial assistance, information, and education for the conservation and responsible development of water for Texas.
P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231
Telephone (512) 463-7847 • Fax (512) 475-2053 • 1-800-RELAYTX (for the hearing impaired)
URL Address: http://www.twdb.state.tx.us • E-Mail Address: info@twdb.state.tx.us
TNRIS - The Texas Information Gateway • www.tnris.state.tx.us
A Member of the Texas Geographic Information Council (TGIC)

TNRIS

DUANE A. SMITH
EXECUTIVE DIRECTOR

BRAD HENRY
GOVERNOR

STATE OF OKLAHOMA
WATER RESOURCES BOARD
www.owrb.state.ok.us

May 25, 2004

Mr. Larry Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division
Environmental Analysis and Compliance Branch
Department of the Army
Corps of Engineers, Tulsa District
Tulsa, OK 74128-4609

Re: Proposed reallocation – Lake Texoma

Dear Mr. Hogue:

Thank you for the opportunity to comment on the proposed reallocation of the storage at Lake Texoma.

As you know, the State of Oklahoma is a party to the Red River Compact. Accordingly, the State of Oklahoma has a significant interest in ensuring compliance with the apportionment provisions of the Red River Compact. Article IV of the Compact, specifically Section 4.04, apportions the water of the mainstem of the Red River and Lake Texoma between the State of Oklahoma and the State of Texas. Basically, the Compact apportions the storage of Lake Texoma and flow of the mainstem of the Red River into Lake Texoma on a 50/50 basis between Oklahoma and Texas. Any reallocation of storage at Lake Texoma must be consistent with the apportionment provisions of the Compact.

Unfortunately, the Compact Commission has not finalized rules to implement the apportionment provisions of the Compact. Until such rules are adopted by the Commission, it will not be possible to determine whether a proposed reallocation of storage is consistent with the Compact's apportionment provisions. The Oklahoma Commissioners and Texas Commissioners of the Red River Compact Commission are aware of the need for rules, and we hope to consider proposed rules at the Commission's annual meeting scheduled during April, 2005. Staff of the Corps' Tulsa District are routinely invited to the Commission's annual meetings, and therefore, will be notified of the Commission's determination regarding the apportionment rules.

A related issue that should be addressed in the reallocation study is the costs of the water supply storage. It is our understanding that the original water supply storage allocation for Lake Texoma was 150,000 acre-feet. Therefore, under the terms of the 50/50 apportionment provision, the Compact apportions 75,000 acre-feet of the original water supply storage

OWRB
3800 N. CLASSEN BOULEVARD • OKLAHOMA CITY, OKLAHOMA 73118 • TELEPHONE (405) 530-8800 • FAX (405) 530-8900
Grady Grandstaff, Chairman • Glenn Sharp, Vice Chairman • Ervin Mitchell, Secretary
Lonnie L. Farmer • Mark Nichols • Bill Secrest • Harry Currie • Richard C. Sevenoaks • Jack Keeley

allocation to Oklahoma and the other 75,000 acre-feet to Texas. Based on plain readings of the Water Supply Act of 1986 and the Red River Compact, we believe that Oklahoma users remain entitled to enter into contracts for up to a total of 75,000 acre-feet of water supply storage under terms and conditions available prior to the Water Supply Act of 1986. An explanation is in order.

Section 838 of the Water Resources Development Act of 1986 provides authority for the Corps to reallocate 300,000 acre-feet of storage in Lake Texoma from hydropower to water supply, with 150,000 acre-feet for Oklahoma users and 150,000 acre-feet for Texas users (this is consistent with the 50/50 apportionment provision of the Compact). Paragraph (d)(1) of Section 838 then indicates that all contracts for the reallocated storage shall be under the new water supply contract terms set forth in Section 932, which terms are substantially less favorable than terms in contracts entered pursuant to the Water Supply Act of 1958. However, paragraph (e) of Section 838 controls the situation by providing that nothing in Section 838 of the Water Resources Development Act of 1986 shall be construed as amending or altering in any way the Red River Compact. As noted above, the Red River Compact split the storage at Lake Texoma and flow from the mainstem of the Red River on a 50/50 basis, as follows: "Oklahoma 200,000 acre-feet and Texas to 200,000 acre-feet, which quantities shall include existing allocations and uses" (emphasis added). The emphasized language in the Compact makes it clear that the 50/50 apportionment provision of the Compact applies to the original 150,000 acre-feet allocation for water supply storage. Therefore, Oklahoma users are entitled to contract for up to 75,000 acre-feet of the original allocation amount without triggering less favorable repayment terms that will apply to contracts for the reallocated storage.

The Environmental Assessment should address both the apportionment rules to be adopted by the Compact Commission and the costs of the storage.

Please keep us informed of the progress of the Environmental Assessment work. Thank you again for the opportunity to provide input.

Sincerely,

Duane A. Smith
Executive Director

cc: Secretary Miles Tolbert
Charles Dobbs, Oklahoma Commissioner
Mark Nichols
Gordon W. Fassett, Federal Commissioner
William A. Abney, Texas Commissioner
Randy Young, Arkansas Commissioner

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APPENDIX B:

SUPER MODEL OUTPUTS

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Updating Red River SUPER Model: Lake Texoma Yield Analysis and Water Supply Reallocation

Overview of SUPER Model

The SUPER Model is a suite of computer programs written for use in the Southwestern Division of the U.S. Army Corps of Engineers to model multi-purpose reservoir system regulation. The programs were developed over a thirty-year period by Ronald L. Hula, primarily as a planning tool to perform period-of-record analysis to evaluate changes in operational scenarios. The model has the ability to simulate flood control operations, and conservation pool operations including hydropower, water supply, water quality, diversions, and returns. In addition to period-of-record analysis, it has the capability to perform conservation pool yield analysis, and firm energy analysis. It also has the capability to develop unregulated conditions models, simulating systems with some or all reservoirs "dummied" out or non-existent. Besides system modeling, SUPER can perform economic analyses of impacts between plans. It can also provide a wide variety of output from which to evaluate scenarios including tabular or graphical formats of hydrographs, duration plots, and frequency curves at all reservoirs and control points within the system model.

SUPER is a daily simulation model that assumes all reservoirs are in place for the entire period of record specified for each model, based on data availability. For each SUPER model, a complex set of intervening area flows is developed for the entire period of record. This is the culmination of the pre-processing of data, before any simulation is done. When simulation is begun, headwater reservoir inflows and subsequent derived releases based on current and future forecast conditions, are then routed through the system on a daily basis. These routed flows are combined with intervening area flows at all control point locations. Reservoir releases are made for flood control, hydroelectric power generation, water supply requirements, and stream flow requirements such as water quality and irrigation. Other regulating considerations include channel capacities and bank stability. All releases are analyzed to determine their impact on current and future forecasted conditions, and are adjusted as needed to meet predefined system constraints. In addition to the above requirements, SUPER works to achieve a target uniform balance between all competing reservoirs during the draw down of system flood storage, and a target uniform balance in system conservation storage remaining during a conservation pool draw down. SUPER has evolved to meet the complex challenge of modeling system operations while meeting system and local constraints, and balancing requirements.

SUPER Hydrologic Development

Prior to this study, the Red River SUPER model had a hydrologic period-of-record from January 1938 to December 1990. Although there had not been any significant floods along the Red River through most of the 1990's, there had been some drier years, and enough additional years of record, that the model needed to be updated. The goal of this update was to extend the period of record to 2000.

This required collecting and formatting an additional ten years of daily inflows for the 20 reservoirs within the model, and daily flows for numerous flow gages used to develop the period-of-record hydrology. Monthly evaporation and precipitation at numerous locations was also collected and formatted. The data was extracted as much as possible from the USGS published data. Reservoir inflows, data for unpublished gages, and some evaporation data was taken from the internal Corps of Engineers databases. All required data was input into the Red River SUPER database.
After the Red River SUPER database was updated and complete, extensive editing of the hydrologic files was done to incorporate and utilize the additional ten years of daily data that was available.

Hydrologic building files were then run through a series of programs to develop the updated period-of-record hydrology or local flows.

With the updated hydrology files, a natural conditions run, simulating no reservoirs in place, was made. As a final check to spot errors in building the hydrology file, a volume checking program was run, which performs a volume comparison between the natural condition flows developed from SUPER and observed gaged flow data. This required building an extensive input file to perform the volume checking analysis. Problems were corrected as required.

Texoma Yield Analysis Using SUPER

With the updated SUPER model, it was desired to determine the true yield of the conservation storage available at the end of the project life. The yield of the conservation storage is required to determine the critical dependable water supply demand that will occur if the entire reallocated storage is used for water supply. This will provide a worse case demand for water supply during the critical drought. At Lake Texoma the conservation storage lies between El. 590 and 617. The end of the project life at Texoma is the year 2044. The water supply yield run was made using an updated elevation-area-capacity table based on the 2002 sediment resurvey of Lake Texoma, with projected future sedimentation to the year 2044. This projected future storage is considered "usable storage". The true yield of the conservation storage at Lake Texoma for the projected 2044 conditions was determined to be 1502.5 cfs. The critical dependable yield for the conservation storage allocated to water supply is determined based on the following equation:

Critical Dependable Yield for = Total Allocated Water Supply Storage * True Yield
Allocated Water Supply Storage Total "Usable" Conservation Storage(in 2044)

For the full 300,000 ac-ft reallocation, the Critical = 150,000 ac-ft (past) + 300,000 ac-ft (present) * 1502.5 cfs
Dependable Water Supply Yield 986,730 ac-ft

= 685.2 cfs or 442.1 mgd

Current water supply contracts based on the 1985 sediment survey with sediment projections to the year 2044 will need to be updated to the current "usable storage" based on the 2002 sediment survey at Texoma.

Texoma Water Supply Reallocation Runs Using SUPER

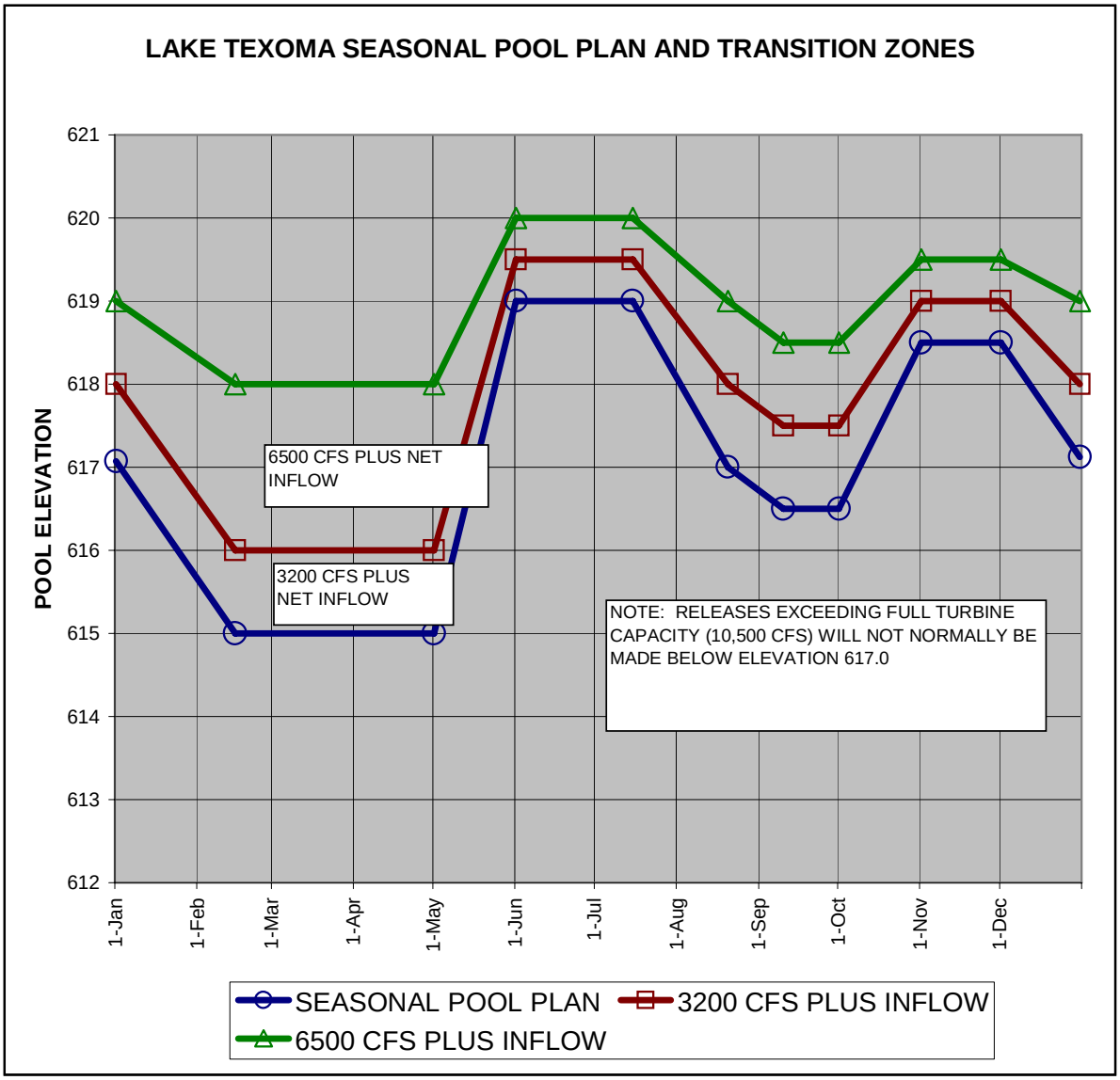
Three SUPER runs were made to model impacts at Texoma due to the current reallocation of hydropower to water supply. The critical dependable water supply demand is the only input parameter that varies between the runs. The runs made are as follows:

(1) Existing conditions in which the full 150,000 ac-ft previously reallocated from hydropower to water supply at Texoma is utilized. The water supply demand modeled = 228.4 cfs
(2) Modified conditions in which the previous 150,000 ac-ft of reallocated water supply storage is utilized at Texoma plus half of the current Texoma water supply reallocation of 300,000 ac-ft (150,000 ac-ft for Texas and 150,000 ac-ft for Oklahoma). Therefore the total water supply demand for Texoma modeled in this run is 300,000 ac-ft. This modified conditions run basically models Texas fully utilizing their water supply demand. The water supply demand modeled = 456.8 cfs
(3) Modified conditions in which the previous 150,000 ac-ft of reallocated water supply storage is utilized at Texoma plus all of the current Texoma water supply reallocation of 300,000

ac-ft. The total water supply demand for Texoma modeled in this run is 450,000 ac-ft. This run models fully utilized water supply conditions at Texoma or the worst case scenario, for demands on Texoma. The water supply demand modeled = 685.2 cfs.

These runs were all done with the updated 2002 Lake Texoma Elevation-Area-Capacity table, with the updated Texoma seasonal pool guide curve (see Figure 1), and the extended period of record hydrology through 2000. To avoid too large a drawdown at Texoma with the larger water supply demands, Southwest Power Administration modified their hydropower loads input into SUPER, to reflect more realistically how they would operate, given the greater water supply demands. Therefore, these runs reflect modified hydropower loads for each scenario. The water supply demand at Texoma is modeled as a constant year-round demand. Results of the runs are provided in graphical form as attachments.

Figure 1. Texoma Seasonal Pool



ATTACHMENTS

Figure 2	**Texoma Comparative Elevation-Frequency Curve between Super Runs A03X07A, A03X08A, and A03X09A**
Figure 3	**Texoma Comparative Elevation-Duration Curve between Super Runs A03X07A, A03X08A, and A03X09A**
Figure 4	**Texoma Outflow Comparative Flow-Frequency Curve between Super Runs A03X07A, A03X08A, and A03X09A**
Figure 5	**Texoma Outflow Comparative Flow-Duration Curve between Super Runs A03X07A, A03X08A, and A03X09A**
Figure 6	**Arthur City Comparative Flow-Frequency Curve between Super Runs A03X07A, A03X08A, and A03X09A**
Figure 7	**Arthur City Comparative Flow-Duration Curve between Super Runs A03X07A, A03X08A, and A03X09A**
Figure 8	**Texoma Comparative Minimum Elevation-Frequency Curve between Super Runs A03X07A, A03X08A, and A03X09A**
Figure 9	**Arthur City Comparative Minimum Flow-Frequency Curve between Super Runs A03X07A, A03X08A, and A03X09A**

FIGURE 2

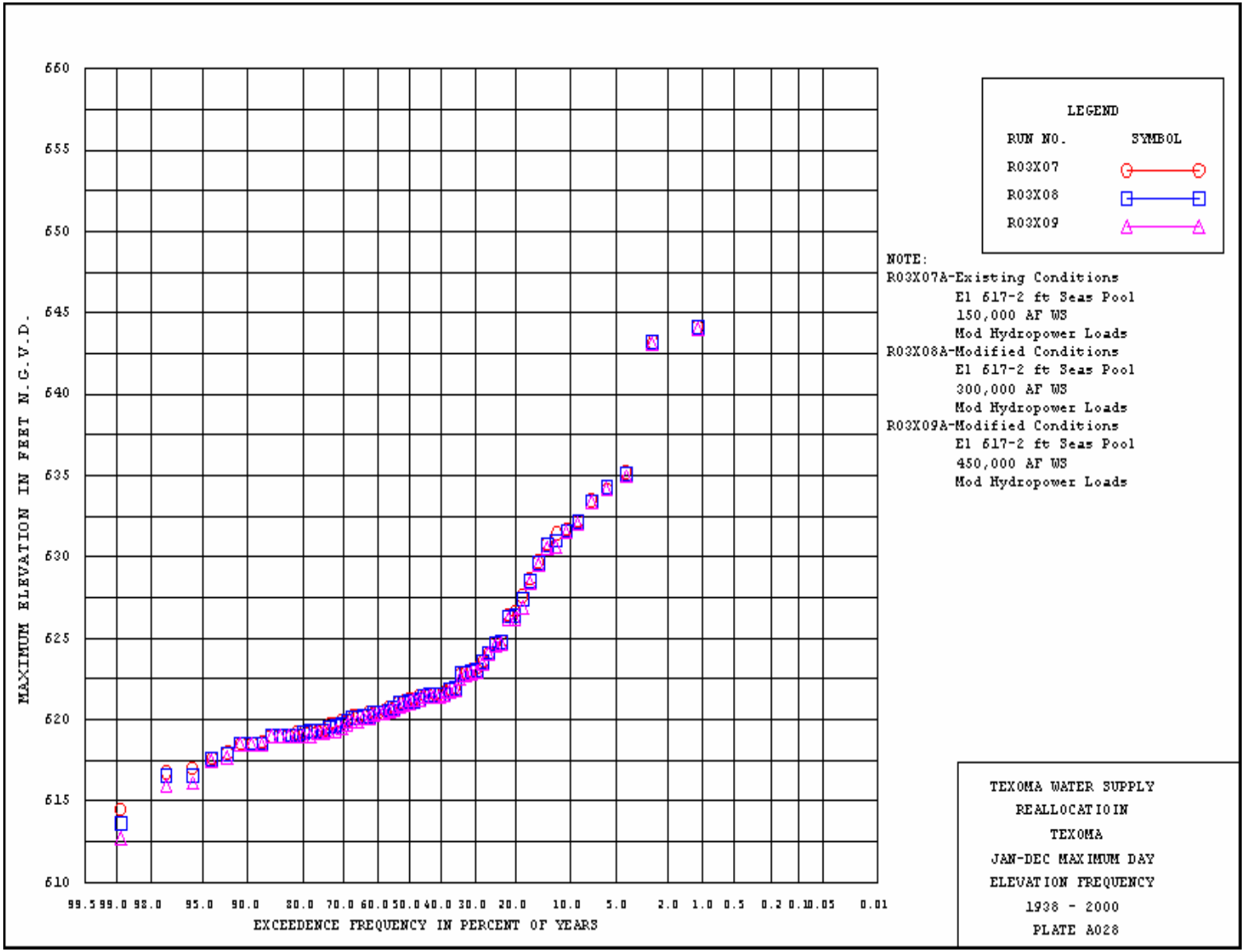

MAXIMUM ELEVATION IN FEET N.G.V.D.
660
655
650
645
640
635
630
625
620
615
610
99.5 99.0 98.0 95.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 5.0 2.0 1.0 0.5 0.2 0.1 0.05 0.01
EXCEEDENCE FREQUENCY IN PERCENT OF YEARS
LEGEND
RUN NO. SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA
JAN-DEC MAXIMUM DAY
ELEVATION FREQUENCY
1938 - 2000
PLATE A028

FIGURE 3

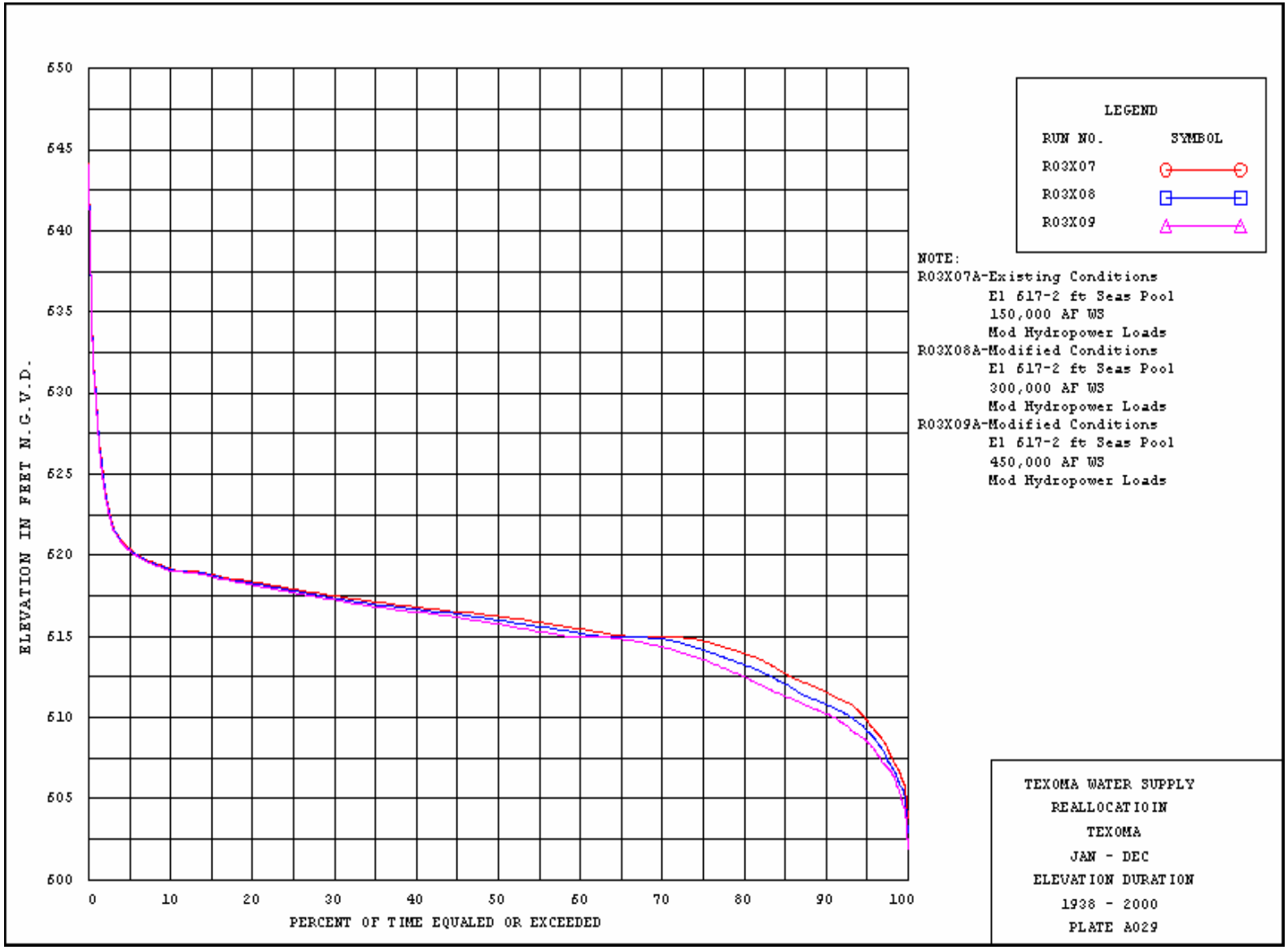

650
645
640
635
630
625
620
615
610
605
600
ELEVATION IN FEET N.G.V.D.
0
10
20
30
40
50
60
70
80
90
100
PERCENT OF TIME EQUALED OR EXCEEDED
LEGEND
RUN NO.
SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA
JAN - DEC
ELEVATION DURATION
1938 - 2000
PLATE A029

FIGURE 4

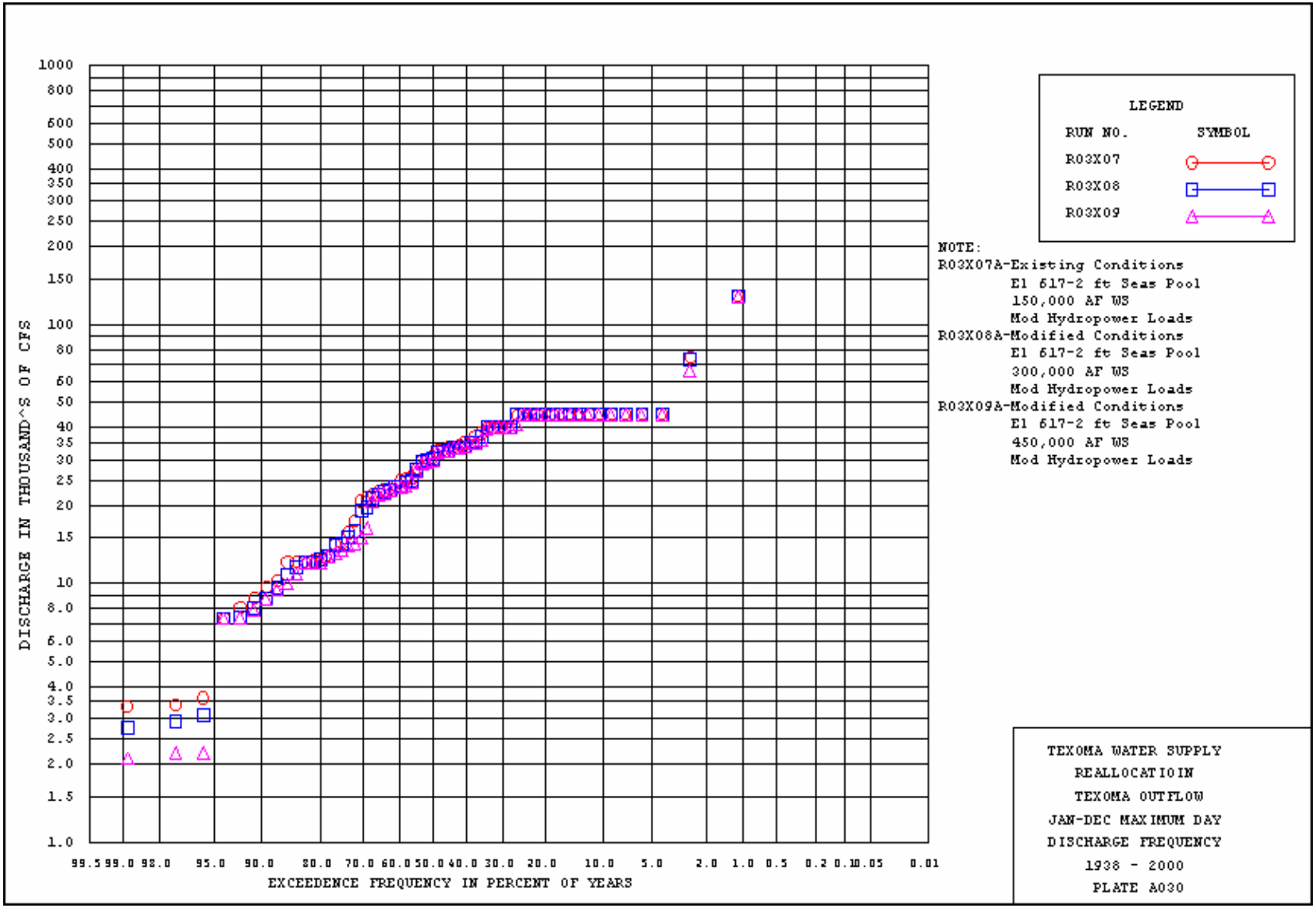

DISCHARGE IN THOUSAND^S OF CFS
1000
800
600
500
400
350
300
250
200
150
100
80
60
50
40
35
30
25
20
15
10
8.0
6.0
5.0
4.0
3.5
3.0
2.5
2.0
1.5
1.0
99.5 99.0 98.0 95.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 5.0 2.0 1.0 0.5 0.2 0.1 0.05 0.01
EXCEEDENCE FREQUENCY IN PERCENT OF YEARS
LEGEND
RUN NO. SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA OUTFLOW
JAN-DEC MAXIMUM DAY
DISCHARGE FREQUENCY
1938 - 2000
PLATE A030

FIGURE 5

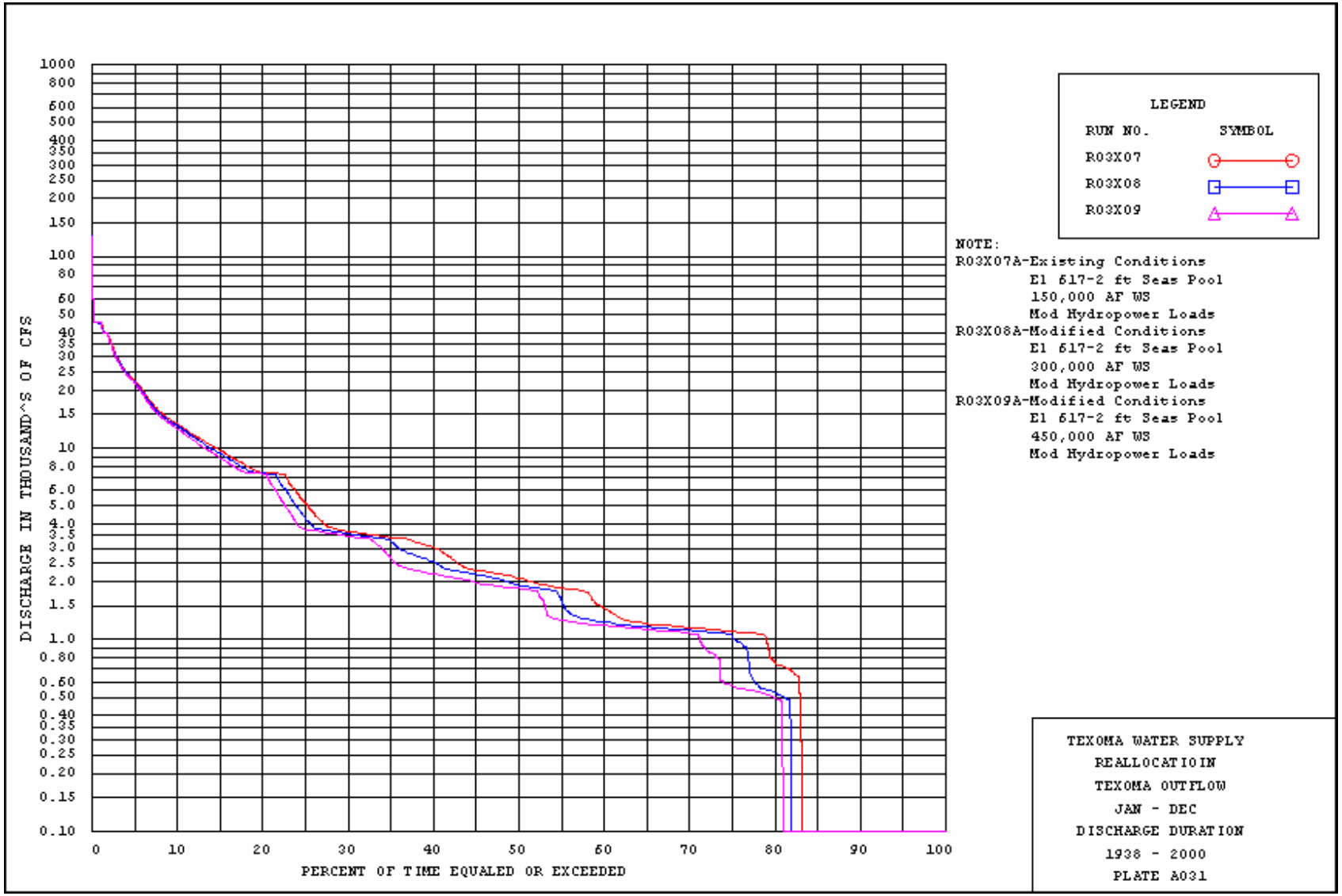

DISCHARGE IN THOUSAND^S OF CFS
1000
800
600
500
400
350
300
250
200
150
100
80
60
50
40
35
30
25
20
15
10
8.0
6.0
5.0
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.80
0.60
0.50
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0
10
20
30
40
50
60
70
80
90
100
PERCENT OF TIME EQUALED OR EXCEEDED
LEGEND
RUN NO.
SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA OUTFLOW
JAN - DEC
DISCHARGE DURATION
1938 - 2000
PLATE A031

FIGURE 6

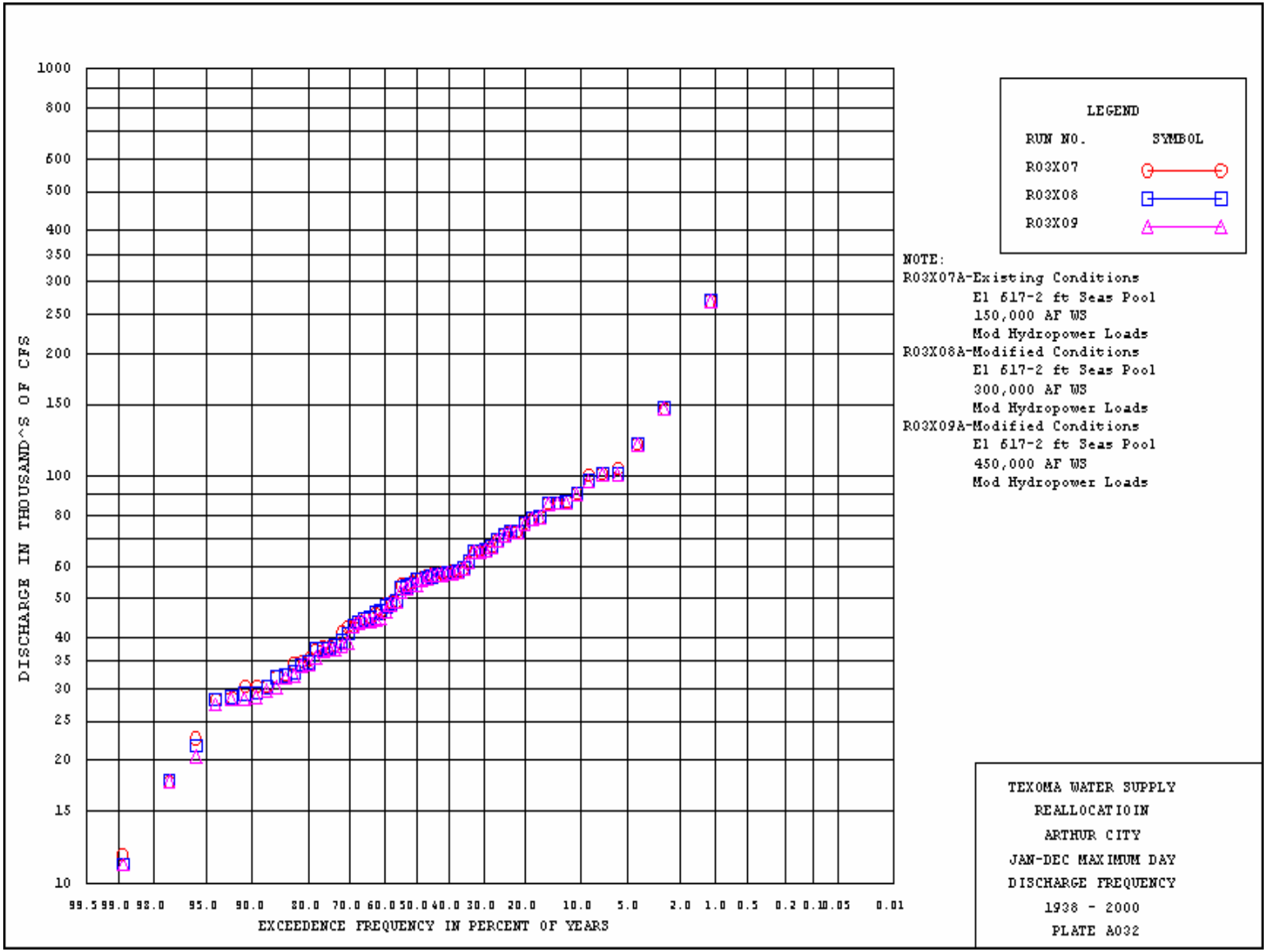
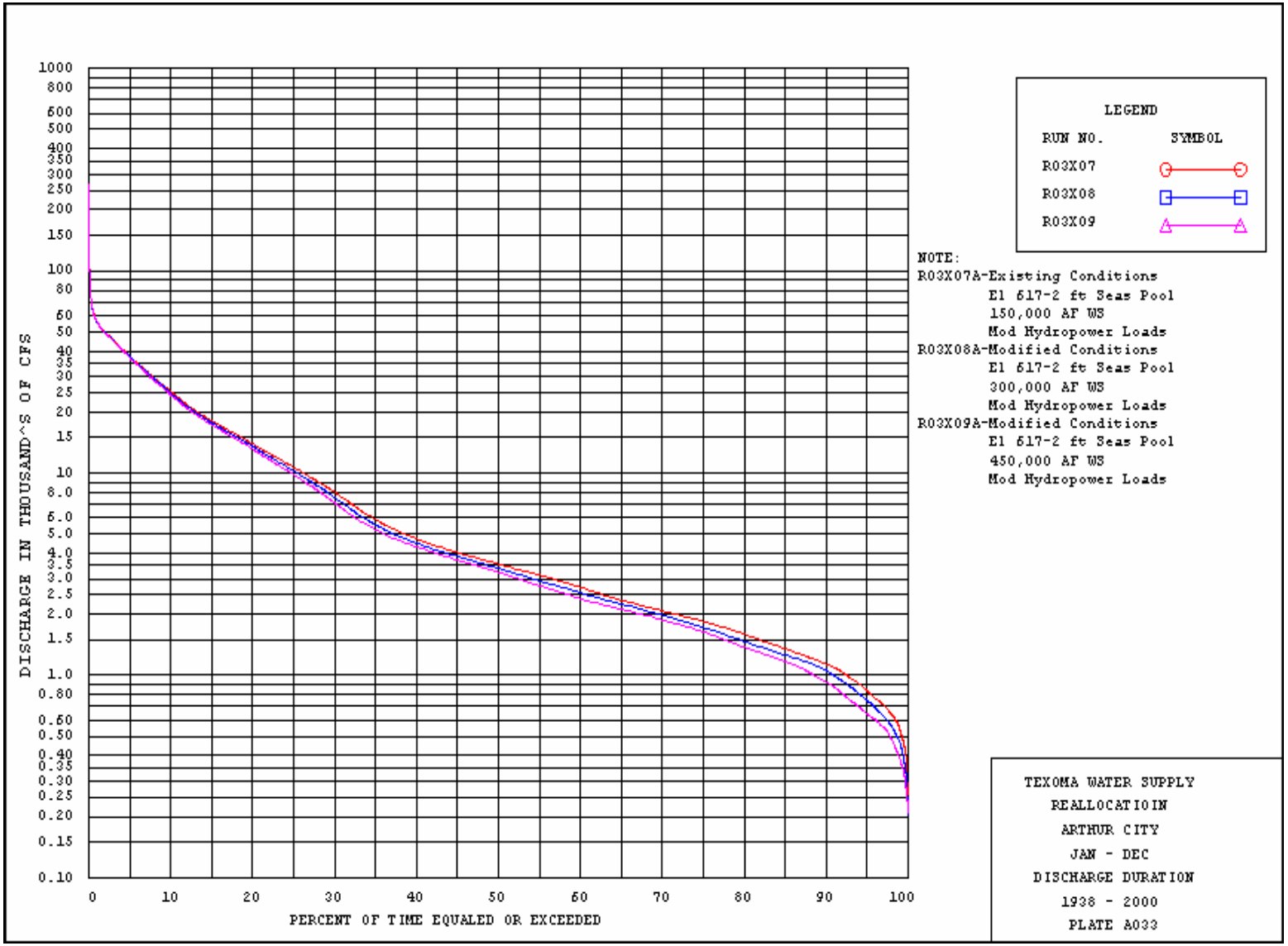

DISCHARGE IN THOUSAND^S OF CFS
1000
800
600
500
400
350
300
250
200
150
100
80
60
50
40
35
30
25
20
15
10
99.5 99.0 98.0 95.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 5.0 2.0 1.0 0.5 0.2 0.1 0.05 0.01
EXCEEDENCE FREQUENCY IN PERCENT OF YEARS
LEGEND
RUN NO. SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
ARTHUR CITY
JAN-DEC MAXIMUM DAY
DISCHARGE FREQUENCY
1938 - 2000
PLATE A032

FIGURE 7


DISCHARGE IN THOUSAND^S OF CFS
1000
800
600
500
400
350
300
250
200
150
100
80
60
50
40
35
30
25
20
15
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8.0
6.0
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4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.80
0.60
0.50
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0
10
20
30
40
50
60
70
80
90
100
PERCENT OF TIME EQUALED OR EXCEEDED
LEGEND
RUN NO.
SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
ARTHUR CITY
JAN - DEC
DISCHARGE DURATION
1938 - 2000
PLATE A033

FIGURE 8

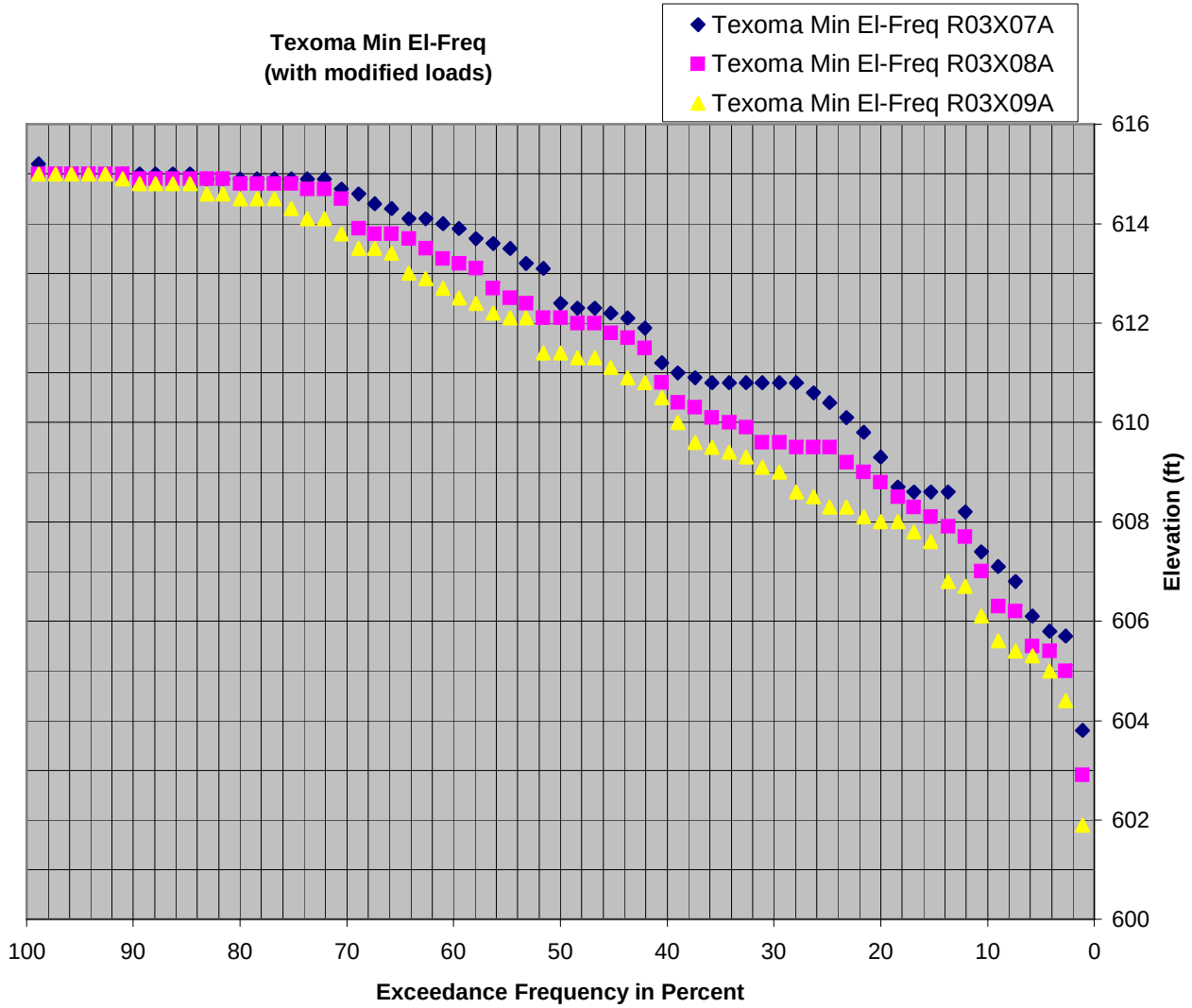
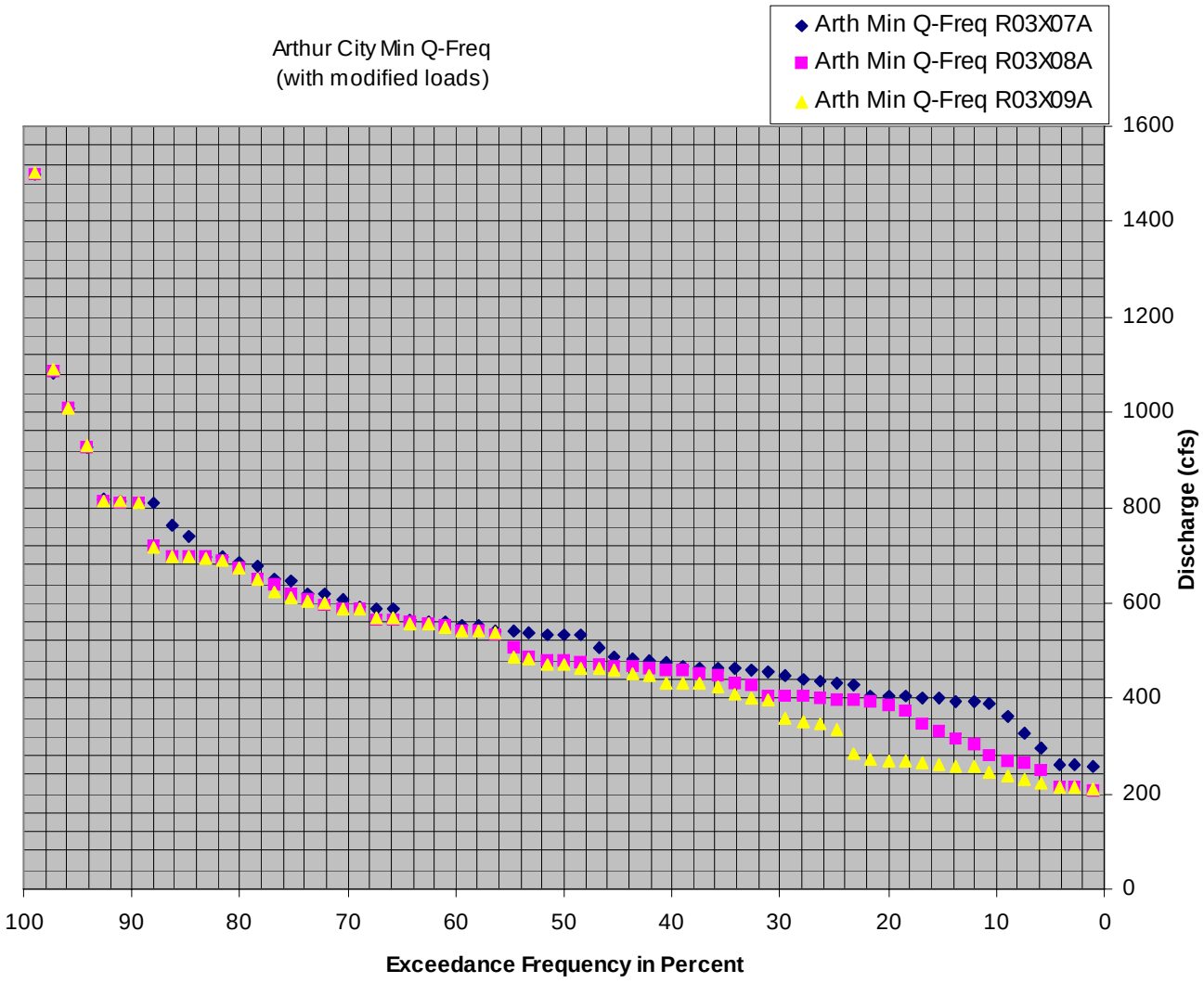


FIGURE 9


Arthur City Min Q-Freq
(with modified loads)
Arth Min Q-Freq R03X07A
Arth Min Q-Freq R03X08A
Arth Min Q-Freq R03X09A
1600
1400
1200
1000
800
600
400
200
0
Discharge (cfs)
100
90
80
70
60
50
40
30
20
10
0
Exceedance Frequency in Percent

APPENDIX C:

CULTURAL RESOURCES COORDINATION

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DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609
FEB 15 2001

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Dr. Bob Blackburn
State Historic Preservation Officer
Oklahoma Historical Society
2704 Villa Prom, Shepherd Mall
Oklahoma City, OK 73107

Dear Dr. Blackburn:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

Because the proposed water reallocation will not result in any changes in the existing lake level of Lake Texoma, we feel that the proposed reallocation of 300,000 acre-feet of existing hydropower storage to water supply will have "no effect" on cultural resources at Lake Texoma. We request your comment on our opinion of effect regarding this project.

Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

Oklahoma Historical Society *Founded May 27, 1893*

State Historic Preservation Office • 2704 Villa Prom • Shepherd Mall • Oklahoma City, OK 73107-2441
Telephone 405/521-6249 • Fax 405/947-2918

March 6, 2001

Mr. David Combs, Chief
Environmental Analysis & Compliance
Tulsa District Corps of Engineers
1645 South 101st East Avenue
Tulsa, OK 74128-4609

RE: File #1068-01; Lake Texoma Reallocation of Water from Hydropower Storage Project

Dear Mr. Combs:

The referenced project does not include construction or earth-moving activities. Comments or opinions by this office are inappropriate for this project.

Should further projects include construction or earth-moving activities, an opinion should be requested from this office.

Further correspondence pertaining to this project must reference the above underlined file number. Thank you.

Sincerely,

Melvena Heisch

Melvena Heisch
Deputy State Historic
Preservation Officer

MH:pm

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

FEB 15 2001

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Dr. Robert Brooks
State Archeologist
Oklahoma Archeological Survey
111 East Chesapeake
Norman, OK 73019

Dear Dr. Brooks:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

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Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

Oklahoma Archeological Survey
THE UNIVERSITY OF OKLAHOMA

February 28, 2001

David L. Combs
Department of Army
Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, OK 74128-4609

RE: USACE proposed reallocation of 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply. Legal Dscription: Parts of T7S R5E and R6E, Love, Marshal, and Bryan Counties, Oklahoma.

Dear Mr. Combs:

Our office has no objections to the referenced project provided no ground disturbance will occur. The nature of the project is such that it should have no impact on the prehistoric cultural or archaeological resources of Oklahoma. We will defer to the State Historic Preservation Officer's opinion regarding impacts to historic structures. This review is conducted in cooperation with the State Historic Preservation Office, Oklahoma Historical Society.

Sincerely,

Vicki Wedel
Vicki L. Wedel
Staff Archeologist

Robert L. Brooks
Robert L. Brooks
State Archeologist

:vlw

cc: SHPO
Louis Vogele

111 E. Chesapeake, Room 102, Norman, Oklahoma 73019-5111 PHONE: (405) 325-7211 FAX: (405) 325-7604
A UNIT OF ARTS AND SCIENCES SERVING THE PEOPLE OF OKLAHOMA

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

FEB 15 2001

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. F. Lawrence Oaks
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dear Mr. Oaks:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

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Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

FEB 15 2001

RECEIVED
FEB 23 2001
TEXAS HISTORICAL COMMISSION

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. F. Lawrence Oaks
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

NO EFFECT
On National Register eligible/listed properties
or State Archeological Landmarks
PROJECT MAY PROCEED
By
for F. Lawrence
State Historic Preservation Officer
Date 3/2/01

Dear Mr. Oaks:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

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Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

NO EFFECT
On National Register eligible/listed properties
or State Archeological Landmarks
PROJECT MAY PROCEED
By
for F. Lawrence
State Historic Preservation Officer
Date

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

FEB 15 2001

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Ms. Stacy Halfmoon
Caddo Indian Tribe of Oklahoma
P.O. Box 487
Binger, OK 73009

Dear Ms. Halfmoon:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

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Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

FEB 15 2001

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Chickasaw Nation of Oklahoma
P.O. Box 1548
Ada, OK 74821

Dear Sirs:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

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Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

FEB 15 2001

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Choctaw Nation of Oklahoma
P.O. Drawer 1210
Durant, OK 74720

Dear Sirs:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

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Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

FEB 15 2001

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Mr. Gary McAdams
Wichita and Affiliated Tribes of Oklahoma
P.O. Box 729
Anadarko, OK 73005

Dear Mr. McAdams:

The purpose of this letter is to initiate consultation pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, regarding a proposal to reallocate 300,000 acre-feet of water at Lake Texoma from existing hydropower storage to water supply for portions of northern Texas.

The enactment of Texas Senate Bill 1 in 1997 required that each area of Texas outline its future water needs for the 2000-2050 time period and to become less dependent upon groundwater resources. As a result of this requirement, the U.S. Army Corps of Engineers has received a request to consider the reallocation of 300,000 acre-feet of existing hydropower storage to use as water supply. If approved, the reallocation would not involve raising the existing lake level of Lake Texoma, but would simply reallocate storage space in the conservation pool of the lake from one purpose to another.

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Thank you for your help with this request. If you have any questions, please contact Mr. Louis Vogele, Archeologist, at 918-669-4934.

Sincerely,

David L. Combs
Chief, Environmental Analysis and
Compliance Branch

APPENDIX D

SECTION 404 PERMIT CORRESPONDENCE

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CESWT-PE-E September 16, 2004

MEMORANDUM FOR CESWT-PE-E, ATTN: Mr. Jerry Sturdy

SUBJECT; Lake Texoma Reallocation Study, Project No. 14057

1. A review has been conducted for the Lake Texoma reallocation of 300,000 acre-feet of hydropower storage to water supply. The information provided does not indicate that a placement of dredged or fill material will be required, permanently or temporarily, into any "waters of the United States," including jurisdictional wetlands. Therefore, this proposal is not subject to regulation pursuant to Section 404 of the Clean Water Act, and a Department of the Army (DA) permit will not be required.

2. Although DA authorization is not required, this does not preclude the possibility that other Federal, State, or local permits may be required.

3. This project has been assigned Identification Number 14057. Please refer to this number during future correspondence. If further assistance is required, contact Mr. Jeff Knack at 918-669-4904.

Jeff Knack for
David A. Manning
Chief, Regulatory Branch

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APPENDIX E

PUBLIC NOTICE AND COMMENTS RECEIVED DURING FIRST AND SECOND PUBLIC REVIEW PERIOD

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Public Notice and Comments Received on First Draft EA

January 2005

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

January 19, 2005

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Dear Interested Party:

The Tulsa District has prepared an Environmental Assessment to assess the environmental and socioeconomic effects of the reallocation of approximately 300,000 acre-feet of water from hydropower storage to water supply storage at Lake Texoma, Oklahoma and Texas. The Environmental Assessment was developed in accordance with the National Environmental Policy Act, implementing regulations issued by the Council on Environmental Quality, and the U.S. Army Corps of Engineers Regulations, Part 230, Policy and Procedures for Implementing the National Environmental Policy Act. It was determined that this action will cause no significant adverse impacts on the natural or human environment.

An electronic copy of the Draft Environmental Assessment and Finding of No Significant Impact, on compact disc, is enclosed for your review and comments. Comments should be submitted within 30 days from the date of this letter to the Tulsa District, Corps of Engineers, ATTN: Environmental Analysis and Compliance Branch, 1645 S. 101st E. Avenue, Tulsa, Oklahoma 74128.

Sincerely,

Stephen L. Nolen
Chief, Environmental Analysis
and Compliance Branch

Enclosure

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

February 23, 2005

Planning, Environmental, and Regulatory Division
Environmental Analysis and Compliance Branch

Dear Interested Party:

The Tulsa District has received a request to extend the formal comment period for the Environmental Assessment to assess the environmental and socioeconomic effects of the reallocation of approximately 300,000 acre-feet of water from hydropower storage to water supply storage at Lake Texoma, Oklahoma and Texas. The Environmental Assessment was developed in accordance with the National Environmental Policy Act, implementing regulations issued by the Council on Environmental Quality, and the U.S. Army Corps of Engineers Regulations, Part 230, Policy and Procedures for Implementing the National Environmental Policy Act.

This letter is to notify interested parties of the decision by the Tulsa District to grant this extension. Comments should be submitted on or before April 7, 2005, to the Tulsa District, Corps of Engineers, ATTN: Environmental Analysis and Compliance Branch, 1645 S. 101st E. Avenue, Tulsa, Oklahoma 74128.

Sincerely,

Stephen L. Nolen
Chief, Environmental Analysis
and Compliance Branch

Enclosure

nt's decision to extend ape victims, drug users

ıer nations. Much of Australia and Brazil ; had guidelines call- pe victims to receive y drug treatment to ıe AIDS virus.

such as ısetts, New York and land came up with policies for treating ns at risk of contract- while some cities, San Francisco, 1 "post-exposure" for treating gay men, prostitutes and intravenous drug users.

"While prudish political appointees delayed the CDC release by four years, thousands of unnecessary HIV infections may have occurred," said California Assemblyman Paul Koretz, who sponsored a bill two years ago calling on state health officials to make AIDS drugs available to people exposed though non-work activities.

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All Sales
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Paris • Since 1891

Announcing: COMMENT PERIOD
DRAFT ENVIRONMENTAL ASSESSMENT
as related to the
Draft Environmental Assessment of the Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas
in compliance with
The National Environmental Policy Act
FORMAL COMMENT PERIOD: January 21, 2005 through February 21, 2005

The Draft Environmental Assessment addresses the environmental and socioeconomic effects of the reallocation of approximately 300,000 acre-feet from hydropower storage to water supply storage at Lake Texoma. The comment period is a continuation of public involvement used to develop the Draft Environmental Assessment. The public is invited to review the Draft Environmental Assessment and make comments. A copy is available at the following locations:

Denison Public Library
300 W Gandy St
Denison, TX 75020

Robert L. Williams Public Library
323 W Beech St
Durant, OK 74701

Written comments and questions will be addressed in the Final Environmental Assessment; to be included, comments and questions must be received prior to the close of the formal comment period. Comments and questions about the Draft Environmental Assessment or the comment process can be directed to:

Mr. Stephen Nolen
Chief, Environmental Analysis & Compliance Branch
Tulsa District Corps of Engineers
1645 S. 101st East Avenue
Tulsa, OK 74128-4629
Phone: 918-669-7660
Fax: 918-669-7546
E-Mail: Stephen.L.Nolen@usace.army.mil

Oklahoma Archeological Survey
THE UNIVERSITY OF OKLAHOMA

January 25, 2005

Stephen L. Nolen
Chief, Environmental Analysis
and Compliance Branch
Department of the Army
Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, OK 74128-4609

Re: Environmental Assessment of the Reallocation of Approximately 300,000 acre feet of water from hydropower storage to water supply storage at Lake Texoma, Oklahoma and Texas.

Dear Mr. Nolen:

I have reviewed the above referenced document and concur with the findings pertaining to cultural resources. The assessment accurately interprets our earlier comment that reallocation involves no new construction and no change in flood pool levels and consequently no new effect to cultural resources within the Oklahoma portion of Lake Texoma. Thus, we have no objection to implementation of this reallocation.

This review has been conducted in cooperation with the State Historic Preservation Office, Oklahoma Historical Society.

Sincerely,

Robert L. Brooks
State Archaeologist

Cc: SHPO

111 E. Chesapeake, Room 102, Norman, Oklahoma 73019-5111 PHONE: (405) 325-7211 FAX: (405) 325-7604
A UNIT OF ARTS AND SCIENCES SERVING THE PEOPLE OF OKLAHOMA

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
222 S. Houston, Suite A
Tulsa, Oklahoma 74127

In Reply Refer To:
FWS/R2/OKES/texomareallocationletter

October 5, 2004

Colonel Miroslav P. Kurka, District Engineer
Attn: Planning, Environmental, and Regulatory Division
U.S. Army Corps of Engineers
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Dear Colonel Kurka:

The U.S. Fish and Wildlife Service (Service) has reviewed a U.S. Army Corps of Engineers' (Corps) proposal to study the reallocation of water storage at Lake Texoma to increase the water supply storage, primarily for municipal use. The proposed study was included in your biological assessment dated November 20, 2003, and was considered part of the Corps' proposed action in the draft biological opinion for your actions on the Arkansas, Canadian, and Red Rivers. The list of species protected by the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*) provided for that formal consultation is still accurate and compliance with Section 7 of the ESA has been addressed in the draft biological opinion.

Assuming water demands for municipal use stay near current levels and Lake Texoma water levels will not be affected; we do not anticipate any federally-listed species to be adversely affected by the proposed reallocation of water storage. However, if demand for municipal water from Lake Texoma increases, we see potential for impacts to recreational use and fish and wildlife resources in the area near the reservoir and the Red River downstream. Municipal use usually has a very high priority relative to other uses and high demands during periods of low inflows could result in lower water levels and compromises for other uses. Management of national wildlife refuges, state wildlife management areas, and mitigation provided in compliance with the Fish and Wildlife Coordination Act and National Environmental Policy Act could be affected. If municipal water use is expected to increase, we recommend that the Corps address these potential impacts before approving any reallocations that may affect reservoir water levels. Consultation should be initiated with us and the state natural resource agencies to avoid any impacts to fish and wildlife resources.

Thank you for providing the opportunity to comment on the proposed study. Please coordinate any comments or information with Mr. Kevin Stubbs at 918-581-7458 ext 236.

Sincerely,

Jerry Brabander
Field Supervisor

cc: ARD-ES, Attn: Dean Watkins, U.S. Fish and Wildlife Service, Albuquerque, NM
Director, ODWC, Attn: Natural Resources Division, Oklahoma City, OK
Director, Texas Parks & Wildlife Dept., Austin, TX

TEX-LA ELECTRIC COOPERATIVE OF TEXAS, INC.

P.O. BOX 631623 • NACOGDOCHES, TEXAS 75963-1623 • 936/560-9532 • FAX 936/560-9215
(STREET ADDRESS: 2905 WESTWARD DRIVE • NACOGDOCHES, TEXAS 75961)

April 6, 2005

Stephen L. Nolen
Chief, Environmental Analysis and Compliance Branch
U.S. Army Corps of Engineers, Tulsa District
1645 South 101st East Ave.
Tulsa, OK 74128-4609

RE: Draft Environmental Assessment – Lake Texoma Reallocation Study – Comments of Tex-La Electric Cooperative of Texas, Inc.

Dear Mr. Nolen:

Tex-La Electric Cooperative of Texas, Inc. ("Tex-La") appreciates this opportunity to provide comments on the Draft Environmental Assessment ("DEA") associated with the proposed reallocation of 300,000 acre-feet of water in Lake Texoma from hydroelectric power production to water supply storage. Tex-La and other interested stakeholders were previously granted an extension of time until April 7, 2005, to submit comments on the DEA.

Tex-La is a generation and transmission electric cooperative that purchases power at wholesale and resells it to member cooperatives for distribution to ultimate consumers in eastern Texas. Under a March 13, 2000 Power Sales Contract with the Southwestern Power Administration ("SWPA"), Tex-La and Rayburn Country Electric Cooperative, Inc. ("Rayburn Country") collectively purchase all of the hydroelectric power generated at Denison Dam, which impounds Lake Texoma. (Tex-La's share of the hydro output is 39.25%; Rayburn Country's share is 60.75%.) Tex-La has a direct interest in the proposed water storage reallocation to the extent that it would impact the quantity, the cost or the scheduling of hydropower generation at Denison Dam.

Tex-La has concerns with both the premature timing of the DEA and certain substantive deficiencies in the document. Tex-La shares and supports the comments that are being separately submitted by SWPA. The following specific observations are intended to supplement and amplify the points raised by SWPA.

Timing of DEA and Reallocation Study – As a general matter, we believe the DEA should be withdrawn at this time and reissued – with necessary modifications – only after the Corps of Engineers ("Corps") has completed its ongoing Reallocation Study for Lake Texoma. It is Tex-La's understanding that the reallocation study will examine in detail the technical and economic issues associated with the proposed reallocation. The Corps (and its EA contractor) cannot produce a complete and properly informed EA until the results of the reallocation study are established, because a number of those results form necessary predicates to the environmental analysis.

In particular, we do not believe the EA can adequately address all pertinent impacts unless a reallocation study is completed that addresses the following topics, among others:

- Identification and analysis of the demand for water supply from Lake Texoma
- Analysis of all water supply alternatives considered, including flood control storage, ground water, conservation storage, other surface water projects, as well as one or more alternative municipal diversion points from the Red River below Denison Dam
- Economic and financial analysis of water storage options, including costs of treatment, conveyance, and compensation to hydroelectric beneficiaries for lost benefits
- A determination of impacts (benefits and revenues forgone) to hydropower and flood control, including analysis of hydroelectric capacity and energy losses to consumptive uses
- Analysis of replacement costs of lost hydroelectric capacity and energy
- Analysis of measures necessary to make Lake Texoma water suitable for municipal purposes (*i.e.*, potable water), and costs thereof

The DEA not only does not have the benefit of the reallocation study results, it does not even acknowledge the existence of an ongoing study.

Section 1 – Purpose, Need and Scope – The DEA contains no meaningful analysis of the need for 300,000 acre-feet of storage for consumptive uses. The DEA merely states (at p.1), "This project is needed to meet the expanding municipal and industrial water supply demands that are a result of population growth in the region." While Tex-La does not object to implementing the congressionally authorized reallocation to the extent there is legitimate demand, the DEA should identify potential contractors and the timing of their needs over the coming 10-year period.

From participation in local coordination meetings related to Lake Texoma, Tex-La is aware of only one pending request for 50,000 a.f. of additional water supply, by the Greater Texoma Utility Authority. The Oklahoma Water Resources Board has indicated during these meetings that it cannot foresee a date for utilization of its 150,000 a.f. Although Congress has authorized a reallocation of up to 300,000 a.f., the Tulsa District needs to explain why a DEA is being prepared now covering the entire authorized reallocation, when the reality is that there will be a demand for only a fraction of that storage in the foreseeable future. The EA's analyses are bound to be stale and no longer valid by the time most of the 300,000 a.f. is contracted for, if ever.

Section 2 – Alternatives – The DEA examines only two alternatives: No Action and the Proposed Action (reallocation of the entire 300,000 a.f.). The National Environmental Policy Act ("NEPA") and the Corps' regulations require, however, that the Corps "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" (42 U.S.C. § 4332(2)(E); *see also* ER 200-2-2, § 10.b). The EA should examine *all* reasonable alternatives, including reallocation in increments as demand develops; water supply from other sources, such as neighboring utilities, ground water, and alternative surface water supplies; diverting water for municipal uses below the Denison Dam tailrace; and reallocation from flood control as well as hydropower storage.

Section 3 – Proposed Action – The DEA states (at p.4) that, "The hydropower storage proposed for reallocation has not been used for hydropower generation in the past." This statement is so plainly and fundamentally inaccurate that it clouds the credibility of the DEA as a whole. Storage in Lake Texoma is used *every day* for hydro generation. Any reduction in the water in storage for hydropower purposes will impact generation. Even if quantities of water released through the turbines were not reduced, consumptive diversions would reduce the generating head, thereby affecting the plant's efficiency. When the Tulsa District issued a partial draft reallocation study in mid-2004, it concurred with SWPA that there would be a significant energy loss, on the order of 22.6 GWh per year, if the entire 300,000 a.f. were reallocated and used for consumptive purposes. It is also clear that the power plant's capacity would be adversely affected, but the magnitude of that impact has not been determined.

The Water Resource Development Act of 1986 included a requirement that affected preference customers are to be reimbursed for an amount equal to the customer's actual replacement cost for hydropower lost as a result of a reallocation, less the cost such customer would have had to pay to SWPA (§ 838(d)(3)). It is important for the DEA to acknowledge that there will be such an impact, and that the hydropower losses will affect the cost and feasibility of the municipal water supply.

In describing the Proposed Action, the DEA states that "300,000 acre-feet of water currently in hydropower storage would be reallocated to water supply storage, creating a total of 450,000 acre-feet of water supply" (p. 4). The DEA goes on to say:

> Water supply at Lake Texoma was not an original project purpose. Several special congressional authorizations have made storage available to users throughout the years. When the Federal government realized that there was an increasing demand for water supply storage, studies were conducted (in 1983 and 1985) to reallocate a total of 150,000 acre-feet of storage from the hydropower purpose to water supply. [p.5.]

Tex-La requests that the Corps clarify the authority to reallocate a total of 450,000 a.f. to water supply storage. While we recognize that the North Texas Municipal Water District

was permitted to contract for an initial 75,000 a.f. of water for municipal uses in 1985, we are not aware of the legal authority under which that contract was executed. The Corps' regulations require a congressional authorization before a volume in excess of 50,000 a.f. can be reallocated from one project function to another (ER 1105-2-100, at pp. 3-33 & E-215). As the DEA correctly notes, water supply was not an original project purpose, but we are unaware of which "congressional authorizations have made storage available to users throughout the years" at Lake Texoma, apart from WRDA in 1986, which authorized a total of 300,000 a.f.—not 450,000.

Section 5.2 – Hydrology – Tex-La supports SWPA's detailed comments on this section (and its constituent subsections). We especially wish to emphasize the DEA's failure to address the proposed reallocation's impact on downstream habitat of the endangered Interior Least Tern. In recent years the Tulsa District, SWPA, and its power contractors have voluntarily increased the duration and frequency of water releases at Denison Dam to maintain and enhance Least Tern habitat. The continuation of these releases is not dependable following a reallocation, because the water supply allocation does not include storage for endangered species habitat enhancement. The Tulsa District should contact the U.S. Fish and Wildlife Service to determine whether a biological assessment of the proposed action's impact on the Least Tern is required.

Section 5.4.2 – Air Quality – The DEA concludes the reallocation will have no material impact on air quality. Although air quality impacts may be relatively minor, the EA should acknowledge that the need for Tex-La and Rayburn Country to replace lost hydroelectric generation with fossil fuel-generated energy will have some impact on air quality.

Water Quality – Information on an extensive list of environmental parameters is presented in the DEA, but remarkably, the DEA contains **no information on the water quality of Lake Texoma – particularly salinity.** The salinity of Lake Texoma makes it unmarketable for human consumption, a primary municipal use, without desalination. Desalination produces brine, the existence and disposal of which must be addressed. To do more than just a cursory analysis, the timing and location of requests is important. Using municipal water adjacent to the shores of Lake Texoma will require a different disposal of brine compared to an inter-basin transfer where water may be blended with larger quantities of "fresher" water to reduce or eliminate the need for brine disposal. Although recent technology advances have reduced the costs of desalination and brine disposal, the need for such measures in connection with municipal water supplies must be acknowledged and addressed. The impact of desalination costs on the demand for municipal water and the feasibility of the proposed reallocation should also be explored.

Appendix B – Yield Analysis Using SUPER – Tex-La agrees with SWPA that the displacement of storage capacity in Lake Texoma due to sediment inflow should be shared among all storage functions, and not assigned entirely to hydropower. Similarly, water dedicated to environmental mitigation following any reallocation should be shared among storage functions *pro rata.*

In closing, Tex-La reiterates its support for SWPA's comments, and appreciates the Tulsa District's consideration of the supplemental points raised above.

Very truly yours,

John H. Butts
Manager

cc: Bethel Herrold (SWPA)
Marshall S. Boyken (SWPA)
Ted Coombes (SPRA)
John Kirkland (Rayburn Country)
David Fitzgerald, Esq. (Rayburn Country)

Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3519

April 4, 2005

Colonel Miroslav P. Kurka
District Engineer
U. S. Army Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Dear Colonel Kurka:

This letter is in response to a U. S. Army Corps of Engineers' Tulsa District letter dated January 19, 2005, concerning the draft Environmental Assessment (EA) Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas. The draft EA is intended to address the impacts of the proposed 300,000 acre-feet (ac-ft) water storage reallocation at Lake Texoma. Southwestern Power Administration's (Southwestern) specific comments regarding the draft EA are included as an enclosure.

Southwestern is very concerned about certain deficiencies of the draft EA. First, the Tulsa District has not identified other alternatives that are reasonable in supplying the requested water storage for municipal water supply. The National Environmental Policy Act (NEPA) requires that all reasonable alternatives to a Federal action be evaluated. Also, the Tulsa District has not identified the impacts that the proposed water storage reallocation will have on the existing authorized purposes at Lake Texoma. The Tulsa District should complete a reallocation study which would adequately evaluate the impacts of the requested action and all reasonable alternatives to that action. Until that study has been completed, Southwestern believes that an adequate draft EA cannot be developed for review.

As you know, Southwestern is the Federal agency that markets the Federal hydropower produced at Lake Texoma. The proposed reallocation of 300,000 acre-feet of hydropower storage will have a severe impact on the marketable capacity and energy that has been contracted from the project. We believe a compensation procedure must be developed to offset those negative impacts.

Southwestern recommends that work on the draft EA be suspended until the reallocation study has been completed in adequate detail to identify the impacts on the existing purposes. Southwestern is willing to partner with the Tulsa District in all areas of the reallocation process, especially in the evaluation of the impacts on the Federal hydropower purpose.

Southwestern appreciates the opportunity to provide comments on the draft EA. Please contact Marshall Boyken, (918) 595-6646 or marshall.boyken@swpa.gov, if you have any questions about our comments or if you desire for Southwestern to actively participate in the reallocation study.

Sincerely,

Forrest E. Reeves
Assistant Administrator
Office of Corporate Operations

Enclosure

cc:
Ted Coombes
Southwestern Power Resources Assoc.

Keith Hartner
Associated Electric Cooperative

John Butts
Tex-La Electric Cooperative

John Kirkland
Rayburn Country Electric Cooperative

April 4, 2005

Southwestern Power Administration Comments for the Draft Environmental Assessment – Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas

1. We believe the draft EA is incomplete because it does not contain or reference a reallocation study for Lake Texoma. In our view, at the very least, a reallocation study for Lake Texoma must contain:

    - An in-depth hydropower benefit analysis
    - An in-depth flood control frequency benefit analysis
    - A water supply demand analysis
    - A water supply storage/yield analysis
    - A detailed summary of the alternatives considered (flood control storage, conservation storage, ground water, other surface water projects, etc.)
    - The National Economic Development Plan analysis
    - A cost of storage analysis
    - A determination of benefits foregone (hydropower and flood control)
    - A determination of revenues forgone (revenues lost by the Federal Treasury due to the reallocation of the storage)
    - An updated cost of storage
    - Updated annual repayment costs
    - The financial feasibility of the reallocation
    - Compensation to existing project purposes

    Southwestern believes that the EA cannot be appropriately drafted without knowing the reallocation study results listed above.

2. Section 1 – Purpose, Need and Scope, Page 1. The second paragraph needs to list the water utilities requesting storage from Lake Texoma and the amount of water supply storage needed in the next 10 year period to meet the water utilities' estimated growth.

3. Section 2.2 – Action Alternatives, Page 4. All reasonable future water supply alternatives need to be addressed in this section. Reasonable alternatives for the future water supply of the area would include: water supply from neighboring utilities, ground water, surface water supplies and flood control and hydropower storage reallocation at Lake Texoma.

4. Section 3 – Proposed Action, Page 4. The sentence, "*The hydropower storage proposed for reallocation has not been used for hydropower generation in the past.*" is incorrect. The hydropower storage at Lake Texoma is used every day. Southwestern markets energy (actual power produced) and capacity (potential power) for the Federal government from Lake Texoma. The less hydropower

Enclosure

storage available for generation, the less capacity a project has, and therefore, the benefits it provides to the electric consumers are diminished. Long-term power sales contracts have been entered into by the Federal Government and would have to be amended as a result of the proposed reallocation. If a large reduction in hydropower storage at Lake Texoma occurs, the marketable capacity and energy of the project will be significantly reduced.

5. Section 4.4.3 – Hydrology, Page 12. Second Paragraph. Second sentence needs to add water supply as a purpose.

6. Section 4.4.3 – Hydrology, Page 13, Table 7. Note 2 is incorrectly placed. The conservation storage includes 150,000 ac-ft of water supply storage.

7. Section 4.4.3 – Hydrology, Page 14, Paragraph 1. The last sentence is misleading. It should state that the 228.4 cfs is the yield available from the existing 150,000 ac-ft of water supply storage in the year 2044, rather than stating that the 228.4 cfs is the future water supply available. Please clarify.

8. 5.1.2.1 Population, Page 20. This paragraph contradicts itself. The first sentence states that the reallocation will have a direct effect on the population. The second sentence states that the reallocation would not affect the population growth trends in the area, while the last sentence says it would cause local changes in population. Will this reallocation effect the area population or not? Please clarify.

9. Section 5.2 – Natural Resource Impacts, Table 10, Pages 21 and 22. Table 10, the Impact Assessment Matrix needs to be corrected and completed as follows:

    - The reallocation will have a minor adverse impact on the Public Health and Safety, Community Growth and Development, Public Facilities and Services, and Air Quality. Please correct.
    - The reallocation will have a substantial adverse impact on Threatened and Endangered Species (see comment 12). Please correct.
    - The reallocation will have a significant adverse impact on Hydropower. Please add hydropower to the Impact Assessment Matrix to complete Table 10.

10. Section 5.2.2.3 – Hydrology, Paragraph 2, Page 23.

    - Change, "These changes could reduce the amount of water available in hydropower storage." to "The changes will reduce the amount of hydropower storage and ultimately the water available for generation."
    - The current Hydropower Storage is 1,317,283 ac-ft which will be reduced to 1,017,283 ac-ft (1,467,283-150,000-300,000 = 1,017,283). The 150,000 ac-ft of current water supply storage must be accounted for.

- It is stated that "The discharges that will have the most pronounced changes are from 600 to 7000 cfs." These discharges represent the hydropower releases. More elaboration on the profound effect the reallocation will have on the hydropower purpose is needed in the paragraph.

11. Section 5.2.2.3 – Hydrology, Paragraph 2, Page 24. Change "Although lake levels might be reduced slightly, this could result in the creation….." to "Although lake levels will be reduced slightly, that could result in the creation…" Also, the EA should state that if the proposed reallocation of 300,000 ac-ft of water storage occurs and the hydropower operation remains constant, the lake level <u>will</u> be reduced significantly.

12. Section 5.2.2.3 – Hydrology, Paragraph 3, Page 24. The reduction in downstream discharge and frequency will affect wetland habitat (specifically Interior Least Tern habitat). The paragraph seems to imply that there is water storage for downstream low flow releases. The draft EA should state that there is no water storage in Lake Texoma allocated for the regulation of a minimum flow downstream from the project and that the low flow releases are voluntary and cannot be considered dependable. If the 300,000 ac-ft is reallocated from hydropower storage to water supply, the water supply purpose should proportionally share with any voluntary/mandatory releases for downstream habitat protection; otherwise, there would be a significant impact on the downstream Interior Least Tern habitat.

13. Section 5.2.2.5 – Threatened and Endangered Species, Paragraph 1, Page 25. We believe the reallocation will reduce hydropower discharges which will affect the habitat of the Endangered Interior Least Tern. What reasoning has the Draft EA used to conclude that reductions in discharge and frequency from Lake Texoma will not affect the Least Tern? Over the past several years, hydropower releases at Lake Texoma have been voluntarily increased (duration and frequency) to enhance and maintain Interior Least Tern habitat. These flows are not dependable since there is no water storage allocation in Lake Texoma for downstream habitat maintenance with the proposed reallocation of water storage.

14. Section 5.4.2. – Air Quality, Proposed Action, Page 26. The draft EA should quantify the additional air pollution that will be produced as a result of the loss of hydropower production (i.e. How many tons of mercury, carbon dioxide, sulfur dioxide, and nitrogen oxide will be emitted into the atmosphere due to the water supply reallocation?). The draft EA should recognize that the loss of hydropower energy will not be replaced with other hydropower energy, but, in all likelihood, with some form of fossil fuel-produced electric energy.

15. Section 6. – Mitigation Plan, Paragraph 3, Page 27. It should be made clear in the paragraph that the water supply purpose has a proportional share of any water releases made for mitigation purposes.

16. Section 7. – Federal, State, and Local Agency Coordination, Page 28. Please place Southwestern Power Administration, Southwestern Power Resources Association, Tex-La Electric Cooperative of Texas, Inc., and Rayburn Country Electric Cooperative, Inc. on the coordination list.

17. Appendix B – Overview of the SUPER Model, Page B-1, Paragraph 1, Sentence 2. Remove the comma after analysis.

18. Appendix B – Texoma Yield Analysis Using SUPER. The yield analysis of the reallocated storage is incorrect. In the year 2044, it is projected that Lake Texoma will have an available water storage amount of 986,730 ac-ft. It appears that the draft EA is maintaining the water supply storage volume and reducing the hydropower storage volume by placing all of the sediment inflow in the hydropower storage of Lake Texoma. If the additional 300,000 ac-ft of water supply storage is reallocated from hydropower storage, the total amount of water supply storage would be 450,000 ac-ft, or about 31 percent of the entire conservation storage and the hydropower storage would account for the remaining 1,017,283 ac-ft of storage, or about 69 percent of the conservation storage. The sediment inflow should be shared on a proportional basis; therefore, the future water supply storage (in year 2044) cannot be 450,000 ac-ft. The future water supply storage should be a smaller volume that has been reduced as a result of sediment inflow. The reduced water supply storage volume would then have a different yield associated with it.

Southwestern Power Resources Association

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April 7, 2005

Colonel Miroslav P. Kurka
Commander, Tulsa District
U.S. Army Corps of Engineers
1645 S. 101st East Avenue
Tulsa, OK 74128-4609

Dear Colonel Kurka:

Via this correspondence, Southwestern Power Resources Association (SPRA) offers its comments on the draft Environmental Assessment (EA), Lake Texoma Storage Reallocation Study. SPRA represents the rural electric cooperatives, municipally owned electric utilities, and state power agencies and authorities that purchase hydropower generated at 24 Corps of Engineers projects in this area of the country. This energy is marketed to us by Southwestern Power Administration (SWPA), an agency of the Department of Energy. One of the projects serving SPRA members is Denison Dam (Lake Texoma). The proposed reallocation of 300,000 acre-feet of hydropower storage at Lake Texoma would reduce electrical energy and capacity available from the project, directly impact SPRA's membership.

SPRA concurs with the conclusion of SWPA and Tex-La Electric Cooperative of Texas, Inc. that the draft EA fails to conform to the requirements of the National Environmental Policies Act (NEPA) and should be withdrawn and redrafted. ER 200-2-2, which provides guidance for NEPA compliance, states that "the EA should include a brief discussion of the need for the proposed action, or appropriate alternatives if there are unresolved conflicts concerning alternative uses of available resources…" The instant draft EA neither establishes a need for the proposed reallocation nor identifies appropriate alternatives. While the draft EA asserts that the reallocation "is needed to meet the expanding municipal and industrial water supply demands that are a result of population growth in the region," nowhere in the draft is that demand documented or quantified. In fact, the draft does not even establish that the existing 150,000 acre-feet of water supply storage at the project is fully contracted or utilized. To comply with both NEPA and ER 200-2-2, the EA should identify how much of the existing M&I storage is contracted for and utilized and should quantify how much additional water supply will be needed in the future, as well as by whom and when it will be needed. Likewise, the EA should identify all reasonable alternatives to the proposed reallocation, including (but not limited to) use of ground water, other surface impoundments, diversion from the Red River below Denison Dam, and reallocation from the flood control pool, in addition to the no-action and reallocation from the power pool alternatives identified in the draft EA. Finally, the draft EA should measure the environmental effects of each of these alternatives and recommend the one that satisfies the established need for additional water supply with the least environmental consequences.

There are other errors and shortcomings in the draft EA, as well. In addition to these general comments, SPRA has enclosed specific comments addressing individual sections of the draft EA. We respectfully request that both of these documents be accepted as public comments submitted in response to the draft EA. Thank you for your consideration.

Sincerely,

Ted Coombes
Executive Director

Specific Comments of SPRA
Draft Environmental Assessment
Lake Texoma Storage Reallocation Study

Section 1, p. 1: The statement that the proposed reallocation "is needed to meet the expanding municipal and industrial water supply demands that are a result of population growth in the region" is an unsubstantiated assertion. The draft EA should identify how much of the existing 150,000 acre-feet of water supply storage is currently contracted for and by whom, and should quantify the need for additional water supply storage and the time-frame during which this additional storage will be needed. (See general comments.)

Section 2.1, No Action Alternative, p. 4: The statement that "Essentially all of the current water supply is being used and North Texas is in need of additional water" is not substantiated. See comment on Section 1 and general comments.

Section 3, Proposed Action, p. 4: The statement that "The hydropower storage proposed for reallocation has not been used for hydropower generation in the past" is patently false. The paragraph should be corrected to show that all of the hydroelectric capacity at Denison Dam is under contract and that the proposed reallocation would reduce both the capacity and energy available from the hydropower plant.

Section 4.3.4, Social Ecology, p. 7: The description of Durant, Oklahoma and Denison, Texas as "growing communities" gives the false impression that there has been substantial population growth requiring additional water supply. In fact, Tables 1 and 2 on p. 6 indicate that population growth of Durant is less than 58 percent of the State of Oklahoma's average growth over the past decade, while the population growth of Denison is only 26 percent of the average growth over that same period for the State of Texas. The adjective "growing" should be dropped from the sentence.

Table 7, Water Storage Data for Lake Texoma and Denison Dam, p. 13: According to footnote 2, the flood control storage includes 150,000 acre-feet of water supply storage. This is incorrect, and the table should be corrected.

Table 8, Comparison of Water Storage Capacity at Lake Texoma (1942-2002), p. 14: This table is very confusing. One would assume from the table that between 1942 and 1969, water storage capacity decreased 8.5 percent. However, the actual decline in storage was 14.2 percent (the water storage capacity by 1969 had dropped 443,882 acre-feet from the design volume, which is 14.2 percent of the design capacity of 3,132,293 acre-feet). Perhaps that is not how the table was computed, because none of the percentages track. At any rate, the table should be redesigned so that the reader can clearly understand what the table purports to show.

Section 4.4.3, Hydrology, p. 14: The second paragraph discussing Appendix B describes discharge duration in two different ways (percent of time a particular discharge was equaled or exceeded vs. percent of years a particular discharge was equaled or exceeded). Presumably the second reference to discharge duration should have referred to discharge frequency. The paragraph should be corrected.

Section 4.5, Cultural Resources, p. 18: The second paragraph notes that the Oklahoma Historical Society concluded that the proposed reallocation would involve "no construction or earth-moving activities." This pointedly ignores the next sentence in the letter from the Oklahoma Historical Society, found at D-2: "Should further projects include construction or earth-moving activities, an opinion should be requested from this office." While it is true that the act of reallocation itself does not involve construction or earth-moving activities, it would be necessary for water supply contractors to construct intake structures to utilize the reallocated storage, as well as constructing additional water treatment facilities or expanding existing treatment facilities. All of these activities involve earth moving. Thus, it is incorrect to conclude, on the basis of the letter from the Oklahoma Historical Society, that there would be no impact on cultural resources. The draft EA should be rewritten to identify and quantify any potential impacts from construction of water intake structures, construction of additional water treatment facilities, or expansion of existing water treatment facilities that would be required to utilize the reallocated storage – if, indeed, there is a demonstrated need for the proposed reallocation.

Section 5.1.1.2, Employment and Income, p. 20: This section states that, under the no-action alternative, "Municipal, industrial, and agricultural opportunities would continue to be limited to the 150,000 acre-feet of water currently available in water supply storage at Lake Texoma." This is incorrect. Additional water supply is available from alternative sources, such as existing, expanded, or new impoundments other than Lake Texoma; ground water withdrawals; and diversions from the Red River below Denison Dam.

Section 5.1.2.1, Population, p. 20: This section concludes that the proposed reallocation "could promote growth of business-related opportunities and residential development in the social area, which could cause small, local changes in population." This statement assumes that there is a need for additional water supply that only the proposed reallocation can satisfy. The draft EA neither demonstrates nor quantifies a need for additional water supply, nor does it examine other alternative sources of water supply.

Section 5.1.2.3, Social Ecology, p. 20: This section asserts that the proposed reallocation would lead to "Increased demand for new residential developments [that] would increase the transition of agricultural lands into residential areas." Again, this statement assumes that there is a need for additional water supply that only the proposed reallocation can satisfy. The draft EA neither demonstrates nor quantifies a need for additional water supply, nor does it examine other alternative sources of water supply.

Section 5.2.2.1, Terrestrial, p. 23: This section states, "Construction and earth-moving activities would not be associated with the storage reallocation project at Lake Texoma." Again, this ignores the construction and earth moving that would be required to build water intake structures and treatment facilities to utilize the proposed reallocated storage. The draft EA can not conclude, therefore, that there are no impacts of the proposed action on terrestrial resources until it identifies and quantifies the impact from these associated construction and earth-moving activities.

Section 5.2.2.2, Soils and Prime Farmland, p. 23: This section asserts that the proposed storage reallocation would not result in any prime farmland being taken out of agricultural production. This directly contradicts the conclusion on p. 20 that the additional water supply will lead to additional residential construction that "would increase the transition of agricultural lands into residential areas." If the latter statement is correct (which the draft EA fails to demonstrate), the former statement is incorrect.

Section 5.2.2.4, Fish and Wildlife, p. 24: This section states, "Construction and earth-moving activities are not necessary to implement the storage reallocation project at Lake Texoma..." Again, this ignores the construction and earth moving that would be required to build water intake structures and treatment facilities to utilize the proposed reallocated storage. The draft EA can not conclude, therefore, that there are no impacts of the proposed action on fish and wildlife resources until it identifies and quantifies the impacts from these associated construction and earth-moving activities.

Section 5.2.2.5, Endangered Species, p. 25: This section asserts that "modified releases from the dam are made to enhance or maintain interior least tern habitat, and would continue under the Proposed Action as necessary." This statement might be correct if water supply contractors are required to proportionately share in the amount of water released for this purpose. However, if such releases are limited to the hydropower storage, the draft EA does not demonstrate that the reduced dependable yield of the power pool will be sufficient to serve these purposes, particularly during periods of drought. SPRA believes that all assigned storage should be required to proportionately share in any releases from the dam necessary to meet endangered species requirements. This section should be redrafted to indicate that proportional releases will be made from the water supply storage to meet these objectives.

This section also states that "there would be no construction-related activities that could impact bald eagles (e.g. noise from heavy equipment or tree removal) associated with the proposed reallocation." A similar statement is made with regard to whooping cranes and piping plovers. Again, this ignores the construction and earth moving that would be required to build water intake structures and treatment facilities to utilize the proposed reallocated storage. The draft EA can not conclude, therefore, that there are no impacts of the proposed action on threatened and endangered species until it identifies and quantifies the impacts from these associated construction and earth-moving activities.

Section 5.4.2, Proposed Action, p. 26: This section concludes that "The Proposed Action would not result in any effects on air quality." This statement is incorrect. The proposed reallocation will reduce both energy and electrical capacity available from the Denison Dam hydropower plant. In today's market, this lost energy and capacity likely would be replaced from thermal generation resources. Hydropower generation does not emit any atmospheric gasses; thermal generation does. The draft EA should be revised to quantify the amount of electrical energy and capacity lost at Denison Dam due to the proposed reallocation and quantify the increase in specific atmospheric gasses that replacement by thermal generation would cause. The draft EA also must identify and quantify the cumulative impacts of reduced hydropower generation at Denison Dam. This would include the impacts of previous reallocations at the project, and it also should quantify the increase in atmospheric gasses that the previous and

proposed reallocations will result in over the remaining life of the project. Only when these impacts have been identified and quantified can the EA realistically assess impacts on air quality.

Section 5.6.2, Proposed Action, p. 27: The draft EA asserts that "The proposed storage reallocation at Lake Texoma would not result in any affects on noise in the project area." Again, this ignores the construction and earth moving that would be required to build water intake structures and treatment facilities to utilize the proposed reallocated storage. The draft EA can not conclude, therefore, that there are no impacts of the proposed action on noise until it identifies and quantifies the impacts from the associated construction and earth-moving activities.

Section 6, Mitigation Plan, p. 27: This section identifies various mitigation activities that might be employed to address various environmental contingencies, including releases from Denison Dam to protect interior least tern nesting sites. Again, this section should be revised to indicate that proportional releases will be made from the water supply storage to meet this objective.

Appendix A, Coordination/Correspondence, p. A-16: The Texas Water Development Board indicates in a letter dated May 3, 2004 that it prefers reallocation from the flood pool of reservoirs as "the most cost-effective and least environmentally disruptive way of meeting water demand in Texas." However, the draft EA did not study this alternative. The State of Texas' support for reallocation from the flood pool should be recognized at the appropriate point in the body of the EA.

Appendix C, U.S. Fish and Wildlife Service Correspondence, p. C-1: A letter dated October 5, 2004 from the U.S. Fish and Wildlife Service (USFWS) contains the following statement: "If municipal water use is expected to increase, we recommend that the Corps address these potential impacts before approving any reallocations that may affect reservoir levels." The draft EA presumes there will be an increase in municipal water use; otherwise, there would be no justification for the proposed reallocation. While the proposed reallocation would not change the top of the conservation pool, the draft EA recognizes in several instances that reallocation would affect reservoir levels. Yet the draft EA does not even acknowledge, much less address, the issue raised by USFWS. The EA should acknowledge this stated concern and address it in the appropriate section.

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April 4, 2005

Mr. Steve Nolan
Chief, Environmental Analysis
and Compliance Branch
U.S. Army Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Dear Mr. Nolan;

Following review of the 19 January 2005 Draft Environmental Assessment (Draft EA) regarding the reallocation of approximately 300,000 acre-feet of water from hydropower storage to water supply storage at Lake Texoma, the Oklahoma Department of Wildlife Conservation (ODWC) provides the following comments.

Hydrology

Data seem to indicate the proposed action will have minimal impact on downstream releases and elevations within the lake during years of normal or average rainfall. However, the predicted changes of 3-8 percent could be much greater during periods of low rainfall or during drought years. Additional data or modeling during record drought years (a worse case scenario) is needed to evaluate actual impacts to lake elevations and downstream resources during these critical months. It is not possible to determine potential effects on the lake and dependent fish and wildlife resources without quantifying the seasonality of all water uses during drought years. Mean conditions over the period of record mask the serious impacts that would be expected during maximum water use under drought periods. Given the expected peak seasonal water withdrawals for both hydropower and water supply use (especially in summer months), the lake would most likely be drawn down earlier, faster and for a longer duration in the summer and fall months with less probability of recovery to target seasonal pool elevations in the fall and winter months.

The cumulative effects of drought years and the increased water demands in the upper Red River, within the reservoir and downstream will adversely affect the existing water level manipulation plan designed and sanctioned by the Lake Texoma Advisory Committee and its benefits to fish and wildlife (i.e., spawning and nursery habitat and planting and flooding of millet for waterfowl).

The Draft EA suggests the reduction in elevation, duration and frequency at Lake Texoma is not expected to adversely affect aquatic or wetland habitat. Although lake levels might be reduced slightly, this could result in the creation of wetlands in areas that were previously flooded. We

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would expect lower average pool elevations that would negatively affect associated riverine and palustrine wetland habitats due to changes in timing and duration of wetland hydrology including but not limited to fall and winter recharge events. It is not clear how it is possible to "create" wetlands by "slightly reducing" the lake level. Certainly a change in the characteristics of the lake as a lacustrine wetland type, including average depths and the overall hydrological regimen would occur. ODWC believes additional clarification is needed.

Fish and Wildlife

The Draft EA indicates reductions in elevation duration, elevation frequency, discharge duration, and discharge frequency could have impacts on wildlife that use the aquatic and wetland habitat available in the lake and the Red River. In the next paragraph it states "Under the Proposed Action, reductions in discharge duration and frequency from the lake are not expected to significantly affect wildlife or their habitat downstream of Lake Texoma." We do not agree that these effects will be insignificant. This document does not provide enough information to make a complete assessment of the impacts to fish, wildlife and invertebrates.

ODWC believes that reduced flows to the tailwater will have a dramatic adverse affect on the fishery from the dam downstream to the confluence of Blue River before supplemental water enters the Red River. This area supports a very popular recreational fishery. We suggest that the Corps monitor the water quality below the dam and continue providing sufficient water releases to prevent fish stress and mortality. Water quality standards for dissolved oxygen and other parameters should be met.

Water quality and fisheries resources in the main pool of Lake Texoma could be adversely impacted as hypolimnetic hydropower releases are replaced by epilimnetic withdrawals for municipal water supply.

Available data suggest that higher lake levels (as promoted in the current water level manipulation plan) in late fall and winter months reduce the risk of mussel and fish mortality due to golden alga. Advocating low water levels that could optimize conditions that can potentially promote a major fish kill event that decimates a $30 million annual fishery resource would have significant economic impacts locally and statewide.

There is no specific section detailing wetland types, numbers and locations that are associated with Lake Texoma which might be impacted by the proposed action. Additional discussion and documentation of wetland impacts in this document is warranted.

The Draft EA should include smallmouth bass ***(Micropterus dolomieu)*** as an important sport fish because of its increasing abundance and popularity with anglers. Lake Texoma has held the past five Oklahoma smallmouth bass State Records since 1988.

The Draft EA indicates "The spawning of striped bass in the Red and Washita Rivers is key to continued success of this sport fishery." In reality the continued success of the Lake Texoma fishery is dependent on numerous physical, chemical, biological and social factors.

Threatened and Endangered Species

It is stated in this section that "Reductions in elevation, duration and frequency at Lake Texoma would not significantly affect the shoreline habitat that may be used by whooping cranes. In fact, a reduction in elevation, duration and frequency at the lake could result in the formation of new wetlands, which could provide additional nest areas for whooping cranes." Whooping crane nesting has not been documented in Oklahoma.

Cumulative Impacts

The Draft EA suggests the proposed action will have no cumulative impacts, but provides no documentation for this assertion. ODWC believes reallocation of 300,000 acre-feet to water supply storage will have adverse impacts to fish and wildlife resources and recreational opportunities at Lake Texoma.

Mitigation Plan

The Corps should continue low flow water releases into the tailwaters during the critical summer months to maintain adequate water quality to prevent the stressing or loss of fish and other aquatic organisms. The Drought Contingency Plan should be updated to accommodate project purposes as related to changes in operational regimens due to this proposed action. The current Water Level Manipulation Plan should not be compromised by this proposed action.

We suspect that appreciable decreases in the fish and wildlife resources of the lake and the Red River below will occur and that an environmental impact analysis should be conducted to adequately assess the magnitude of this proposed action.

Sincerely,

Greg D. Duffy
Director

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April 7, 2005

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ROBERT L. COOK
EXECUTIVE DIRECTOR

Tulsa District, Corps of Engineers
Attention: Environmental Analysis and Compliance Branch
1645 S. 101st E. Avenue
Tulsa, Oklahoma

Re: Reallocation of 300,000 Acre-Feet of Water from Lake Texoma

Staff has reviewed the notice of intent to reallocate 300, 000 acre-feet of water from hydropower storage to water supply storage at Lake Texoma to increase water supply storage for municipal use.

The effects on State of Texas fish and wildlife resources would presumably be primarily within Lake Texoma. The downstream aquatic and near-stream habitats actually lie within the State of Oklahoma as the state boundary is the south bank of the Red River. Department staff defer to staff of the Oklahoma Department of Wildlife Conservation for assessment of impacts to fish and wildlife resources in Oklahoma. Since the actual amount of water removed from Lake Texoma remains the same, there should not be major alternative impacts to the lake fishery, unless the timing of removals is significantly altered. The conditions placed previously by the Corps on the intake of water from Lake Texoma for the same water supply entities should remain in place: Measures should be taken as stipulated to prevent significant effects on striped bass and other pelagic species in the reservoir. Further, the management measures placed on discharging the redirected water through streams like Sister Grove Creek should be followed to prevent any significant adverse impacts on the fish fauna and the integrity of the streambed and banks by inappropriate flow regimes.

A new factor of concern has arisen since that previous permit was issued: Golden Alga has been detected in streams and reservoirs in the western parts of Oklahoma and Texas, and has in a number of cases resulted in major fish kills and detrimental effects on the fishery, recreation and tourism in the affected areas. The potential for exacerbation of this toxic alga on receiving waters should be thoroughly analyzed and resolved prior to changing the delivery rates and times of potentially hazardous water to previously unaffected water bodies.

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Questions can be directed to Rollin MacRae in Austin (512-389-4639) rollin.macrae@tpwd.state.tx.us.

Sincerely,

J. Rollin MacRae
Wetlands Conservation Team Leader

JRM:sh

Kathleen Hartnett White, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
Larry R. Soward, *Commissioner*
Glenn Shankle, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

March 18, 2005

Stephen L. Nolen
Chief, Environmental Analysis and Compliance Branch
Department of Army
Corp of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Re: TCEQ GEARS # 6431, Lake Texoma Water Reallocation

Dear Mr. Nolen:

The Texas Commission on Environmental Quality (TCEQ) has reviewed the above-referenced project and offers the following comments:

A review of the project for General Conformity impact in accordance with 40 CFR Part 93 and Chapter 101.30 of the TCEQ General Rules indicates that the proposed action is located in Grayson and Cooke Counties, which are currently unclassified or in attainment of the National Ambient Air Quality Standards for all six criteria air pollutants. Therefore, general conformity does not apply. Further, the project as proposed contains no demolition, construction, rehabilitation or repair component which will produce dust and particulate emissions and we, therefore, have no objections or comments at this time.

Significant long-term environmental impacts from this project are not anticipated as long as construction and waste disposal activities are completed in accordance with applicable local, state, and federal statutes and regulations. We recommend that the applicants take necessary steps to insure that best management practices are utilized to control runoff from construction sites to prevent detrimental impact to both surface and groundwater.

Thank you for the opportunity to review this project. If you have any questions, please call Mr. Forrest Brooks at (512) 239-4900.

Sincerely,

Thomas W. Weber
Manager, Water Section
Chief Engineer's Office

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BRICKFIELD BURCHETTE
RITTS & STONE, PC

WASHINGTON, D.C.
AUSTIN, TEXAS

February 17, 2005

Via Facsimile (918-669-7546) and Federal Express (Overnight)

Mr. Stephen L. Nolen
Chief, Environmental Analysis and Compliance Branch
U.S. Army Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, OK 74128-4609

Re: January 2005 Draft Environmental Assessment, Storage Reallocation Study, Lake Texoma, Oklahoma and Texas

Dear Mr. Nolen:

Brickfield, Burchette, Ritts & Stone, P.C. represents Tex-La Electric Cooperative of Texas, Inc ("Tex-La"). Under a March 13, 2000 Power Sales Contract with the Southwestern Power Administration ("SWPA"), Tex-La and Rayburn Country Electric Cooperative, Inc. ("Rayburn Country") collectively purchase all of the hydroelectric power generated at Denison Dam, which impounds Lake Texoma. (Tex-La's share of the hydro output is 39.25%; Rayburn Country's share is 60.75%.) Tex-La very recently became aware that the Corps of Engineers' Tulsa District office had issued a Draft Environmental Assessment ("DEA") for the proposed reallocation of 300,000 acre-feet of water in Lake Texoma from "hydroelectric storage" to "water supply." Because the proposed reallocation would significantly and adversely affect the quantity of hydroelectric capacity and energy available for sale to Tex-La, and because Tex-La did not receive the DEA until early February, we hereby request a 45-day extension of the February 21, 2005 deadline for submitting comments on the DEA.

Tex-La has serious concerns with the scope of the proposed reallocation and with the DEA. To the extent that hydroelectric production is diminished as a result of reallocating Lake Texoma water to municipal, industrial and agricultural water supply, the Cooperatives must replace the lost generation with relatively expensive alternative power supplies. The DEA contains no analysis whatsoever of the impacts of the reallocation on hydropower generation. Instead, the DEA merely states that "[t]he hydropower storage proposed for reallocation has not been used for hydropower generation in the past." This statement is clearly in error, and casts doubt on the analyses contained elsewhere in the DEA.

The Water Resources Development Act of 1986 (Public Law 99-662), which the Corps cites as authority for the reallocation, provides (in section 838(d)(3)) that any water supply contractor who benefits from a reallocation of Lake Texoma water must compensate SWPA for the replacement cost of any lost hydropower production, and SWPA in turn must make its power

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customers whole. The DEA does not address how this statutory requirement would be implemented in connection with any water supply contracts that may result from the reallocation.

The Corps did not initially serve Tex-La with a copy of the January 2005 DEA, nor was a notice of availability of the DEA published in the Federal Register. Tex-La became aware of the DEA only after being notified by SWPA, and has had little more than one week to review the DEA's contents. The initial comment deadline does not afford adequate time for Tex-La to coordinate with its engineering consultants, SWPA, Rayburn Country, and other interested parties to formulate fully informed comments. Accordingly, Tex-La respectfully requests that the Corps extend the deadline for public comments on the DEA by 45 days, *i.e.*, through April 7, 2005.

We understand that SWPA already has made a similar request for extension of time to comment, and that additional such requests have been or will be made by Rayburn Country and the Southwest Power Resources Association. We would very much appreciate a confirmation by fax (202-342-0807) or e-mail (Brian.Drumm@bbrslaw.com) that the deadline has been extended, so that we are not forced to submit rushed and incomplete comments on February 21 (a Federal Government holiday).

Thank you for your consideration.

Very truly yours,

Michael N. McCarty
Brian C. Drumm

cc: John H. Butts, Manager, Tex-La
David Fitzgerald, Esq. (Rayburn Country)
Bethel Herrold (SWPA)
Ted Coombes (SPRA)
Tob Gebhard (GDS Associates)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
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Tulsa, Oklahoma 74127
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In Reply Refer To:
FWS/R2/OKES/
02-14-04-I-0748

February 23, 2005

Steve Nolan
Environmental Analysis and Compliance Branch
U.S. Army Corps of Engineers
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Dear Mr. Nolan:

This is in response to a January 19, 2005, letter and Draft Environmental Assessment (Draft EA) from your office requesting comments on a proposed reallocation of water storage at Lake Texoma. The Draft EA was developed in compliance with the National Environmental Policy Act (NEPA) and the proposed action would reallocate approximately 300,000 acre-feet of water storage from hydropower to water supply use. In an October 5, 2004, letter, the U.S. Fish and Wildlife Service (Service) previously provided comments during the scoping process. After reviewing the Draft EA, the Service has additional comments and we are amending some of our previous comments.

Previous Comments

Our October 5, 2004, letter stated that "we do not anticipate any federally-listed species to be adversely affected by the proposed reallocation of water storage." However, that was prefaced by an assumption that demands for municipal water use would stay near current levels and Lake Texoma water levels would not be affected. The modeling in the Draft EA demonstrates that Lake Texoma water levels would be affected if the entire 450,000 acre-feet of allocated water supply were utilized. Lake elevation-duration reductions of 3 to 8 percent are predicted for water surface elevations below 617 feet above mean sea level (MSL). The example in the Draft EA states that elevations of 613 feet above MSL would be exceeded approximately 85 percent of the time with existing conditions, but only 80 percent of the time with the proposed action. The Corps' Management Guidelines for Interior Least Terns lists 613 feet above MSL as a critical low pool condition and all low flow releases for least terns *Sterna antillarum* would be discontinued when lake elevations were predicted to fall below 613 feet above MSL. The information in the Draft EA demonstrates that the proposed project could cause Lake Texoma to be below critical low pool elevations more frequently and low flow releases for least terns could be affected.

The proposed reallocation would reduce discharges into the Red River below Denison Dam. The discharge duration for releases between 600 and 7,000 cfs would be reduced by approximately 3 to 8 percent. Reductions in flows and discontinued low flow releases for least terns are adverse effects that can increase landbridging and related disturbances such as predation, trampling by cattle, and human recreational use. After reviewing this new information, the Service does not concur with the Corps' determination that the proposed action would have no effect on least terns.

Hydrology

The Service agrees that the effects of the proposed action on lake elevations and downstream flows are likely to be relatively small in years or periods of time with above average inflows. However, averaging the potential changes over the entire period of record (1938-2000) tends to mask significant changes that may occur in some years. If changes of 3 to 8 percent are measured over the entire period of record, then much greater changes are likely to occur in some individual years or drought periods. The highest municipal demands for water are likely to be during summer months and drought periods.

Potential impacts to fish and wildlife resources and recreational uses also are more likely to occur during periods of low inflows. We need to know the variability of changes, as well as the averages, to properly assess potential impacts of the proposed project. It is important to know the potential changes in stage or flow, in addition to the averages of time above a given elevation. The Service recommends modeling individual years that represent examples of low inflow or drought conditions and comparing lake elevations and downstream flows with and without project. We recommend modeling daily elevations during the summer, fall, and winter months to determine potential impacts to the millet seeding program and aquatic habitat. Relatively small changes in reservoir elevation can impact fish and wildlife management and recreational use on Lake Texoma.

Fish and Wildlife Resources

We agree that the potential effects to lake elevations and flows could impact fish and aquatic or aquatic-dependent wildlife. We do not agree that these effects are insignificant. The Draft EA does not provide enough information to make a determination concerning the degree of impacts to most fish and wildlife resources. For example, the Draft EA claims that new wetlands would be formed by the reduced lake elevations and implies that this would somehow mitigate for the loss of aquatic habitat. However, the value of these new wetlands would be questionable because they could be inundated at any time and may not be shallow long enough to develop vegetation and other wetland characteristics. The quantity of wetlands also needs to be addressed. The proposed action actually could reduce total wetland acreage and certainly would reduce total aquatic habitat. The quantity of shallow water habitat or wetlands at Lake Texoma for any elevation is determined by the topography of the reservoir basin. We see no evidence in the Draft EA that reservoir topography information was used to determine the potential project-related impacts to the quantity of shallow water areas. Other Draft EA claims, such as creation of additional nest areas for whooping cranes *Grus Americana* represent a lack of knowledge of wildlife habitat use in Oklahoma and make us question the validity of other claims or assumptions in the Draft EA.

The seasonal pool plan is not changed by the proposed action and we are assuming the Corps will try to maintain the target elevations in that plan. The proposed action would increase the fluctuation of reservoir elevations below the target elevations and such fluctuations that are not planned or timed for wildlife management generally have a negative effect on fish and wildlife resources.

Downstream flows in the Red River would be reduced by the proposed project. Without the modeling we recommended (see comments on Hydrology), it is difficult to assess the degree of impacts to aquatic species in the Red River below Denison Dam. We agree that impacts diminish downstream distance and impacts below the Arthur City gauge may be insignificant. However, the

proposed project would affect hydropower generation and flows downstream of the dam for a considerable distance. The tailrace supports a very popular recreational fishery that would be affected by reduced flows in the summer months or during any drought period. Due to hydropower operations only generating for portions of the day, and not at all on some days, the downstream flows already are very erratic and very low for extended periods of time. The proposed project would make the existing conditions even worse and would extend periods of low downstream flows when inflows and lake elevations were relatively low. The Corps should be monitoring water quality in the tailrace and provide minimum flows to avoid stressing fish and to meet state water quality standards. The proposed mitigation of providing a 50 cfs low flow release may prevent fish kills, but may not be adequate to meet state water quality standards for dissolved oxygen concentrations.

Threatened and Endangered Species

The Service does not concur with the determination in the Draft EA for least terns (see comments for least terns in the Previous Comments section), but we do agree that all other federally-listed species are not likely to be adversely affected by the proposed action. The proposed action has potential to adversely affect least terns, but as we mentioned in our October 5, 2004, letter, compliance with Section 7 of the Endangered Species Act of 1973 (ESA) is being addressed in an existing formal consultation. The Corps currently is reviewing a draft biological opinion for that consultation.

However, we are confused by some comments in the Draft EA. The Mitigation Plan proposes to provide high-flow releases every 2 to 3 years to enhance least tern nesting habitat. This is contrary to what was previously included in the Corps' proposed action for the section 7 consultation. Also, the Service does not agree that the proposed action would create "additional nest areas for whooping cranes." Whooping Cranes do not nest in Oklahoma and we do not think that project-related reductions in lake elevations would create wetlands suitable for nesting.

Cumulative Impacts

This section of the Draft EA simply states that no cumulative impacts are anticipated; however, no justification is provided for this statement. The Service does not agree that there are no cumulative impacts and we do not consider this adequate compliance with NEPA. Potential impacts to fish and wildlife resources are not limited to the area at Lake Texoma. The proposed action clearly has potential to boost urban and industrial development at or near areas receiving the reallocated water. It also is likely that this reallocation of water to water supply would encourage additional requests for reallocation in the future. We expect conflicts related to competing uses of water stored at Lake Texoma to increase over time (even with existing allocations). Water storage capacity at the reservoir has declined from 3,132,293 acre-feet in 1942 to 2,516,232 in 2002 (at 617 feet above MSL) and some of that storage is not available for withdrawal. The reservoir will continue to lose storage capacity as it fills with sediment over time and the proposed 450,000-acre-feet of water supply storage will become an increasing percentage of the remaining usable capacity.

Water supply is a high priority use and once dependent on this water supply, municipal demand for this water is unlikely to decrease. Compromises to reduce water withdrawals during drought periods with low reservoir water levels may be less likely to occur with water allocated for water supply relative to allocations for hydropower. The Service believes that the proposed reallocation would

increase conflicts with, and impacts to, fish and wildlife resources and recreational uses at Lake Texoma. The Service suggests that the Draft EA address the following issues:

1. Potential growth of communities or industries that would use the reallocated water and impacts to fish and wildlife habitat related to that growth.

2. Potential impacts to recreational use on Lake Texoma and the tailrace.

Mitigation Plan

We question the accuracy of some statements in the Mitigation Plan section (see our comments related to high flow releases for least tern habitat in the Threatened and Endangered Species Section) and all mitigation measures mentioned in the Draft EA already exist with the No Action Alternative. The Draft EA does not provide any new mitigation for impacts related to the proposed action.

Coordination with the Lake Texoma Advisory Committee

The Service is a member of the Lake Texoma Advisory Committee (Committee) and would consider this type of action to be appropriate for review by this Committee. Potential impacts to fish and wildlife resources and related recreation are apparent and the Committee was formed to provide advice to the Corps on such proposed actions.

The Service appreciates the opportunity to provide comments and we look forward to further coordination on the proposed action. If you have any questions, please contact Kevin Stubbs at 918-581-7458, extension 236.

Sincerely,

Jerry J. Brabander
Field Supervisor

cc: Director, ODWC, Attn: Natural Resources, Wildlife, and Fisheries Sections, Oklahoma City, OK
Director, TPWD, Austin, TX
USFWS, Arlington ESFO, Arlington, TX
USFWS, Tishomingo NWR, Tishomingo, OK
USFWS, Hagerman NWR, Sherman, TX

NORTH TEXAS MUNICIPAL
WATER DISTRICT

Regional Service Through Unity

February 21, 2005

Mr. Larry Hogue, P.E.
Chief, Planning, Environmental and Regulatory Division
United States Army Corps of Engineers - Tulsa District
16545 South 101st East Avenue
Tulsa, OK 74128

Re: Environmental Assessment Report -- Lake Texoma Reallocation

Dear Mr. Hogue:

The North Texas Municipal Water District (the "District") has reviewed the above-referenced environmental assessment, USACE Contract No. DACA56-02-D-2002, dated January 2005. In so doing, the District agrees with the assessment that there will be no significant adverse effects on Lake Texoma as part of the USACE's action in reallocating conservation storage in the lake from hydropower to municipal use. Further, the District would like to emphasize its support of this project, and to request that it be included on the notice list provided as Attachment A in the report.

The District appreciates the USACE's activities in implementing the Water Resources Development Act of 1986, and looks forward to completion of the final reallocation study. Should you have any questions, please contact Robert McCarthy, Special Projects Coordinator, or my office.

Sincerely,

JAMES M. PARKS
Executive Director

JMP/RMM/bh

505 E. Brown St., P.O. Box 2408, Wylie, Texas 75098-2408 Telephone: 972/442-5405 Fax: 972/442-5405

Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3519

February 10, 2005

Stephen Nolen
Chief, Environmental Analysis and Compliance Branch
Planning, Environmental and Regulatory Division
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Dear Mr. Nolen:

This letter is in response to a U. S. Army Corps of Engineers' Tulsa District (SWT) letter dated January 19, 2005, concerning the Environmental Assessment (EA) and reallocation study on the reallocation of 300,000 acre-feet of conservation pool storage at Lake Texoma. The letter requests Southwestern Power Administration's (Southwestern) comments on the EA.

The letter states that all comments should be received by SWT within 30 days of January 19, 2005. Southwestern has begun to diligently review the EA and make comments, but it has determined that more time will be needed to address all of the issues concerning hydropower in this EA. Therefore, to review the EA thoroughly, Southwestern requests a time extension of 45 days beyond the original comment period to submit comments. Southwestern anticipates having comments to SWT on or before April 4, 2005

Please contact Mr. Marshall Boyken, (918)-595-6646 or marshall.boyken@swpa.gov, if you have additional questions concerning our request.

Sincerely,

Forrest E. Reeves
Assistant Administrator
Office of Corporate Operations

TEXAS WATER DEVELOPMENT BOARD

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February 10, 2005

Mr. Stephen L. Nolen, Chief
Environmental Analysis and Compliance Branch
Tulsa District, Corps of Engineers
1645 South 101st East Avenue
Tulsa, Oklahoma 74128

Re: Draft Environmental Assessment for Lake Texoma Storage Reallocation Study

Dear Mr. Nolen:

Staff engineers and scientists of the Texas Water Development Board (TWDB) reviewed the Draft Environmental Assessment (DEA) for the Lake Texoma Storage Reallocation Study dated January 2005 and concur with the draft finding of no significant impact with the proposed action, reallocation of 300,000 acre-feet of storage volume from existing use for hydropower generation to proposed use for water supply, Texas could use up to 150,000 acre-feet of the new water supply storage.

Based on information presented in the DEA, the reallocation is not anticipated to adversely impact the lake and riverine fishery, or shoreline or terrestrial habitat. The proposed action was modeled and shown to cause minor changes to frequency and duration of existing lake levels and downstream flow rates. The changes are anticipated to result in minor adverse impact to downstream and terrestrial habitats. The TWDB completed a lake hydrographic survey in 2002 which showed a 2.5 percent loss in storage between 1985 and 2002. The proposed action is not anticipated to increase bank caving or erosion that has potential to reduce storage volume.

Water reallocation is a recommended strategy in the 2002 State Water Plan and the TWDB supports innovative ways to develop new water supplies while minimizing degradation to the environment. If we can assist you further, please contact me at 512-936-0813 or Dr. Barney Austin, at 512-463-8856.

Sincerely,

Bill Mullican

Bill Mullican
Deputy Executive Administrator
Office of Planning

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RCEC

RAYBURN ELECTRIC COOPERATIVE

February 18, 2005

VIA EMAIL

Mr. Stephen Nolen
Chief, Environmental Analysis & Compliance Branch
Tulsa District Corps of Engineers
1645 S. 101st East Avenue
Tulsa, OK 74128-4629

Re: Draft Environmental Assessment of the Lake Texoma Storage Reallocation Study

Dear Mr. Nolen:

As the President of Rayburn Country Electric Cooperative, Inc., ("Rayburn Country") I am writing to provide preliminary comments on the Draft Environment Assessment ("Draft Assessment") for the reallocation of storage at Lake Texoma. Rayburn Country purchases capacity and energy provided by the Denison Dam at Lake Texoma pursuant to a long-term contract with the Southwestern Power Administration ("SWPA"). Rayburn Country has historically followed changes to the operations at Lake Texoma because the reallocation of storage could adversely affect the generation of the hydropower at Denison Dam.

In light of Rayburn Country's longstanding interest, we have begun to review the Draft Assessment but cannot provide extensive comments because we just received notice from you of this ongoing process. I understand that the Southwestern Power Administration ("SWPA") and Tex La Electric Cooperative of Texas, Inc ("Tex-La") have requested an extension to provide comments. We join in that request so that a comprehensive record can be developed on this proposal.

In the meantime, Rayburn Country notes that the Draft Assessment has proposed an action that appears to exceed the Corps' authority to reallocate storage. Further, concerns still exist whether the Corps has adequately considered alternative actions for providing water supply from Lake Texoma by relocating intake pipes below the penstocks and thereby minimizing hydropower loss and reducing the need to purchase the full amount of the requested storage. Because the Draft Assessment fails to account for this alternative, Rayburn Country believes the Draft Assessment does not comply with

the statutory and regulatory requirements of the National Environmental Policy Act ("NEPA").

Authority to Reallocate Storage

The Water Supply Act of 1958 (WSA") limits the authority of the U.S. Army Corps of Engineers ("Corps") to reallocate storage if the reallocation will seriously affect authorized project purposes and require a major operational change. The Corps' own regulations suggest that these triggers are met when the lesser of fifteen percent of the total storage capacity or 50,000 acre feet are to be allocated from storage devoted to authorized purposes.[1] When such limits are reached, the Corps must seek and receive the authorization from Congress for the reallocation.

In 1986 Congress authorized the Corps to allocate a total of 300,000 acre-feet of storage for water supply purposes. As set forth in Section 838 of Public Law 99-662:

> The project for Denison Dam (Lake Texoma), Red River, Texas and Oklahoma, authorized by the Flood Control Act approved June 28, 1938 (52 Stat. 1219), is modified to provide that the Secretary is authorized to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 150,000 acre-feet for municipal, industrial, and agricultural water users in the State of Texas and up to 150,000 acre-feet for municipal, industrial, and agricultural water users in the State of Oklahoma.

The Draft Assessment explains that a total of 450,000 acre-feet of storage would be allocated from the hydropower pool to water supply.[2] As the Draft Assessment correctly notes that "[w]ater supply at Lake Texoma was not an original project purpose" the proposed reallocation exceeds the cap of 300,000 acre feet set forth by Congress. The proposed action can only occur when Congress passes legislation to reallocate the additional 150,000 acre-feet. In the alternative, the Corps only has the authority to reallocate 150,000 acre-feet. As set forth in the Draft Assessment, however, the Corps' proposed action violates federal law and cannot proceed as currently designed.

Consideration of Alternatives

The Corps has an obligation under NEPA to consider alternative courses of action in lieu of the proposed action. Rayburn Country notes that the Corps has contemplated only one other possible alternative, declining to provide the storage for water supply. This view discounts other possibilities such as locating water intake pipes below the dam penstocks to remove water from the river downstream of the project. This action could minimize the impact on hydropower operations and reduce the amount of storage needed for water supply purposes. The Corps has failed to consider this possibility, which would

---

[1] Engineer Regulation 1105-2-100 at E-215.

[2] See Section 3, Proposed Action, p. 4.

appear to violate its obligations to consider alternatives to the proposed action. Rayburn Country believes such study is warranted in the next Draft Assessment that the Corps will generate.[3]

Preserving Hydropower Benefits

In closing, please note that Rayburn Country does not per se oppose the use of storage at Lake Texoma for water supply purposes. To the extent that hydropower benefits are preserved, as Congress intended in P.L. 99-662, Rayburn Country has no objection to the reallocation of storage within the authority granted to the Corps by Congress. On behalf of the Rayburn Country members, I thank you for your consideration of these comments.

Sincerely,

/s/

John Kirkland
President
Rayburn Country Electric
Cooperative, Inc.

[3] As noted above, the current Draft Assessment proposes an action that facially appears to exceed the Corps' current authority and cannot legally proceed as designed.

Sturdy, Jerry C SWT

From: Nolen, Stephen L SWT
Sent: Monday, August 29, 2005 4:04 PM
To: Sturdy, Jerry C SWT
Subject: FW:

Include in comments section for Texoma EA.

From: Nolen, Stephen L SWT
Sent: Friday, March 04, 2005 1:38 PM
To: 'Steve Reider'
Subject: RE:

Mr. Reider:

Effects on lake levels resulting from this action are described on p. 23 of the Draft Environmental Assessment. This document can be found at:

http://www.swt.usace.army.mil/library/libraryDetail.cfm?ID=175

I trust this will answer your questions. Thank you for your interest in this matter.

Steve Nolen

From: Steve Reider [mailto:SteveReider@GreaterMetroInt.com]
Sent: Wednesday, March 02, 2005 6:23 PM
To: Nolen, Stephen L SWT
Subject:

Stephen, What effect on lake level will occur from hydropower storage to water supply storage? Hopefully it won't be lower as lower levels affect golden algea outbreaks such as last winter when lake was so low.

RCEC

RAYBURN ELECTRIC COOPERATIVE

April 7, 2005

VIA EMAIL

Mr. Stephen Nolen
Chief, Environmental Analysis & Compliance Branch
Tulsa District Corps of Engineers
1645 S. 101st East Avenue
Tulsa, OK 74128-4629

Re: Draft Environmental Assessment

Dear Mr. Nolen:

In February, I submitted comments on the Draft Environmental Assessment of the Lake Texoma Storage Reallocation Study ("Draft EA") on behalf of Rayburn Country Electric Cooperative, Inc. ("Rayburn Country"). Around that time, we learned from your offices that the deadline to submit comments had been extended to April 7, which has given the Southwestern Power Administration ("SWPA") the opportunity to comment on the Draft EA which Rayburn Country supports with only one notable exception. In addition, Rayburn Country asks to follow these comments with a more detailed discussion of the underlying Corps authority to reallocate storage. Just today we received copies of Water Storage contracts from the U.S. Army Corps of Engineers ("Corps"), which may reveal the limitations of the Corps' authority to reallocate storage at Lake Texoma.

With regard to the SWPA comments we strongly support the conclusions that the Draft EA fails to include a suitable analysis on the impact on hydropower production at Lake Texoma. This is a notable omission and leads to additional infirmities within the Draft EA as it fails to consider a host of alternative approaches to the reallocation. Further, we believe SWPA has appropriately touched upon the issue of how much a contracting entity should pay for storage at Lake Texoma. The underlying authority for the reallocation, the Water Resources Development Act of 1986 ("WRDA") states that existing hydropower uses must be kept whole from the loss of storage from the hydropower pool.

Still, Rayburn Country has lingering questions regarding the authority of the Corps to allocate the amount of storage suggested in the Draft MOA. As we explained in our February 18 letter, WRDA set forth the limitations on the amount of storage that the Corps could reallocate from the hydropower pool at Lake Texoma. As set forth in section 838:

The project for Denison Dam (Lake Texoma), Red River, Texas and Oklahoma, authorized by the Flood Control Act approved June 28, 1938 (52 Stat. 1219), is modified to provide that the Secretary is authorized to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 150,000 acre-feet for municipal, industrial, and agricultural water users in the State of Texas and up to 150,000 acre-feet for municipal, industrial, and agricultural water users in the State of Oklahoma.

Rayburn Country disagrees with the assumption made by SWPA that there was an existing 150,000 acre-feet use in place at the time that WRDA 1986 was passed. The language of the law explicitly indicates that Texas interests are entitled to an amount which is "up to" an additional 150,000 acre-feet of storage. It appears that both the Corps and SWPA believe this section provides a 150,000 acre-feet baseline from which 150,000 acre-feet additional storage can be reallocated. This overlooks the insertion by Congress of the words "up to." If Congress intended for the Corps to use a 150,000 baseline, it would have omitted these small yet legally significant terms from the statutory language.

Rayburn Country believes the best way to determine the proper baseline is through an examination of the water supply or water storage contracts in effect when WRDA passed. Earlier today we received over 144 pages of contracts that we have not yet been able to examine fully. We believe a more comprehensive record can be developed if these contracts are reviewed. Therefore, we ask for the opportunity to supplement the record with an analysis of the contracts that were just provided today.

Nonetheless, the uncertain nature of the Draft EA continues to trouble Rayburn Country. In our review, we have determined that there are no pending demands for the storage at Lake Texoma other than a request for 50,000 acre-feet of storage. The Draft EA appears to mismatch the Corps proposed agency action and the scope of the Draft EA. If and when there is a subsequent request for storage, the Environmental Assessment, as required by the National Environmental Policy Act ("NEPA"), will be stale. As each future reallocation could constitute a major federal action, the Corps has a responsibility to conduct a timely NEPA analysis for such future actions.

In our further review of the Draft EA, we conclude that it suffers from several deficiencies, most notably the absence of a completed reallocation study. Perhaps the overall process would be best served if the Corps suspended the Draft EA and finished the reallocation study. We encourage your offices to consider seriously this option. In the meantime, I thank you again for the opportunity to supplement our earlier comments.

Sincerely,

/s/
John Kirkland
President, Rayburn Country
Electric Cooperative, Inc.

Public Notice and Comments Received on Revised (Second) Draft EA

October 2005

NORTH TEXAS MUNICIPAL WATER DISTRICT

Regional Service Through Unity

December 13, 2005

Mr. Steven Nolen
Chief, Environmental Analysis and Compliance Branch
Tulsa District Corps of Engineers
1645 South 101st East Avenue
Tulsa, OK 74128-4629

Re: Draft Environmental Assessment – Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas – October 2005

Dear Mr. Nolen:

The North Texas Municipal Water District has reviewed the revised Draft Environmental Assessment – Lake Texoma Reallocation Study, dated October 2005. In its review, the District finds that the report addresses comments on the January 2005 draft Environmental Assessment and demonstrates that the reallocation of Lake Texoma storage from hydropower to municipal use will have no significant adverse impacts. In particular, the report demonstrates that the proposed reallocation:

- Will make available needed water supplies to serve the growing population in North Texas and, when needed, in Oklahoma.
- Will result in negligible changes to elevation duration and frequency and discharge duration and frequency for Lake Texoma.
- Will not significantly impact fish and wildlife or endangered species.
- Will result in some reduction in hydropower benefits, which will be fairly compensated.

The District would like to emphasize its support for the proposed reallocation and for the Corps of Engineers' efforts to implement the Water Resource Development Act of 1986. We are attaching some minor comments that we believe would improve the final report. If you have any questions, please contact Robert McCarthy, Special Projects Coordinator, or my office.

Sincerely,

James M Parks

JAMES M. PARKS
Executive Director

JMP/MR/bh
Attachment

505 E. Brown St., P.O. Box 2408, Wylie, Texas 75098-2408 Telephone: 972/442-5405 Fax: 972/442-5405

North Texas Municipal Water District

Comments on Draft Environmental Assessment – Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas – October 2005

The report clearly presents the benefits of the proposed reallocation of storage in Lake Texoma from hydroelectric power to municipal water supply. We believe that the minor comments below may improve the final report.

Page 6. "Reuse water in the region [Region C] is not expected to be more than about 100,000 acre-feet per year by 2060." The *Initially Prepared 2006 Region C Water Plan* shows a recommended supply from currently existing and proposed reuse projects of about 740,000 acre-feet per year in 2060 (Table 6.5). In the final version of the plan, recently approve by the Region C Water Planning Group and currently being printed, the recommended supply from currently existing and proposed reuse projects is about 771,000 acre-feet per year in 2060. Even with significant conservation efforts, including this substantial development of reuse projects, the *2006 Region C Water Plan* shows that supplies are needed from Lake Texoma and other existing and new supply sources.

Appendix F, Page 11. With regard to the apportionment of water between Texas and Oklahoma, we believe that it is important to note that water has been made available from Lake Texoma for use by Oklahoma as requested in the past. The proposed reallocation will make 150,000 acre-feet of storage available to meet future requests for Lake Texoma water from Oklahoma.

Appendix F, Page 13. In the second paragraph, it might be desirable to say that the *Region C Water Plan* recommends reallocation of 100,000 acre-feet of storage in Lake Texoma to North Texas Municipal Water District and 50,000 acre-feet of storage in Lake Texoma to Greater Texas Utility Authority.

Appendix F, Page 20. "The NTMWD is comprised of Collin County and portions of Kaufman, Rockwall, and Dallas counties in north-central Texas. The NTMWD provides wholesale water and wastewater services to communities within its boundaries." It would be more accurate to say "The NTMWD supplies wholesale water and wastewater service to member cities and customers in Collin, Denton, Fannin, Dallas, Rockwall, Hunt, and Kaufman counties in north-central Texas."

Appendix F, Page 20. "There are no reservoirs proposed for construction in this region." It is not clear what region is intended, but the *2006 Region C Water Plan* does recommend three reservoirs in Region C – Muenster Reservoir (Cooke County), Lake Ralph Hall (Fannin County), and Lower Bois d'Arc Creek Reservoir (Fannin County). Lower Bois d'Arc Creek Reservoir will provide supplies for the North Texas Municipal Water District. The plan also includes two lakes outside the region which will provide supplies to the region (Marvin Nichols Reservoir and Eastrill Reservoir). Even with these

and other recommended projects, the *2006 Region C Water Plan* shows that supplies are needed from Lake Texoma.

Appendix F, Page 56. "Conservation measures will also reduce the per capita use rate from 197 gallons per capita per day (gpcd) in 2000 to less than 120 gpcd by 2020." It would be more accurate to say: "Water reuse and other conservation measures will reduce the per capita municipal water use rate from 197 gallons per capita per day (gpcd) in 2000 to less a normal-year value of 121 gpcd by 2020 (after crediting for reuse)."

Appendix F, Page 58. "The NTMWD is comprised of Collin County and portions of Kaufman, Rockwall, and Dallas counties in north-central Texas. The NTMWD provides wholesale water and wastewater services to communities within its boundaries." It would be more accurate to say "The NTMWD supplies wholesale water and wastewater service to member cities and customers in Collin, Denton, Fannin, Dallas, Rockwall, Hunt, and Kaufman counties in north-central Texas."

Appendix F, Page 59. New Bonham Reservoir is now known as Lower Bois d'Arc Creek Reservoir.

Appendix F, Page 59. The parenthetical phrase "(have you identified TRWD?)" should be removed.

Appendix F, Page 60. New Supply from Lake Texoma" and "Lower Bois d'Arc Creek Reservoir" should be added as "water management strategies other than those joint efforts discussed above…" They are described on page 4E.19 of the *Initially Prepared 2006 Region C Water Plan*.

Appendix F, Page 67. "DWU is part of a group of providers that will participate in the Marvin Nichols I Reservoir…" Marvin Nichols is not a recommended strategy for DWU in the *Initially Prepared 2006 Region C Water Plan*.

Appendix F, Tables 10 and 11. The quantities of groundwater listed as available appear to represent total volumes in storage rather than reliable annual supplies. This makes the presentation confusing.

Oklahoma Archeological Survey
THE UNIVERSITY OF OKLAHOMA

October 19, 2005

Steven L. Nolen
Chief, Environmental Analysis
and Compliance Branch
Department of the Army
Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, OK 74128-4609

Re: *Draft Environmental Assessment, Lake Texoma Storage Reallocation Study*, Lake Texoma, Oklahoma and Texas.

Dear Mr. Nolen:

As reflected in the previous correspondence on this action documented in the draft environmental assessment, the Archeological Survey comment in February, 2001 that we have no objection to the proposed undertaking due to the absence of earth disturbing activities. Unless there is a change in the plan that would result in raising of the pool level or construction activities in Oklahoma, our opinion on the storage reallocation is that it will not result in ay new effects to archaeological resources.

This review has been conducted in cooperation with the State Historic Preservation Office, Oklahoma Historical Society.

Sincerely,

Robert L. Brooks
State Archaeologist

Cc: SHPO

111 E. Chesapeake, Room 102, Norman, Oklahoma 73019-5111 PHONE: (405) 325-7211 FAX: (405) 325-7604
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Publisher's Affidavit

THE STATE OF TEXAS

County of Grayson

Personally appeared before the undersigned authority Richard Thurmond, Retail Advertising Sales who being sworn says that the attached U.S. Army Corps of Engineers, Draft Environment Assesment was published in the Herald Democrat on the following date to wit: Friday, October 14, 2005.

Richard Thurmond

Subscribed and sworn to before me this 14th day of October, A.D., 2005.

BRUCE R. VIRGIN
Notary Public
STATE OF TEXAS
My Comm. Exp. 05/18/2008

Notary Public, Grayson County, Texas

CASE NO._____ PROOF OF PUBLICATION

Announcing: COMMENT PERIOD
DRAFT ENVIRONMENTAL ASSESSMENT
as related to the
Lake Texoma Storage Reallocation Study
Lake Texoma, Oklahoma and Texas
in compliance with
The National Environmental Policy Act
FORMAL COMMENT PERIOD
Oct. 14, 2005 through Nov. 14, 2005

The Draft Environmental Assessment addresses the environmental and socioeconomic effects of the reallocation of approximately 300,000 acre-feet from hydropower storage to water supply storage at Lake Texoma. The comment period is a continuation of public involvement used to develop the Environmental Assessment. This is the second comment period for the Draft Environmental Assessment. The first formal comment period was January 21, 2005 through February 21, 2005. However, the first formal comment period was extended by request to April 7, 2005. Based upon comments received during the first comment period the Draft Environmental Assessment was revised and the Hydropower Reallocation Report included as an appendix during this public review period. The public is invited to review the draft assessment and make comments. A copy of the assessment is available at the following locations:

Denison Public Library
300 W. Gandy
Denison, Texas 75020

Robert L. Williams Public Library
323 W. Beech
Durant, Oklahoma 74701

Written comments and questions will be addressed in the Final Environmental Assessment. Comments and questions must be postmarked prior to the close of the formal comment period to be included in the final assessment. Comments and questions about the draft assessment or the comment process can be directed to:

Mr. Stephen L. Nolen
Chief, Environmental Analysis and Compliance Branch
U.S. Army Corps of Engineers, Tulsa District
ATTN: CESWT-PE-E (Texoma Reallocation)
1645 S. 101st East Avenue
Tulsa, Oklahoma 74128
Phone: 918-669-7660
e-mail: Stenhen.L.Nolen@usace.army.mil

Durant Daily Democrat

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Sherman, Tx.
903-892-9131
of Counsel Brown & Butscher, L.L.P.

Announcing: **COMMENT PERIOD**
DRAFT ENVIRONMENTAL ASSESSMENT
as related to the
Lake Texoma Storage Reallocation Study
Lake Texoma, Oklahoma and Texas
in compliance with
The National Environmental Policy Act
FORMAL COMMENT PERIOD
October 14, 2005 through November 14, 2005

The Draft Environmental Assessment addresses the environmental and socioeconomic effects of the reallocation of approximately 300,000 acre-feet from hydropower storage to water supply storage at Lake Texoma. The comment period is a continuation of public involvement used to develop the Environmental Assessment. This is the second comment period for the Draft Environmental Assessment. The first formal comment period was January 21, 2005 through February 21, 2005. However, the first formal comment period was extended by request to April 7, 2005. Based upon comments received during the first comment period the Draft Environmental Assessment was revised and the Hydropower Reallocation Report included as an appendix during this public review period. The public is invited to review the draft assessment and make comments. A copy of the assessment is available at the following locations:

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Durant, Oklahoma 74701

Written comments and questions will be addressed in the Final Environmental Assessment. Comments and questions must be postmarked prior to the close of the formal comment period to be included in the final assessment. Comments and questions about the draft assessment or the comment process can be directed to:

Mr. Stephen L. Nolen
Chief, Environmental Analysis and Compliance Branch
U.S. Army Corps of Engineers, Tulsa District
ATTN: CESWT-PE-E (Texoma Reallocation)
1645 S. 101st East Avenue
Tulsa, Oklahoma 74128
phone: 918-669-7660
e-mail: Stephen.L.Nolen@usace.army.mil

Sherman Herald Democrat

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December 19, 20005

VIA FEDERAL EXPRESS

Colonel Miroslav P. Kurka
District Engineer
U.S. Army Corps of Engineers
Tulsa District
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

Re: Draft Environmental Assessment

Dear Colonel Kurka:

On behalf of Rayburn Country Electric Cooperative Inc., ("Rayburn Country"), we are pleased to provide the following comments in response to the Draft Environmental Assessment and related Appendices ("DEA") published on October 1, 2005. Rayburn Country purchases the majority of capacity and energy marketed by the Southwestern Power Administration ("SWPA") from the Denison Dam project located at Lake Texoma. Rayburn Country's financial interests and ability to provide cost efficient resources for its members are directly implicated by the plan of action outlined in the DEA .

At the outset, Rayburn Country believes that the DEA and Appendix F merit several revisions and that the U.S. Army Corps of Engineers ("Corps") should provide appropriate clarification regarding the proposed reallocations. Rayburn Country's conclusions emanate from its reading of the Water Resources Development Act of 1986 ("WRDA 1986"), which is also identified in the DEA as Public Law 99-662. Failure to make such modifications would lead the Corps to issue a DEA that is arbitrary and capricious and not consistent with the statutory authority under which the Corps proposes to act.

As discussed in greater detail below, Rayburn Country believes any reallocation of storage must comply with the statutory authority provided by WRDA 1986. In particular, the Corps must abide by the crediting requirement set forth in the statutory language of WRDA 1986. The DEA fails to fulfill this obligation as it relies on erroneous conclusions regarding the impact on capacity, provides a static calculation on anticipated energy costs, and proposes to terminate the credit concurrent with the

BOSTON NEW YORK WASHINGTON, DC

expiration of current power supply agreements between SWPA and Rayburn Country and Tex-La Electric Cooperative of Texas Inc.

Statutory Authority to Reallocate Storage

The DEA states that water supply is not an original authorized project purpose of Lake Texoma.[1] Acknowledging this legal foundation, the DEA outlines the statutory history that allows the Corps to provide storage for water supply purposes at Lake Texoma.[2] The DEA correctly identifies that the Water Supply Act of 1958 ("WSA") limits the Corps authority to reallocate storage at an existing Corps project where the reallocation of storage would adversely affect original authorized project purposes.[3] Engineer Regulation ER1105-2-100 limits the Corps' discretion to reallocate storage in amounts up to 50,000 acre-feet. Reallocations above this level require congressional action.

The 1985 reallocation raises questions whether the Corps has complied with these limitations in reallocating storage from the hydropower pool at Lake Texoma. The 1983 reallocation of storage relied upon the Corps discretionary authority to allocate 50,000 acre-feet of storage. However, the Corps reallocated 75,000 acre-feet of storage to the North Texas Municipal Water District ("NTMWD") without identifying in the DEA what authority exists for the entire reallocation.[4] As the authority to provide up to 50,000 acre feet had been used for the 1983 reallocation, the Corps was obligated to seek congressional approval to reallocate the additional 75,000 acre feet to comply with the WSA.

The DEA suggests, however, that in making the subsequent reallocation in 1985, the Corps concluded that there would be no serious adverse affect on hydropower production as a consequence of the reallocated storage. This conclusion is contradicted unequivocally throughout the entire DEA as the Corps calculates the impact on benefits foregone by the reallocation of storage. Specifically, on page 10 of the DEA, the Corps concludes that reallocation of 300,000 acre feet of storage would eliminate $656,000 of capacity and energy benefits on an annual basis. However, on the same page, the DEA concludes that reallocation of 450,000 acre feet of storage would reduce energy and capacity benefits equal to $1.4 million.

The comparison calculations in the DEA illustrate how there is an increase in lost hydropower benefits with the reallocation of 450,000 acre-feet of storage from the hydropower pool.[5] And yet, because the Corps has operated the project for water supply in excess of its discretionary authority since 1985, it has acted in apparent violation of the

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[1] Page 18, Appendix F.
[2] Page 7, Appendix F.
[3] Id.
[4] The DEA notes that Public Law 85-146 provided limited storage rights of 41,000 acre feet for the city of Sherman, Texas.
[5] See Power Benefits Foregone report attached to Appendix F.

WSA and the original authorizing statutes.[6] The only way that the Corps could continue to meet the original authorized project purposes during this period of time and without Congressional reauthorization is by maintaining hydropower benefits through a credit to SWPA for the use of such storage. This approach has been essentially endorsed by WRDA 1986.

The DEA alludes to a full credit on page 26 of Appendix F for such reallocations, but does not provide details. Rayburn Country submits that the DEA should include details of such crediting to demonstrate that the Corps has continued to provide hydropower benefits from the Lake Texoma project notwithstanding the absence of clear congressional authority to reallocate storage from the hydropower pool. Failure to do so would provide a clear indication that the Corps has and continues to act *ultra vires* at Lake Texoma with regard to the use of hydropower storage. Indeed, in this regard, compliance with the law simply requires further documentation of steps that the Corps has alluded to on page 26 of Appendix F of the DEA.

Statutory Obligation to Provide a Credit to SWPA

The DEA has identified that the Corps has an obligation to provide a credit to SWPA for the reallocation of 300,000 acre-feet of storage at Lake Texoma. Page 2 of Appendix F sets forth the following statutory language from WRDA 1986 which provides the instruction to the Corps to provide a credit to SWPA:

> With respect to any water supply contract entered into by the Secretary under this section after June 1, 1985, the Secretary shall determine (A) the amount of hydropower lost, if any as a result of the implementation of such contract, and (B) the replacement cost of the hydropower lost (where replacement cost is defined as the cost to purchase power from existing alternative sources). If hydropower is lost as a result of the implementation of such contract, the Secretary shall provide credits to the Southwestern Power Administration of amounts equal to such replacement costs. Such credits shall be against sums required to be paid by the Southwestern Power Administration for costs of the project allocated to hydropower. In each case, the Southwestern Power Administration shall reimburse each preference customer for an amount equal to the customer's actual replacement cost for hydropower lost as a result of the

[6] The Water Supply Act of 1958 limits the Corps ability to reallocate storage at projects where such reallocation would severely affect existing project purposes. Specifically, subsection (d) provides that:

> Modifications of a reservoir project heretofore authorized, surveyed, planned or constructed to include storage as provided in subsection (b) of this section which would seriously affect the purpose for which the project was authorized, surveyed, planned or constructed, or which would involve major structural or operational changes shall be made only upon the approval of Congress as now provided by law. 43 U.S.C. § 390b

implementation of such contract, less the costs such customer would have to pay to the Southwestern Power Administration for such hydropower.

Section 838(d)(3) WRDA 1986

The DEA has recognized that the Corps has an obligation pursuant to this subsection to provide a credit to the Southwestern Power Administration in an amount "equal to the customer's actual replacement cost for hydropower."[7] And yet, the analysis that follows in Appendix F suggests that the Corps will provide a credit that is less than the customer's actual replacement power costs.[8] The lower credit is a direct result of the Corps' calculation of the credit and failure to abide by the instruction in WRDA 1986. Rayburn Country believes the DEA contains three major flaws that will lead the Corps to violate WRDA 1986 if followed. Because SWPA has outlined in specific details how the Corps has failed to provide an accurate prediction of replacement costs of energy , Rayburn Country encourages the Corps to follow the guidance provided by SWPA on the calculation of this credit in light of SWPA's particular expertise in calculating actual replacement costs.

Capacity and Energy Impacts

The attached Power Benefits Foregone calculations included in Appendix F of the DEA contain several erroneous conclusions. In table 4-2 on page 23 and table 4-3 on page 24, the Corps uses a model based on the operation of the Kerr-Philpott projects on the Roanoke River to assess weekly energy availability. The Kerr-Philpott projects provide a poor comparison to the Lake Texoma project for several reasons.

The John H. Kerr and Philpott projects are two discrete projects on the Roanoke River. The Southeastern Power Administration ("SEPA") markets the capacity and energy from the Kerr-Philpott projects on an integrated basis and such power benefits are scheduled by Dominion resources into the PJM South market for the benefit of the preference customers of these projects. Schedules can be met through the coordination of these projects. In contrast, SWPA markets the power from Lake Texoma on a stand alone-basis and does not provide integration or any back up to the Denison Dam project from other Corps projects providing power in the SWPA marketing area. The Denison Dan project therefore operates as a stand-alone project in contrast to the coordinated operations between the Kerr and Philpott projects.

The DEA uses an arbitrary benchmark to determine replacement resources by assuming that any replacement energy will be from a combination of energy resources,

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[7] DEA at 9.

[8] On page V of the executive summary of the reallocation report in Appendix F, the Corps explains that hydropower will be credited at a level of revenues foregone. This statement conflicts with WRDA 1986 and the DEA and Rayburn Country believes that it is a typographical error. Nonetheless, Rayburn Country disputes this inconsistent proposed action and believes that a credit to SWPA at a revenues foregone level would violate WRDA 1986.

one half produced from a natural gas-fired combustion turbine and the other half produced from a natural gas-fired combined cycle generation plant.[9] While the DEA appropriately determines that a gas-fired combustion turbine is the appropriate resource to examine for replacement energy costs for peak resources, the DEA has failed to examine how the energy from the Denison Dam is used by the current preference customers. As Rayburn Country relies on the Denison Dam resource to provide a peaking resource, any calculation that assumes that a gas-fired combined cycle plant will provide replacement energy will yield a lower and erroneous predictor of replacement power costs.

Static Energy Calculations

With rising natural gas prices over the past several months, Rayburn Country has been painfully aware of escalating fuel costs. Simple energy forecasting suggests that fuel costs will rise and Rayburn Country believes any analysis of replacement energy costs must account for escalating fuel costs. The DEA, however, states that the Corps policy does not allow the use of real fuel cost escalation in determining anticipate energy and capacity values.[10] Therefore, the Corps has used a static fuel cost in the DEA to determine future anticipated replacement power costs.

The policy to apply a static variable for fuel costs to predict future fuel costs is flawed from an energy industry perspective. More importantly, it conflicts with WRDA 1986 and must yield to the statutory directive provided by Congress. There is no conceivable scenario under which fuel prices will remain static in the future and such a static variable cannot be used to calculate "actual replacement cost of hydropower."[11] To rely on this calculation would be arbitrary and capricious and in violation of the plain meaning of WRDA 1986. Rayburn Country encourages the Corps to recalculate the potential impact using realistic fuel escalation factors in order to comply with WRDA 1986.

Termination of the Credit

Rayburn Country can discern no language or intent in the applicable provision of WRDA 1986 that suggests that the credit to be provided to preference customers shall terminate at the conclusion of applicable power supply agreements. Indeed, the language of Section 832(d)(3) states the Corps has an obligation to provide credits in amounts equal to replacement costs with no delineation of an expiration period. The assumption in the DEA that the credits will terminate concurrent with the expiration of power supply agreements with the affected preference customers is erroneous and contrary to the plain language of WRDA 1986. Such suggestions regarding a termination of the congressionally mandated credit should therefore be deleted.

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[9] Power Benefits Foregone report at page 6, Appendix F.
[10] Power Benefits Foregone report at 26, Appendix F.
[11] WRDA 1986.

Conclusion

As suggested by the DEA, the Corps has the ability to ensure that hydropower benefits are delivered from the Denison Dam at Lake Texoma even after 450,000 acre feet of storage are allocated to water supply use from the hydropower pool. The mechanism to deliver such benefits after a reallocation is by providing a credit as Congress has set forth in WRDA 1986. However, Rayburn Country strongly encourages the Corps to review and revisit the crediting calculations set forth in the DEA to ensure compliance with WRDA 1986. As Congress has clearly stated an obligation to provide a credit equal to actual costs, predictions of anticipated replacement costs must evaluate appropriate variables and where necessary to comply with the law, disregard Corps policy.

On behalf of Rayburn Country and its members, we thank you for the opportunity to submit these comments.

Sincerely,

Sherry A. Quirk/AHC

Sherry A. Quirk
David A. Fitzgerald

Counsel for
Rayburn Country Electric Cooperative, Inc.

cc: John Kirkland, President, Rayburn Country Electric Cooperative, Inc.

Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3519

DEC 2 0 2005

Stephen L. Nolen
Chief, Environmental Analysis
and Compliance Branch
U. S. Army Corps of Engineers
1645 South 101st East Avenue
Tulsa, OK 74128-4609

Dear Mr. Nolen:

This letter is in response to a U. S. Army Corps of Engineers (Corps) Tulsa District letter dated October 14, 2005, concerning the second public comment period for the draft Environmental Assessment (EA) Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas, dated October 2005. The draft EA included, as Appendix F, the Report for the Water Supply Storage Reallocation Project at Lake Texoma Reservoir, Oklahoma and Texas, dated October 2005 which also lists the draft EA as its Appendix 11.7. The comment period was extended to December 20, 2005 by letter dated November 21, 2005, from Colonel Miroslav P. Kurka. Southwestern Power Administration's (Southwestern) specific comments on the total package received are enclosed (see Enclosure 1). Additionally, Southwestern is providing (see Enclosure 2) an alternative formulation showing storage reallocated from the flood control storage to meet the water supply needs.

Your letter states that the first draft EA was revised based on comments received. Examining Southwestern's earlier comments, and after reviewing the comments of others, including the U. S. Fish & Wildlife Service and the Oklahoma Department of Wildlife Conservation as shown in Appendix B of the draft EA, it appears that only minimal substantive revisions were made to the draft EA, few of which address our concerns. It is frustrating for us to utilize the staffing resources necessary to provide both a thorough review and comprehensive comments of the report when it appears the Corps is firmly entrenched in the results the report was crafted to yield. Nonetheless, the proposed reallocation of 300,000 acre-feet of hydropower storage will severely impact the Federal marketable capacity and energy contracted from the project. That impact is real and will occur whether or not the Corps properly identifies the losses in its report. Therefore, Southwestern is committed to working with the Corps in correcting the report's deficiencies.

There are many inconsistencies evident throughout the report. One instance is the denial of any Federal responsibility for the administration or enforcement of the Red River Compact in one part of the report while later using the requirements of the compact in the justification for the selected alternative. Another inconsistency is the application of the Corps' own regulations. For instance, a viable, and likely the best, alternative, reallocation from the flood control storage, was dismissed without study, contrary to

Corps regulations. The rationale for the need for the reallocation is based on projections through the year 2060 while Corps regulations state that the need for reallocation to meet water supply need should be based on immediate need, typically considered to be ten years into the future. However, when Corps regulations appear to specify the use of techniques that underestimate both the value and amount of power and energy lost from the proposed reallocation, the report states that the Corps policy and guidelines must be followed. It is inconsistencies such as these that lend credence to the concept that the report was written, not as documentation of a thorough unbiased study, but rather as justification for a predetermined conclusion.

Southwestern appreciates the process that allows us to review and comment on both the report and the draft EA. We expect legitimate consideration of our comments. Southwestern has conscientiously prepared our comments and believe they should be incorporated into the documents. We believe that the draft report should be rewritten and another draft prepared for public review before it is sent forward for approval at Corps Headquarters. If you have any questions about our comments, please contact me at (918) 595-6681 or bethel.herrold@swpa.gov.

Sincerely,

Bethel J. Herrold

Bethel J. Herrold
Lead Hydraulic Engineer
Division of Scheduling and Operations

2 Enclosures

cc:
Ted Coombes
John Kirkland
John Butts
Keith Hartner
Tom Gebhard
Michael McCarty

December 19, 2005

Southwestern Power Administration Comments for the Draft Environmental Assessment – Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas, October 2005

Appendix F – Report for the Lake Texoma Water Supply Storage Reallocation Project at Lake Texoma Oklahoma and Texas, October 2005:

(Note: Paragraphs are numbered from the beginning of the referenced section or sub-section)

1. All Titles. "Reservoir" should be deleted after all references to Lake Texoma to be consistent with Public Law 454, 78th Congress, 2nd Session, approved September 30, 1944 which designated the name of the impoundment as Lake Texoma (referenced on page 2 of the report).

2. Entire Report. In general, the report makes numerous statements that have no documentation or supporting evidence. An example occurs in the Executive Summary, Paragraph 3, Sentence 2, Page v. Please include documentation of statements.

3. Reallocation Report Executive Summary, Paragraph 2, Page v. A copy of the letter requesting the water storage should be included in the report.

4. Reallocation Report Executive Summary, Paragraph 4, Sentence 2, Page v. The sentence should read, "The updated cost of storage for the 300,000 acre-feet of water supply storage is calculated to be $96,199,693.

5. Reallocation Report Executive Summary, Paragraph 4, Sentence 3, Page v. The sentence should read, "The total annual hydropower benefits foregone with a 300,000 acre-feet reallocation is $3,817,539."

6. Reallocation Report Executive Summary, Paragraph 5, Page v. Delete entire paragraph. The paragraph does not correctly summarize the hydropower compensation and the difference between revenues and benefits. There is no reason for the paragraph.

7. Reallocation Report Executive Summary, Paragraph 6, Page vi. Add sentence to the beginning that states, "Because of negative impacts, hydropower will be compensated for replacement costs as outlined in the Water Resources Development Act of 1986."

8. Reallocation Report Executive Summary, Paragraph 6, Sentence 1, Page vi. The Statement is not consistent with comments the Corps received from the US Fish and Wildlife Service, Oklahoma Department of Wildlife Conservation, and the Southwestern Power Administration, and the statement is not consistent with the Evaluation Matrix in Section 3.0.1 on page 16 of the reallocation report. Summary should be consistent.

9. Reallocation Report, Section 1, Paragraph 3, Sentence 3, Page 1. Delete "...necessary to meet expanding municipal and industrial water supply demands that are a result of population growth in the region" from the sentence and add in its place "...an alternative to supply the projected water need in the Texas Region C water plan."

10. Reallocation Report, Section 1, Paragraph 3, Last Sentence, Page 2. Provide the documentation of the requests from the municipalities in Oklahoma and Texas requesting the reallocation of water supply storage in an appendix to the reallocation report.

11. Reallocation Report, Section 1, Paragraph 5, Sentence 2, Page 2. Place a copy of the draft water storage agreement with NTMWD in the reallocation report as an appendix.

12. Reallocation Report, Section 1, Paragraph 5, Sentence 3, Page 2. Provide documentation of the interest in future water supply storage from Lake Texoma from other nearby communities in Oklahoma and Texas in an appendix to the reallocation report.

13. Reallocation Report, Section 1, Paragraph 6, Sentence 1, Page 2. Delete "some" from the sentence and replace with "significant." Reallocation of 35% of the existing conservation pool from hydropower storage to water supply storage must be considered to have significant adverse impacts to the hydropower purpose at Lake Texoma.

14. Reallocation Report, Section 1, Paragraph 6, Sentence 2, Page 2. Revise sentence 2 and 3 to state, "Compensation for future lost hydropower production as a result of the reallocation shall be made in accordance with Section 838(d)(3) of the 1986 WRDA which states:"

15. Reallocation Report, Section 1, Paragraph 7, Sentence 1, Page 2. Delete. The statement is too early in the report and should not be included in the Purpose section of the reallocation report.

16. Reallocation Report, Section 2.1, Paragraph 4, Sentence 5, Page 3. The channel capacity stated (50,000 cfs) is inconsistent with channel capacity stated on page 17 of the EA (45,000 cfs). Correct.

17. Reallocation Report, Section 2.2, Paragraph 3, Sentence 3, Page 4. The statement is inconsistent with the statement made on page 18 of the EA (Section 4.4.3, page 18, paragraph 2, sentence 3), which lists recreation as the only enhancement gained from the 1992 seasonal pool plan. Make consistent. Southwestern believes that ALL purposes receive some benefit from the seasonal pool plan, or the seasonal pool plan would NOT have been implemented.

18. Reallocation Report, Section 2.2, Paragraph 3, Sentence 6, Page 4. If the statement is true, what is the urgency of making more storage available, since the current storage is not being fully utilized? Explain fully.

19. Reallocation Report, Section 2.3, Paragraph 1, Sentence 1, Page 7. Delete "usuage" and replace with "usage."

20. Reallocation Report, Section 2.3, Paragraphs (3), (4) and (5), Page 7 and 8. The actions are NOT reallocations. They are new contracts for water storage at Lake Texoma that was reallocated under the 1983 reallocation and was not contracted for until the dates listed. Correct.

21. Reallocation Report, Section 2.4, Section Title, Page 9. Section title is in incorrect format. Reformat.

22. Reallocation Report, Section 2.4, Table 3, Page 10. In the feature column, the NTMWD (Pending) feature needs to have the footnote "3" included in the entry.

23. Reallocation Report, Section 2.4, Table 3, Page 10. Footnote 3 must be corrected to state that 1,515 acre-feet remain uncontracted from the previous reallocation.

24. Reallocation Report, Section 2.5.1, Paragraph 2, Sentence 3, Page 11. The statement is incorrect. Southwestern views terms like "up to" and "in increments as needed" stated in sentence 1 of the paragraph to be VERY limiting in the amount of the reallocation. Delete Sentence 3.

25. Reallocation Report, Section 2.5.1, Paragraph 3, Sentence 3, Page 11. Change "...the Congressional mandate of reallocating equal amounts of water..." to "...the Congressional mandate of reallocating equal amounts of storage..."

26. Reallocation Report, Section 2.5.2, Paragraph 1, Sentence 5, Page 12. The sentence is incorrect. The dependable yield from the 300,000 ac-ft of reallocated storage is 295 mgd not 442 mgd. The dependable yield of

450,000 ac-ft (150,000 previously reallocated plus the proposed 300,000 ac-ft reallocation) is 442 mgd.

27. Reallocation Report, Section 2.5.2, Paragraph 1, Sentence 6, Page 12. Incorrect reference. Super Model and H&H Storage Yield Analysis are attached in Appendix 11.3.

28. Reallocation Report, Section 3.0.1, Paragraph 1, Sentence 7, Page 12. Change the sentence from, "The NED objective is to provide a cost-effective water supply source..." to "The NED objective is to provide the most cost-effective water supply source..."

29. Reallocation Report, Section 3.0.1, Paragraph 1, Sentence 8, Page 12. Delete the last sentence of the paragraph. It is inappropriate to make the determination that the reallocation from the hydropower pool meets the NED criteria at that point in the report.

30. Reallocation Report, Section 3.0.1, Paragraph 2, Sentence 2, Page 12. Statement conveys an urgent need for the storage reallocation; however, Corps regulations do NOT permit an incomplete study due to an apparent critical need. Also, it is stated earlier in the report that currently all available water supply storage is not being fully used. Delete sentence.

31. Reallocation Report, Section 3.0.1, Paragraph 4, Sentence 2, Page 13. The letter requesting the storage is not found in Appendix to the reallocation report. Include.

32. Reallocation Report, Section 3.0.1, Paragraph 5, Sentence 1, Page 13. "Feasibility" should be capitalized. "Report" should not have an apostrophe after the t.

33. Reallocation Report, Section 3.0.1, Action Alternatives, Paragraph 3, Sentence 7, Page 14. 46% is a gross overestimate of the flood control storage that would be reduced if the entire 300,000 ac-ft were to be reallocated from the flood control pool. If the water storage was to be reallocated from the flood control pool, a very conservative estimate of the flood control storage reduction would be 11%.

34. Reallocation Report, Section 3.0.1, Action Alternatives, Paragraph 3, Sentence 8, Page 14. The statement is subjective. There has been no evaluation to make the conclusion and, applying the same logic, the loss of hydropower storage is not acceptable to those impacted by that loss.

35. Reallocation Report, Section 3.0.1, Action Alternatives, Entire Paragraph 3, Page 14. It appears that the Corps is inconsistently applying its own

regulations. The Corps is adamant that antiquated methods must be used when determining hydropower losses, but when planning formulation regulations are used, there seems to be a lot of flexibility. On page 12 of the report, it states that "[c]onsideration of **ALL REASONABLE** alternatives is required under the National Environmental Policy Act (NEPA) to create a better decision-making process for implementing projects and programs that could adversely impact the environment. It seems that the Corps applies NEPA inequitably depending on the Corps business line.

An example of the discriminatory practice that the Corps takes with hydropower as opposed to the Corps' other business lines can be clearly illustrated when the final decision concerning the Arkansas River Navigation Project is analyzed. Congress authorized a study in which the Corps was to investigate the deepening of the Arkansas River Navigation Channel to 12 feet to facilitate and encourage increased barge traffic. However, the Corps did not just focus on the deepening of the channel to 12 feet, but they also investigated deepening the channel to 10 or 11 feet and various flow scenarios. The law only authorized the channel deepening to 12 feet, but the Corps deemed it appropriate to "consider all reasonable alternatives" as required under NEPA and studied many alternatives.

In the case of the Lake Texoma reallocation, the Corps has adamantly stated that they have no authority to study any other option and can only reallocate the water storage from the hydropower pool to be in compliance with the WRDA 1986. Either the Corps had no authority to investigate and implement several portions of the Arkansas River Navigation Study and broke the law studying that project, or the Corps is violating NEPA by not studying flood control storage reallocation for the Lake Texoma reallocation study.

ODWC and USFWS have expressed concern about the impacts that the reallocation of conservation storage will have on the downstream endangered species and the in-lake habitat of Lake Texoma (found respectively on pages E-25 and E-33 of the Public Notice and Comments Received on First Draft EA). Southwestern Power Resources Association and Southwestern have expressed deep concern about the water storage reallocation being reallocated from the hydropower pool and have suggested and/or indicated that the flood control pool should be studied for the water storage reallocation (found respectively on pages E-13 and E19 of the of the Public Notice and Comments Received on First Draft EA). The Texas Water Development Board in a letter dated May 3, 2004 (found on page A-17 of the correspondence appendix) stated "Flood reallocation from reservoirs may be the most cost effective and least environmentally disruptive way

of meeting water demand in Texas." The fact that the reallocation of water storage from the flood control pool was not seriously considered when so many affected entities expressed concern about the recommended plan and suggested an alternate plan is disturbing.

36. Reallocation Report, Section 3.0.1, Downstream Red River Diversion, Paragraph 1, Page 15. The Downstream Red River Diversion options should be considered to be an option of ANY storage reallocation. Southwestern has met with representatives from GTUA and NTMWD and they have stated that their engineers believe the Downstream Red River Diversion is an option that they are currently exploring. Why is it dismissed so quickly in the report?

    Furthermore, the narrative on the Downstream Red River Diversion is comparing several withdrawal strategies that should be incorporated and considered with each reallocation alternative. Basically, the paragraph discusses withdrawal options. They are NOT independent alternatives.

37. Reallocation Report, Section 3.0.1, Downstream Red River Diversion, Paragraph 2, Sentence 3, Page 15. Delete. This study does not contain enough information and has no basis to make this unsupported statement.

38. Reallocation Report, Section 3.0.1, Downstream Red River Diversion, Paragraph 2, Sentences 4 and 5, Page 15. Delete. This is the Reallocation Report, not the EA.

39. Reallocation Report, Section 3.0.1, Evaluation Matrix of Preliminary Alternatives, Page 16. The last two columns (Legislative Direction (WRDA 1986) and Evaluated in Previous Studies) on the Screening Results are NOT screening criteria and must be deleted.

40. Reallocation Report, Section 3.0.1, Evaluation Matrix of Preliminary Alternatives, Page 16. The water storage reallocation from the flood control pool must be placed on the Evaluation Matrix as an alternative. The No Action alternative must be placed on the Evaluation Matrix as an alternative. The Evaluation Matrix must have a + or – rating system to let the readers know if the impacts are positive (+) or negative (–), and the Evaluation Matrix should have a footnote explaining the positive and negative symbols. The Evaluation Matrix in the report does not match the Evaluation Matrix found on page 8 of the EA. Correct.

41. Reallocation Report, Section 3.0.1, Evaluation Matrix of Preliminary Alternatives, Row 3, Alternative 4, Page 16. The Evaluation Matrix states that the existing surface water sources can be used to meet the Texas Region C 2060 needs and Table 5, Source of Water Supply and

Water Demand by Decade Recommended Water Management Strategies North Texas Municipal Water District found on page 23 of the report, shows that even without a water storage reallocation from Lake Texoma the future water supply demand can be met. There is no reason for a reallocation of water storage from Lake Texoma if the Evaluation Matrix and Table 5 are factual. If ER 1105-2-100 is followed, a reallocation occurs when there is an immediate need for the water storage, and since there is apparently enough water in the area to meet the immediate need, a reallocation of water storage would disregard the regulation.

42. Reallocation Report, Section 3.0.1, Evaluation Matrix of Preliminary Alternatives, Row 5, Alternative 6, Downstream Red River Diversion, Page 16. Delete Row. "Alternative 5" is just a withdrawal plan that should be considered with all of the alternatives.

43. Reallocation Report, Section 3.0.1, Evaluation Matrix of Preliminary Alternatives, Page 16. Please see the revised Evaluation Matrix of Preliminary Alternatives attached on page 8. Please incorporate the changes in the Evaluation Matrix in the Report and EA.

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Alternative	Potential Study Alternatives	Screening Results*						Conclusion	Appropriate for Detailed Evaluation
		Meet Future Water Demands	Hydropower Impacts	Environmental Impacts	Flood Control Impacts	Recreation Impacts	Economic Costs		
1	No Action	Yes	None	None	None	None	None	Meets Texas Region C Near Term Water Demand.	Yes
2	Reallocating from Existing Flood Control Pool	Yes	Low -	Low -	Low -	None	Low -	Further study warranted due to low impacts for all interests.	Yes
3	New Reservoirs above Lake Texoma	Yes	Medium -	High -	Low +	High +	High -	Difficult to justify based on high costs and environmental impact.	No
4	New Groundwater Wells	No	None	None	None	None	High -	Production not sufficient to meet high municipal and industrial demands.	No
5	Existing Surface Water Sources	Yes	None	None	None	None	Low +	Accounted for in Texas State Water Plan, Region C.	Yes
6	New Surface Water Sources	Yes	Low -	High -	Low +	High +	High -	Accounted for in Region C water management strategy in Texas State Water Plan.	Yes
7	Reallocating from Existing Conservation Pool	Yes	High -	Low -	Low +	Low -	Medium -	Legislative authorization to reallocate hydropower storage to water supply storage.	Yes

*Note: + indicates a Positive impact, - indicates a negative impact

44. Reallocation Report, Section 3.0.1, Page 17. Why is the page blank? Please delete.

45. Reallocation Report, Section 3.0.1, Selected Alternative, Paragraph 1, Page 18. The section needs to be moved to the end of the reallocation report and inserted right before the conclusions. The reallocation report has not developed ANY economic, environmental or financial impacts of the alternatives to be studied; therefore, an alternative CANNOT be selected at that stage of the reallocation report.

46. Reallocation Report, Section 3.0.1, Selected Alternative, Paragraph 1, Sentence 4, Page 18. The statement is inconsistent with the statement made on Page 11 in Section 2.5.1, Paragraph 3. In the referenced paragraph, it was stated that the Red River Compact was NOT a constraint, but here, it is stated that it is a constraint. Which is correct?

47. Reallocation Report, Section 4.0, Economic Analysis, Page 18. The title of the section should be changed to "Water Supply Demand Analysis." The section only discusses water supply sources and demand for the study area. The report must have a complete Economic Analysis Section developed that outlines the economic gains or losses from the authorized project purposes at Lake Texoma. The Economic Analysis Section should also identify the National Economic Development Plan.

48. Reallocation Report, Section 4.1.2, Paragraph 1, Sentences 3 and 4, Page 19. The acronym DWU is used for two entities (Dallas Water Utilities and Denton). Correct.

49. Reallocation Report, Section 4.2, Paragraph 2, Sentence 1, Page 20. The storage referenced in the statement is the future storage in 2044. That must be made clear.

50. Reallocation Report, Section 4.2.3, Paragraph 1, Sentence 1, Page 21. ER 1105-2-100 requires a near term (10 years) need to justify reallocation. The values for the study need to reflect 2015 values, NOT 2060.

51. Reallocation Report, Section 4.2.3, Paragraph 1, Sentence 6, Page 22. The amount (acre-feet) of water required in 2015 needs to be stated.

52. Reallocation Report, Section 4.2.3, Table 5, Page 23. In 2060, the supply exceeds the demand by more than 219,000 acre-feet. Explain why the excess in supply is needed? If the resource is not going to be used, then it is not needed.

53. Reallocation Report, Section 5.1, Table 7, Page 25. The footnote needs to be deleted and replaced with, "Impacts for the 150,000 and 300,000 acre-feet reallocation. Base already includes 150,000 acre-feet." The table shows the impacts of reallocating an additional 150,000 acre-feet or 300,000 acre-feet, not the total including the existing 150,000 acre-feet.

54. Reallocation Report, Section 5.1, Table 7, Page 25. Southwestern disagrees with all of the values tabulated in Table 7 as described in the Southwestern White Paper found at the end of HAC's report (Section 11.5).

55. Reallocation Report, Section 5.2, Paragraph 1, Page 25. The Energy Charge and Capacity Charge are incorrect. They are simply stating the rates that Southwestern charges and to be correct, they must be changed to:

    Energy Charge = 8.20 mills/kWh
    Capacity Charge = $36.36/kW-yr

56. Reallocation Report, Section 5.2, Paragraph 2, Sentence 1, Page 25. $861,000 is incorrect for the annual revenues foregone using Southwestern's current rates and HAC's calculations. The revenues foregone should be $1,223,000.

57. Reallocation Report, Section 5.2, Table 8, Page 25. The footnote needs to be deleted and replaced with, "Impacts for the 150,000 and 300,000 acre-feet reallocation. Base already includes 150,000 acre-feet."

58. Reallocation Report, Section 5.2, Table 8, Page 25. Southwestern disagrees with all of the values tabulated in Table 8 as described in the Southwestern White Paper found at the end of HAC's report (Section 11.5).

59. Reallocation Report, Section 5.3, Paragraph 1, Sentences 3 and 4, Page 25. These statements are inconsistent with statements made in Section 3, Proposed Action, on Page 9 of the EA and with the language of WRDA 1986. Delete these sentences.

60. Reallocation Report, Section 5.3, Paragraph 2, Table 9, Page 25 and 26. Delete entire paragraph. Southwestern would like to point out that full compensation for the past reallocations has not been received. An agreed upon compensation needs to be developed in the near future. Delete Table 9. Add a new section that illustrates the compensation to the hydropower purpose in accordance with WRDA 1986. The new section should be place in Section 7.2 of the report.

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61. Reallocation Report, Section 5.4, Table 10, Page 27. Update the last column to October 2005 costs.

62. Reallocation Report, Section 5.5, Paragraph 1, Sentence 2, Page 28. Based on Southwestern's computation of hydropower benefits foregone, $3,817,539, the updated cost of storage is considerably less than the hydropower benefits foregone. Therefore, the user costs must be developed using hydropower benefits foregone.

63. Reallocation Report, Section 5.5, Paragraph 1, Sentence 4, Page 28. The report is inconsistent among the interest rates used. Here it is stated as 5.125%, and in Section 6.1.2.2 the interest rate is stated as 5.375%. Make consistent.

64. Reallocation Report, Section 6.1.2, Paragraph 1. For a reasonable cost comparison, the costs for desalinization of the raw Lake Texoma water must be included in the costs considered. Include those costs in Table 6.

65. Reallocation Report, Section 6.1.2.2, Paragraph 1, Bullet 1, Sentence 6, Page 28. See comment 63.

66. Reallocation Report, Section 7.1, Paragraph 1, Page 30. The updated cost of storage calculation needs to use an "X" in the first calculation to indicate multiplication, not an "*" to avoid confusion. The "*" is used for a footnote prior to the calculation.

67. Reallocation Report, Section 7.2, Paragraph 1, Page 30. Change title to "Compensation to the Federal Hydropower Purpose."

68. Reallocation Report, Section 7.2, Paragraph 1, Page 30. Re-write entire paragraph to be compliant with WRDA 1986. All of the references to *revenues* must not be used in the re-write.

69. Reallocation Report, Section 7.3, Paragraph 1, Page 30. Change title to "HAC and SWPA Methodology Differences for Determining Hydropower Impacts."

70. Reallocation Report, Section 7.3, Paragraph 1, Sentence 2, Page 30. Differences center on FIVE issues. Although the contract rates (# 3 in report) used in the study are in error, it has not been an issue. However, in addition to 1 and 2, the following should be included to represent Southwestern's concerns: "4.) the calculation of energy loss; 5.) the value applied to the capacity; and 6.) the time period used when calculating the compensation for benefits foregone."

71. Reallocation Report, Section 7.3, Paragraph 2, Sentence 2, Page 30. Delete. Concerns are enumerated in the preceding paragraph.

72. Reallocation Report, Section 7.3, Paragraphs 2 and 3, Pages 30 and 31. Although Appendix A to the HAC Report can be found on the Corps' website, the CD sent to Southwestern did not contain Appendix A of the HAC report. The HAC report does not reference an Appendix A. Appendix A to the HAC report is listed four times on pages 30 and 31. Incorporate Appendix A in the HAC Report in the next draft of the Reallocation Report.

73. Reallocation Report, Section 8.0, Paragraph 1, Page 31. The EA cannot conclude that there are no cumulative impacts since the Reallocation Report was NOT completed prior to the EA being drafted.

74. Reallocation Report, Section 9.0, Paragraph 1, Sentence 1, Page 32. The statement is a faulty conclusion since all reasonable alternatives have NOT been evaluated, and a reallocation of 100,000 acre-feet would satisfy all of the near term need (to be compliant with ER1105-2-100) in Texas (there is no documented water storage demand from Lake Texoma in Oklahoma). Reformulate and evaluate correctly.

75. Reallocation Report, Section 9.0, Paragraph 1, Sentence 1, Page 32. The Reallocation Report fails to provide support for concluding that reallocation of an additional 300,000 acre-feet from hydropower storage to water supply storage is the most efficient alternative. Reformulate and evaluate correctly.

76. Reallocation Report, Section 9.0, Paragraph 1, Sentence 5, Page 32. WRDA 1986 AUTHORIZED the reallocation of "up to" 300,000 acre-feet from Lake Texoma. The Reallocation was NOT directed. Correct.

77. Reallocation Report, Section 9.0, Paragraph 2, Sentence 1, Page 32. There are significant negative impacts to hydropower and the EA should address that impact.

78. Reallocation Report, Section 10.0, Paragraph 1, Sentence 2, Page 33. Southwestern believes that the report should recommend only the reallocation of 100,000 acre-feet to meet the near term needs of the water users to comply with ER 1105-2-100. Also, Southwestern recommends that the reallocation of storage from the flood control storage be thoroughly evaluated, and Southwestern believes that will be the NED plan.

79. Reallocation Report, Section 11.0, Appendix 11.7, Page 34. The report and the EA contain circular references. The EA is an appendix of the report, but the report is an appendix of the EA. Correct.

80. Reallocation Report, Appendix 11.4, Paragraph 11.4.1.2.3.a. (1) Lake Texoma, Paragraph 1, Sentence 2, Page 58. The report should not include internal questions about what the Cumberland Pool is. Edit out.

81. Reallocation Report, Appendix 11.4, Table 11, Water Demand and Supply by Year, County and Category Southern Region, Pages 87 and 88. The number in the last row and the last column ("Total Balance") has been incorrectly calculated in all instances (2000, 2010, 2020 and 2060), and the Total M&I water demand projected for 2010 has been miscalculated. The report needs to have a QA/QC check. Correct.

82. Reallocation Report, Appendix 11.5, Section 1.2, Paragraph 2, Sentence 3, Page 1 (Appendix starts on page 91). The energy amount stated in the second paragraph (235 GWh) is inconsistent with what is stated in Section 3.6 on page 12 (275 GWh). Correct.

83. Reallocation Report, Appendix 11.5, Section 1.3, Paragraph 1, Sentence 6, Page 2. Correct the contact information for Ms. Janet Hotubbee (the telephone number listed is not a Tulsa District number).

84. Reallocation Report, Appendix 11.5, Section 3.2, Paragraph 2, Sentences 1 and 2, Page 9. Delete "Additionally, the Commander, USACE, has Congressional..." in sentence 2 and replace it with "The Commander, USACE, has interpreted the Congressional discretionary authority as the..." The Corps has only interpreted the discretionary authority given in the Water Supply Act of 1958 to be 15 percent of the total water storage or 50,000 acre-feet, which ever is lesser. The Corps has no "additional" Congressional authority to reallocate water storage.

85. Reallocation Report, Appendix 11.5, Section 4.6, Tables 4-2 and 4-3, Dependable Capacity Calculation, Pages 23 and 24. The explanation of calculations for column 2 states that the average weekly energy before water supply withdrawals is based on the output from the Kerr-Philpott model for June through August. This is NOT the correct model to use. Southwestern believes that the SWD Red River Super Model should have been used and referenced. Correct.

Draft Environmental Assessment, Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas, October 2005:

1. Environmental Assessment. The EA should be part of the Reallocation Report. The draft EA remains incomplete. The EA does not address the reallocation of flood control storage as a possible alternative in depth. At the very least, the flood control pool storage reallocation should be carried out to a level that calculates the benefits foregone from the loss of the flood control storage.

2. Environmental Assessment, Section 1, Paragraph 2, Page 1. The water utilities requesting storage from Lake Texoma and the amount of water supply storage needed in the next 10 year period to meet the water utilities' estimated growth need to be listed.

3. Environmental Assessment, Section 2.2, Change in the upper and/or lower limits of the conservation pool to provide additional water supply, Paragraph 1, Page 6. The 46% loss of flood control storage is incorrect. Recalculate (a conservative estimate is about 11%). Also, the paragraph neglects to analyze the reduction in flood control benefits due to the flood control storage reallocation alternative. Include the analysis. See comments 33-35 in the Reallocation Report comments.

4. Environmental Assessment, Section 2.2, Downstream Red River Diversion, Paragraph 1, Page 7. Based on inquires from potential water users, the downstream diversion should be considered further. See comment 36 in the Reallocation Report comments.

5. Environmental Assessment, Section 2.2, Evaluation Matrix of Preliminary Alternatives, Page 8. See comments 39 – 43 in the Reallocation Report comments.

6. Environmental Assessment, Section 5.2, Table 13, Pages 27 and 28. Table 13 needs to be corrected and completed as follows:

    - The reallocation as proposed will have a minor adverse impact on the Air Quality due to the increased thermal generation to replace lost hydropower. Correct.
    - The reallocation as proposed will have a minor adverse impact on Threatened and Endangered Species. Correct.
    - The reallocation as proposed will have a significant adverse impact on Hydropower. Correct.
    - The reallocation as proposed will have a substantial adverse impact on Controversy. Correct.

7. Environmental Assessment, Section 5.2.2.3, Paragraph 1, Sentence 1, Page 29. "[N]egligible changes to...discharge duration, or discharge frequency...." The sentence is not consistent with adverse impacts indicated in Table 13 or with the discussion in the 5th paragraph of that section.

8. Environmental Assessment, Section 5.2.2.3, Paragraph 5, Sentence 4, Page 30. The reduction in downstream discharge and frequency will affect wetland habitat (specifically Interior Least Tern habitat). The paragraph seems to imply that there is water storage for downstream low flow releases. The draft EA should state that there is no water storage in Lake Texoma allocated for the regulation of a minimum flow downstream from the project and that the low flow releases are voluntary and cannot be considered dependable. The water supply purpose must proportionally share with any voluntary/mandatory releases for downstream habitat protection; otherwise, there would be a significant impact on the downstream Interior Least Tern habitat.

9. Environmental Assessment, Section 5.2.2.5, Paragraph 1, Page 31. Southwestern believes the reallocation will reduce hydropower discharges which will affect the habitat of the Endangered Interior Least Tern. What reasoning has the Draft EA used to conclude that reductions in discharge and frequency from Lake Texoma will not affect the Least Tern? Over the past several years, hydropower releases at Lake Texoma have been voluntarily increased (duration and frequency) to enhance and maintain Interior Least Tern habitat. These flows are not dependable since there is no water storage allocation in Lake Texoma for downstream habitat maintenance with the proposed reallocation of water storage. Water supply storage must receive their part of any mandatory releases for endangered species mitigation.

10. Environmental Assessment, Section 5.4.2, Paragraph 1, Sentence 1, Page 33. The draft EA must quantify the additional air pollution that will be produced as a result of the loss of hydropower production (i.e. how many tons of carbon dioxide, sulfur dioxide, and nitrogen oxide will be emitted into the atmosphere due to the water supply reallocation?). The draft EA must recognize that the loss of hydropower energy will not be replaced with other hydropower energy, but, in all likelihood, with some form of fossil fuel-produced electric energy and have a DIRECT effect on air quality. For example, according to Southwestern's estimates, a loss of 23,792 MWh of energy per year would result in increased air emissions tabulated below.

Air Pollutant	Increase in Tons per Year For the Loss of 23,792 MWh Of Energy
Carbon Dioxide	19,724
Sulfur Dioxide	59
Nitrogen Oxide	48

11. Environmental Assessment, Appendix B, Texoma Yield Analysis Using SUPER, Paragraph 1, Page B-2. The yield analysis of the reallocated storage is incorrect. In the year 2044, it is projected that Lake Texoma will have an available water storage amount of 986,730 ac-ft. It appears that the draft EA is maintaining the water supply storage volume and reducing the hydropower storage volume by placing all of the sediment inflow in the hydropower storage of Lake Texoma. If the additional 300,000 ac-ft of water supply storage is reallocated from hydropower storage, the total amount of water supply storage would be 450,000 ac-ft, or about 31 percent of the entire conservation storage and the hydropower storage would account for the remaining 1,017,283 ac-ft of storage, or about 69 percent of the conservation storage. The sediment inflow should be shared on a proportional basis; therefore, the future water supply storage (in year 2044) cannot be 450,000 ac-ft. The future water supply storage should be a smaller volume that has been reduced as a result of sediment inflow. The reduced water supply storage volume would then have a different yield associated with it.

Southwestern Power Administration
Lake Texoma Water Supply Storage Reallocation
Storage Reallocation Alternative Analysis

SUPER Run Overview

Southwestern performed its own SUPER analysis of the proposed reallocation of 300,000 acre-feet from Lake Texoma. Five SUPER runs were performed. The first two runs were identical to the runs performed by the Tulsa District (TD) and represent the existing (Base) condition and the proposed reallocation (Proposed) of 300,000 acre-feet from hydropower storage. The third run is Southwestern's Alternative 1 (SWPA1). It calls for reallocating the 300,000 acre-feet from the flood control pool, raising the top of the conservation pool to a flat 620.177. Also, Southwestern included dependable yield mitigation storage (DYMS) for the current water supply users and hydropower. Therefore, the additional water supply yield available to new users is 222.9 cubic feet per second (cfs) (compared to an additional water supply withdrawal available in the proposed plan of 456.8 cfs). The fourth run is Southwestern's Alternative 2 (SWPA2). It calls for reallocating 100,000 acre-feet (representing the current request from North Texas Municipal Water District) from flood storage, raising the existing seasonal pool by about one foot (not to exceed elevation 619.0). DYMS was not included for hydropower in the SWPA2 run. The total water supply withdrawal is 380.7 cfs, which represents 228.4 cfs from the current water supply storage and 152.3 cfs from the reallocated 100,000 acre-feet. The raised seasonal pool would increase the yield of the conservation pool by 74.6 cfs, so hydropower would lose 77.7 cfs of its yield. The fifth run is Southwestern's Alternative 3 (SWPA3). It calls for reallocating 100,000 acre-feet from hydropower storage and using the current seasonal pool. The total water supply withdrawal is 380.7 cfs, which represents 228.4 cfs from the current water supply storage and 152.3 cfs from the reallocated 100,000 acre-feet. Note: All yields were computed using projected 2044 sediment numbers from TD. The SUPER alternative runs were done using current sediment numbers.

Alternative Name	SUPER Run	Water Supply Storage (AF)	Water Supply Withdrawal (cfs)
Base	R03X07	150,000	228.4
Proposed	R03X09	450,000	685.2
SWPA1	300K	*450,000	451.3
SWPA2	R03X12	250,000	380.7
SWPA3	R03X10	250,000	380.7

*The reallocated 300,000 acre-feet includes DYMS for the existing water supply users and hydropower.

Flood Damages

Based on the SUPER runs the proposed plan provides an increase in flood benefits of $52,000 annually. In the SWPA1 plan, there is a decrease in flood control benefits of $495,000 annually. The SWPA2 plan provides a decrease in flood benefits of $47,000 annually. The SWPA3 plan provides an increase in flood benefits of $18,000 annually.

Alternative Name	Avg. Ann. Flood Damages ($1,000)	Delta Ann. Flood Damages ($1,000)
Base	$9,089	-
Proposed	$9,037	-$52
SWPA1	$9,584	$495
SWPA2	$9,136	$47
SWPA3	$9,071	-$18

Energy Losses

Based on the SUPER runs the hydropower purpose will lose 23,797 megawatt-hours (MWh) of energy annually with the proposed plan. In the SWPA1 plan, the average annual energy loss is 25,682 MWh. In the SWPA2 plan, the average annual energy loss is 10,837 MWh. In the SWPA3 plan, the average annual energy loss is 8,042 MWh. Because the reallocations in the proposed plan and in the SWPA3 plan are totally from hydropower storage, the energy losses in those alternatives will be all on-peak energy. Because the yield of the hydropower storage is kept whole in the SWPA1 plan, the energy loss is all off-peak. The energy loss in the SWPA2 plan will be part on-peak and part off-peak because of the increased yield of the raised seasonal pool. Additionally, in all the alternatives there is an off-peak energy loss due to water supply withdrawn in excess of the water supply storage yield. The water supply user is entitled to withdraw however much water the storage will provide. In the critical year, that amount is the storage yield. During any other period, it is more. The calculation is documented in the white paper entitled "Southwestern Power Administration Water Storage Reallocations Hydropower Impacts" which is included as an appendix in the water supply storage reallocation report. The energy loss due to the Additional Water Usage Adjustment is an off-peak energy loss.

Alternative Name	Avg. Ann. Energy Produced (MWh)	Delta (MWh)	On-Peak Energy Loss (MWh)	Off-Peak Energy Loss (MWh)	Additional Water Usage Adjustment (MWh)
Base	232,092	-	-	-	-
Proposed	208,295	23,797	23,797	0	30,131
SWPA1	206,410	25,682	0	25,682	15,066
SWPA2	221,255	10,837	5,529	5,308	10,046
SWPA3	224,050	8,042	8,042	0	10,046

Capacity Losses

Capacity losses to the Federal hydropower purpose occur whenever the yield of the hydropower storage (and thus the on-peak energy available) is reduced. Because both the proposed plan and the SWPA3 plan reallocate storage from hydropower storage, there would be reduced hydropower storage yield and thus capacity losses. Because the hydropower storage yield is kept whole in the SWPA1 plan, there would be no capacity loss. Because DYMS is not included for hydropower in the SWPA2 plan, the hydropower storage yield is reduced and there is a capacity loss. The capacity losses to hydropower in the proposed plan, the SWPA2 plan, and the SWPA3 plan can be computed by taking the critical year on-peak energy loss and dividing it by Southwestern's 1,200 hours per year peaking energy requirement. The critical year on-peak energy loss can be computed with the power equation used in the SUPER model:

kWh = [(H x eff x Q)/11.8] x 8,760 hours/year

kWh = annual energy loss
H = net head
eff = hydropower plant efficiency
Q = The water yield lost to hydropower

H = (HW – TW – FL)

HW = headwater elevation
TW = tailwater elevation
FL = friction loss

From SUPER, the eff (efficiency) = 0.850, the TW = 508.50 and the FL = 3.60. The HW is computed as the average pool elevation during the critical period (1963-1964) which is 611.7.

Substituting,

H = (611.7 – 508.5 – 3.6) = 99.6

Proposed Plan:
Critical year on-peak energy loss for the proposed plan (Q = 456.8 cfs) is:

kWh = [(99.6 x 0.850 x 456.8)/11.8] x 8,760 = 28,710,000

Dividing the lost energy by Southwestern's 1,200 hours/year requirement gives:

28,710,000 / 1,200 = **23,925 kW capacity loss**.

SWPA2:
For the SWPA2 plan, Q = 77.7 cfs, the critical year energy loss is 4,883,390 kWh which gives a **4,069 kW capacity loss**.

SWPA3:
For the SWPA3 plan, Q = 152.3 cfs, the critical year energy loss is 9,571,950 kWh which gives a **7,977 kW capacity loss**.

Power Benefits Foregone

The values used for energy are $72.54/MWh for on-peak energy and $20.05/MWh for off-peak energy. The capacity value used is $62.16/kW-yr. The on-peak energy and capacity values come from the Hydropower Analysis Center (HAC) Appendix A, "Alternative Power Benefits Foregone Analysis for the Lake Texoma Water Supply/Storage Reallocation Study" dated August 23, 2005, for the Combustion Turbine Power Value on page 10. The off-peak energy value comes from the HAC Report "Denison Dam & Powerhouse, Lake Texoma, Red River, Oklahoma & Texas, Water Supply Storage Reallocation, Power Benefits Foregone" dated April 2005 (revised) for the Coal-Fired Steam Power Value on page A-2. The numbers are used for consistency between evaluations. Southwestern believes that the values for power, both on and off-peak, are undervalued.

Proposed Plan Power Benefits Foregone:

Item	Loss Amount	Rate	Annual Loss ($/year)
On-Peak Energy Loss	23,797 MWh	$72.54/MWh	$1,726,234
Off-Peak Energy Loss	0 MWh	$20.05/MWh	$0
Add. Water Usage Adj.	30,131 MWh	$20.05/MWh	$604,127
Capacity Loss	23,925 kW	$62.16/kW	$1,487,178
Total Hydropower Benefits Foregone			**$3,817,539**

SWPA1 Plan Power Benefits Foregone:

Item	Loss Amount	Rate	Annual Loss ($/year)
On-Peak Energy Loss	0 MWh	$72.54/MWh	$0
Off-Peak Energy Loss	25,682 MWh	$20.05/MWh	$514,924
Add. Water Usage Adj.	15,066 MWh	$20.05/MWh	$302,073
Capacity Loss	0 kW	$62.16/kW	$0
Total Hydropower Benefits Foregone			**$816,997**

SWPA2 Plan Power Benefits Foregone:

Item	Loss Amount	Rate	Annual Loss ($/year)
On-Peak Energy Loss	5,529 MWh	$72.54/MWh	$401,074
Off-Peak Energy Loss	5,308 MWh	$20.05/MWh	$106,425
Add. Water Usage Adj.	10,046 MWh	$20.05/MWh	$201,422
Capacity Loss	4,069 kW	$62.16/kW	$252,929
Total Hydropower Benefits Foregone			**$961,850**

SWPA3 Plan Power Benefits Foregone:

Item	Loss Amount	Rate	Annual Loss ($/year)
On-Peak Energy Loss	8,042 MWh	$72.54/MWh	$583,367
Off-Peak Energy Loss	0 MWh	$20.05/MWh	$0
Add. Water Usage Adj.	10,046 MWh	$20.05/MWh	$201,422
Capacity Loss	7,977 kW	$62.16/kW	$495,850
Total Hydropower Benefits Foregone			**$1,280,639**

Total Benefits Foregone

Proposed Plan Total Benefits Foregone:

Item	Annual Loss ($/year)
Flood Control Benefits Foregone	-$52,000
Power Benefits Foregone	$3,817,539
Total Benefits Foregone	**$3,765,539**

SWPA1 Plan Total Benefits Foregone:

Item	Annual Loss ($/year)
Flood Control Benefits Foregone	$495,000
Power Benefits Foregone	$816,997
Total Benefits Foregone	**$1,311,997**

SWPA2 Plan Total Benefits Foregone:

Item	Annual Loss ($/year)
Flood Control Benefits Foregone	$47,000
Power Benefits Foregone	$961,850
Total Benefits Foregone	**$1,008,850**

SWPA3 Plan Total Benefits Foregone:

Item	Annual Loss ($/year)
Flood Control Benefits Foregone	-$18,000
Power Benefits Foregone	$1,280,639
Total Benefits Foregone	**$1,262,639**

Conclusion

As can be seen from the above tables, the National Economic Development (NED) Plan for providing 300,000 acre-feet of water supply storage would be the SWPA1 alternative with a loss of only $1,311,997 annual benefits from the project compared to the loss of $3,765,539 annual benefits from the TD recommended plan. The NED plan for reallocating the North Texas request is the SWPA2 alternative with a loss of only $1,008,850 annual benefits from the project compared to the loss of $1,262,639 annual benefits from the reallocation from the conservation storage.

Southwestern Power Resources Association

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December 20, 2005

Stephen L. Nolen
Chief, Environmental Analysis and
Compliance Branch
ATTN: CESWT-PE-E (Texoma Reallocation)
U.S. Army Corps of Engineers
1645 S. 101st East Avenue
Tulsa, OK 74128-4609

Dear Mr. Nolen:

Southwestern Power Resources Association (SPRA) represents the rural electric cooperatives and municipally owned electric utilities that purchase hydropower generated at 24 Corps of Engineers multipurpose reservoirs in this region of the country. This energy and capacity is marketed to SPRA's members by Southwestern Power Administration (SWPA), an agency of the U.S. Department of Energy. Via this letter SPRA respectfully submits its comments on the Draft Environmental Assessment Lake Texoma Storage Reallocation Study, Lake Texoma, Oklahoma and Texas, dated October 2005.

Reallocation from the hydropower pool is not mandated. Throughout the draft reallocation report and draft Environmental Assessment (EA), the Corps treats Section 838 of Public Law 99-662 as a mandate from Congress that 300,000 acre-feet (AF) be reallocated from the hydropower pool of Texoma to municipal and industrial (M&I) water supply. *This legislation is not a mandate for such action!* The language in Section 838 (a) specifically *authorizes* the Secretary of the Army to reallocate 300,000 AF of storage from the hydropower pool to M&I water supply; it does not *mandate* such action. If Congress intended to mandate such action, the subsection would have read that "the Secretary is authorized and directed" to undertake the reallocation described. By consciously omitting direction that the reallocation be carried out, Congress gave the Secretary of the Army the discretionary authority to take such action, but did not require it.

The Corps alternately hides behind the law and ignores it as it suits the agency's purposes. In 2003, Congress authorized the Corps to maintain a 12-foot channel for the entire McClellan-Kerr Arkansas River Navigation System (MCKARNS). In that instance, the Corps maintained that Congressional authorization gave the agency the discretion to study alternatives other than a 12-foot channel, and the Corps proceeded to study alternatives of 10-, 11- and 12-foot channel depth in five or more segments of MCKARNS. Yet in the draft Lake Texoma reallocation report and EA, the same Corps appears to throw up its hands and lament that the 1986 Congressional authorization limits its consideration to reallocation from the Texoma hydropower pool. The draft reallocation report plainly states, "Only one alternative was identified. That alternative is the proposed action. *Other alternatives were eliminated from further consideration based on*

language in the authorizing legislation."[1] If a 2003 Congressional authorization gave the Corps the discretion to study alternatives other than the one cited in the authorization, the 1986 authorization of Lake Texoma storage reallocation gives the Corps the discretion (and, as demonstrated below, the Corps has the legal obligation) to study alternatives to the authorized reallocation from the hydropower pool. Truly, what's sauce for the goose is sauce for the gander.

Statute, policy and regulations require the Corps to look at all reasonable alternatives. The National Environmental Policy Act[2] and the Corps' own policy and regulations[3] require that the agency "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." While the draft reallocation report and EA do identify some alternatives to reallocation of M&I storage from the hydropower pool at Texoma, no alternative to this course of action other than the "no action" alternative is studied in any depth. Instead, they are given short shrift and dismissed, to wit:

> *Reallocation from the flood pool.* This alternative is dismissed out of hand with the unsupported assertion that it would reduce flood control storage by approximately 46%[4]. This is absurd on its face, as the full amount authorized for reallocation, 300,000 AF, constitutes less than 12% of the 2,544,830 AF of storage in the flood control pool[5]. The draft EA also makes the unsupported assertion that reallocation from the flood pool "would not be acceptable to those in the floodplain downstream of Denison Dam."[6] In both instances, the draft report and EA reach conclusions that are not supported by documentation contained in the draft report. Without such documentation, these conclusions are merely unsupported assertions, and further development and study of this alternative must be conducted. The Corps had tools at hand to study this alternative, but failed to do so. SWPA, however, utilizing the Corps' own SUPER computer simulation model, did investigate this alternative. SWPA's study found that reallocation of 100,000 AF for M&I water supply – the only documented need identified in the draft report (see comments below) – from the flood control pool is the National Economic Development (NED) plan alternative, providing the least loss of overall benefits provided by the Lake Texoma project.[7] The same analysis showed that, at such time as reallocation of the entire 300,000 AF to M&I water supply is justified, the NED alternative would be reallocation of the entire amount from the flood control pool, with Dependable Yield Mitigation Storage.[8]

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[1] Draft reallocation report, Sec. 11.4.3.2, p. 89 (emphasis added)
[2] 42 USC 4332(2)(E)
[3] ER 200-2-2
[4] Draft EA, Sec. 2.2.1, p. 6
[5] Draft EA, Table 10, p. 19
[6] Draft EA, Sec. 2.2.1, p. 6
[7] SWPA Lake Texoma Water Supply Storage Reallocation Alternative Analysis (Enclosure 2 of SWPA's comments on the draft reallocation report and EA), SWPA2 Plan Total Benefits Foregone table, p. 5
[8] *Ibid.*, SWPA1 Plan Total Benefits Foregone table, p. 5

- *Downstream Red River diversion.* This alternative was dismissed because it "would require communities located in the upper reaches of Lake Texoma to construct extensive pipeline facilities to transport water greater distances…"[9] The draft reallocation report makes no attempt to quantify these costs. Such information is necessary before it can be concluded that the alternative is not feasible. Instead, this alternative also is dismissed out of hand. The draft reallocation report acknowledges that North Texas Municipal Water District (NTMWD) has M&I water supply storage in Cooper Lake, along with facilities to transport raw water from that lake to its treatment and distribution facilities.[10] Presumably, water could be diverted from the Red River downstream of Denison Dam into Cooper Lake. Such a diversion would only require facilities to transport the water from the diversion point to Lake Cooper, as NTMWD could use its existing facilities to transport the raw water from that point. Use of these existing facilities might lower the cost of this alternative to the point that it is economically feasible. Because the draft reallocation report did not look at this alternative, we have no basis to conclude that it is not feasible.

- *New reservoirs above Lake Texoma.* The draft reallocation report identified this alternative, but rejected it without further study on the basis that a 1990 restudy of Lake Texoma found that two potential sites were not feasible for development of flood control operation[11]. However, a project built only to provide M&I water supply presumably would require acquisition of much less property than construction of a flood control project at the same site. Additionally, construction of upstream impoundments in the Lake Texoma watershed, even if operated only for water supply, would increase the flood protection provided by Lake Texoma – which means that some increment of flood control storage at Texoma could be reallocated to M&I water supply without reducing the downstream flood protection that the project already provides. Would these cost reductions make upstream water supply projects economically feasible? Would a combination of upstream water supply projects and conversion of Lake Texoma flood control storage provide more economic benefits than the recommended alternative? We do not know the answers to these questions because the draft reallocation report improperly dismisses this alternative without further study.

Because the draft EA and reallocation report failed to properly consider these alternatives, in violation of federal law, policy and regulations, they should be withdrawn and redrafted to more fully identify the costs and benefits of said alternatives.

The draft reallocation report does not justify reallocation of 300,000 AF of Lake Texoma storage to M&I water supply. As SWPA points out in its comments, the need for reallocating 300,000 AF of storage at Lake Texoma to M&I water supply is based on projections of water supply demand through 2060.[12] Corps regulations require demonstration of an immediate need for additional M&I water storage before a reallocation is considered.[13] In practice, "immediate

[9] Draft EA, Sec. 2.2.6, p. 6
[10] *Ibid.*, Sec. 4.2, p. 20
[11] *Ibid.*, Sec. 2.2.2, p. 6
[12] Comments submitted by Southwestern Power Administration, cover letter dated December 19,2005, p.1
[13] ER 1105-2-100

need" has been limited to 10 years from the date of the reallocation report. The only expressed need over the next 10 years is the request by NTMWD for an additional 100,000 AF of M&I water storage in Lake Texoma.[14] Even this need is suspect. Appendix 11.4 to the draft reallocation report contains a table that identifies sources of water supply and demand for NTMWD over the next six decades.[15] As a part of its water management strategies, NTMWD identifies additional reallocated storage in Lake Texoma as the source for 38,250 AF – not 100,000 AF – of water supply by the year 2020. Even then, NTMWD anticipates that total water supply in that year will exceed its demand by almost 150,000 AF – roughly four times the amount of additional water the utility hopes to draw from Lake Texoma at that time. Obviously, if NTMWD is able to secure the additional sources of water supply it has planned, no additional storage in Lake Texoma would be needed over the next 10 years. Further, the reallocation of 300,000 AF includes 150,000 AF to be provided to water supply users in the state of Oklahoma. But the draft reallocation report acknowledges that "Oklahoma has shown very little interest in contracting for any of the storage set aside for its use."[16] The draft reallocation report does not identify any need – in either the immediate or long-range future – for additional M&I water supply storage in Oklahoma.

Reallocation of 300,000 AF of Lake Texoma storage at this time would violate the reallocation authorization. Subsection 838(a) of P.L. 99-662 authorizes the reallocation of "*in increments as needed,* up to an additional" 150,000 AF of Lake Texoma hydropower storage for water users in the State of Texas and 150,000 AF for water users in the State of Oklahoma (emphasis added). Subsection 838 (d)(2) further provides that "until such time" as the Corps obtains contracts for additional M&I water supply in Lake Texoma, the "storage for which reallocation is authorized in this section may be used for hydropower production." Congress included this language specifically to prevent reallocation of large quantities of storage until they are needed for M&I purposes. I can speak with authority on the intent of Congress in this regard, because I was employed by the U.S. House of Representatives and tasked by then-Congressman Wes Watkins and Congressman Ralph Hall to draft this language in 1985. After consultation with SWPA, the two Texas rural electric cooperatives that purchase the hydro output of Denison Dam, and representatives of NTMWD, it was recognized that legislative language was needed to preserve storage for hydropower until such time as it was actually needed for M&I water supply. The language we drafted to achieve this end was ultimately incorporated into the Water Resources Development Act as Section 838. This language clearly requires the Corps to reallocate the Texoma storage only when a signed contract for M&I water supply has been implemented and limits the reallocation to the amount of storage contracted for. The draft reallocation report

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[14] Although the draft reallocation report claims on p. 5 that the Greater Texoma Utility Authority "also desires reallocated water supply storage," the draft report fails to document any such request. Indeed, it plainly states: "The identified need examined in the 2005 Reallocation Report is the request by the North Texas Municipal Water District for additional water supply storage of 100,000 acre-feet in Lake Texoma." Also, the Executive Summary of the draft reallocation report states on p. v that beyond the NTMWD request, "No others have expressed interest in purchasing storage."

[15] Draft reallocation report, Table 3, pp. 62-63

[16] Draft reallocation report, Sec. 2.5, p. 13

states that a draft contract with NTMWD for 100,000 AF of Lake Texoma storage has been prepared and will be sent forward to headquarters for consideration along with the reallocation report. It also states:

> A reallocation of water supply storage from hydropower storage does not occur until water supply agreements are signed by all parties and the water supply users starts to pay for the storage. Storage identified for reallocation but not under contract is still considered hydropower storage; however, *it no longer becomes a dependable source of power* (emphasis added).[17]

If the proposed reallocation of all 300,000 AF is approved, it would immediately cease to be a dependable source of power – the very situation that Congress sought to avoid by including the legislative language cited above. In keeping with the authorization, *if* a need for 100,000 AF of storage within the immediate future is demonstrated, and *if* it is determined after consideration of all reasonable alternatives that reallocation from hydropower storage is the recommended course of action, and *if* all parties sign the contract for 100,000 AF of M&I storage, it would be reallocated from the hydropower pool and unavailable for dependable hydropower generation only when NTMWD begins paying for the storage.

The method and manner of compensating SWPA and its power customers is mandated by law. Although the Corps improperly cites Subsection 838 (a) of P.L. 99-662 as the basis for ignoring other alternatives to reallocation from the hydropower pool, it chooses to ignore Subsection 838 (d)(3). This subsection clearly sets forward the manner for determining hydropower losses associated with reallocation and for compensating SWPA and its affected customers as follows:

> With respect to any water supply contract entered into by the Secretary under this section after June 1, 1985, the Secretary shall determine (A) the amount of hydropower lost, if any, as a result of such contract, and (B) *the replacement cost* of the hydropower lost (where replacement cost is defined as the cost to purchase replacement power from existing sources). If hydropower is lost as a result of the implementation of such contract, the Secretary shall provide credits to the Southwestern Power Administration of amounts *equal to such replacement costs*. Such credits shall be against sums required to be paid by the Southwestern Power Administration for costs of the project allocated to hydropower. In such case the Southwestern Power Administration shall reimburse each preference customer for an amount equal to the customer's actual replacement costs for hydropower lost as a result of the implementation of such contract, less the cost such customer would have had to pay the Southwestern Power Administration for such hydropower.[18]

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[17] Draft reallocation report, Sec. 9.0, p. 32
[18] Section 838, P.L. 99-662 (emphasis added)

Again, for reasons cited above, I am in a unique position to understand the intent of Congress in enacting this provision. All affected parties involved in discussion over the drafting of the section recognized that any reallocation from the hydropower pool would reduce the hydropower available from Denison Dam, and that other sources of power would have to be purchased to replace the amount lost. The parties, including Congress, agreed that SWPA and its hydropower customers should be held harmless from higher costs incurred because of reallocation of hydropower storage. Note the intentional use by Congress of the word "shall" in the phrase that "the Secretary shall provide credits to the Southwestern Power Administration of amounts *equal to such replacement costs"* of power from alternative sources (emphasis added). This constitutes a mandate – it is not discretionary – on the part of the Corps to determine the impacts of the reallocation on hydropower and to compensate SWPA – and through SWPA, its customers – for the actual cost of power purchases incurred because of the reallocation. Discussion for pages on end in the draft reallocation report about the Corps method for determining hydropower impacts and compensating SWPA are totally irrelevant and should be removed from the final report. Congress, by statute, identified how compensation should be determined and directed how it should be carried out. Corps policy and regulations governing identification of and compensation for hydropower impacts in routine storage reallocations do not apply when hydropower storage is reallocated for M&I water supply at Lake Texoma under the authority of Section 838.

Conclusion

SPRA has read the comments of both SWPA and Tex-La Electric Cooperative of Texas concerning the draft EA and reallocation report. SPRA concurs in these comments and incorporates them in its comments by reference. SPRA usually submits additional comments specific to text in the draft report and EA documents, and in fact, our staff spent considerable time in reading and analyzing each page of said reports and supporting documents. However, we have read SWPA's specific comments[19] and, for the most part, their comments raise the same points that SPRA would have made in its specific comments. There seems little purpose in such repetition; however, by incorporating SWPA's specific comments by reference, we embrace them as our own.

[19] Enclosures 1 and 2 accompanying letter comments of SWPA

Finally, the draft reallocation notes that after public comments are received and reviewed, the recommendations may be modified. SPRA respectfully requests that after the public comments have been received and reviewed and the report modified to address issues raised in said comments, that SPRA be provided a copy of the revised report so that we might determine how our comments were addressed and interact with higher authorities in the Corps as appropriate.

Sincerely,

Ted Coombes
Executive Director

TEX-LA ELECTRIC COOPERATIVE OF TEXAS, INC.

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December 20, 2005

Stephen L. Nolen
Chief, Environmental Analysis and
Compliance Branch
ATTN: CESWT-PE-E (Texoma Reallocation)
U.S. Army Corps of Engineers, Tulsa District
1645 South 101st East Ave.
Tulsa, OK 74128-4609

RE: Draft Environmental Assessment and Reallocation Report – Lake Texoma Storage Reallocation Study – Comments of Tex-La Electric Cooperative of Texas, Inc.

Dear Mr. Nolen:

Tex-La Electric Cooperative of Texas, Inc. ("Tex-La") appreciates this opportunity to provide comments on the October 2005 Lake Texoma Storage Reallocation Study and the Draft Environmental Assessment ("DEA") accompanying that study.

Tex-La is a generation and transmission electric cooperative that purchases power at wholesale and resells it to member cooperatives for distribution to ultimate consumers in eastern Texas. Under a March 13, 2000 Power Sales Contract with the Southwestern Power Administration ("SWPA"), Tex-La and Rayburn Country Electric Cooperative, Inc. ("Rayburn Country") collectively purchase all of the hydroelectric power generated at Denison Dam, which impounds Lake Texoma. (Tex-La's share of the hydro output is 39.25%; Rayburn Country's share is 60.75%.) Tex-La has purchased Denison Dam power since the project's inception and expects to continue to purchase power into the foreseeable future. Tex-La is proud that its initial power purchase contract helped to provide incentive and assistance to the Federal Government and the Corps of Engineers by contributing to the economic feasibility of dam construction. Tex-La has a direct interest in the proposed water storage reallocation to the extent that it would impact the quantity, the cost, or the scheduling of hydropower generation at Denison Dam.

While Tex-La believes the October 2005 DEA represents a slight improvement over the initial draft released for comment in January 2005, we are alarmed by several aspects of the revised DEA and the Reallocation Report (Appendix F to the DEA). As

you know, the Reallocation Report was not included with the January 2005 DEA, and this is the first opportunity Tex-La has had to review that Report. **We are especially concerned that the analysis of Power Benefits Foregone by the Corps' Hydropower Analysis Center ("HAC") is inconsistent with the Water Resources Development Act of 1986 (WRDA 1986), and that consequently, HAC's analysis substantially understates both the value of the power benefits foregone and the PMA Credit due to SWPA upon the reallocation.** We are also distressed that the Tulsa District has given such short shrift to potential alternatives to a reallocation from the lake's conservation pool, including reallocating water from the flood control pool and the downstream diversion of municipal water below Denison Dam.

Tex-La has reviewed a draft of the comments on the DEA and Reallocation Report that the SWPA staff prepared for submission to the Tulsa District. Tex-La supports and adopts by reference the comments that are being separately submitted by SWPA. The following observations are intended to supplement the points raised by SWPA in its comments.

I. Comments on October 2005 DEA

§ 2.2 – Action Alternatives –

In **subsection 1** on p. 6, the DEA discounts the feasibility of adjusting the upper and/or lower limits of the conservation pool to provide additional water supply without adversely impacting hydropower. The DEA acknowledges that this alternative would benefit water supply, hydropower, and recreation, but summarily concludes that (a) flood control storage would be reduced approximately 46% and (b) "encroaching on the flood pool would not be acceptable to those in the floodplain downstream of Denison Dam." We concur with SWPA that this greatly overstates the reduction in flood control storage that would result from an encroachment on the flood pool. It is inconceivable that reallocating up to 300,000 acre-feet from the flood pool could reduce flood storage by 46%, when the flood pool has usable storage of 2,611,438 acre-feet, compared with the conservation pool's 986,730 a.f. (see Reallocation Report (DEA App. F), Table 3, p. 10). Reallocating the full amount from the flood pool would reduce flood storage by no more than 11.5%. Nor has the District supported its conclusion that reallocating from the flood pool would have consequences that would make such action "unacceptable to those in the floodplain downstream of Denison Dam."

In **subsection 6** on p. 7, the DEA dismisses Downstream Red River Diversion as an alternative and removes this option from further study. The principal stated basis for eliminating this option is the Corps' September 1990 Denison Dam-Lake Texoma Restudy, which evaluated the feasibility of pumped storage facilities at Lake Texoma with an

afterbay dam constructed seven miles downstream of the existing dam. It is unclear how the feasibility of a pumped storage hydropower facility bears upon the validity of a downstream Red River diversion as a water supply alternative. According to SWPA, representatives of the North Texas Municipal Water District ("NTMWD") and the Greater Texoma Utility Authority ("GTUA") have indicated that the Downstream Red River Diversion **is** an option that should be explored. The Tulsa District should not have dismissed this alternative so summarily.

Evaluation Matrix of Preliminary Alternatives (DEA p. 8) – The matrix should include an additional alternative: "Reallocate from Flood Control Storage." Additionally, the Conclusion listed for Alternative #7 (Reallocation from Existing Conservation Pool) incorrectly states: "Legislative mandate to reallocate hydropower storage to water supply storage." The congressional **authorization** to reallocate from hydropower storage is not a mandate, and does not relieve the Corps of the obligation under NEPA and its own regulations to evaluate a full range of potential alternatives. Further, the Conclusion listed for Alternative #6 (Downstream Red River Diversion) contains conclusions that are not substantially supported by the environmental assessment (economically unfeasible, excessive water loss, water rights issues).

§ 3 – Proposed Action (DEA p. 9) – The DEA describes the Proposed Action as follows:

> In accordance with the Water Resources Development Act of 1986, 300,000 acre-feet of water would be reallocated to water supply storage, creating a total of 450,000 acre-feet of water supply. The reallocation would provide up to 150,000 additional acre-feet for municipal, industrial, and agricultural waters users in the state of Oklahoma and up to 150,000 additional acre-feet for municipal, industrial, and agricultural waters users in the state of Texas. This apportionment of the reallocation is consistent with Section 4.04 of Article IV of the Red River Compact, which states that water storage in Lake Texoma, as well as flow from the main stem of the Red River into Lake Texoma, will be divided equally between the states of Oklahoma and Texas. [DEA at p. 9.]

Although the DEA cites WRDA 1986 for authority, the Proposed Action is in fact inconsistent with Section 838 of that law. Section 838(a) states, with specific regard to Lake Texoma, that "the Secretary is authorized to reallocate from hydropower storage to water supply storage, **in increments as needed, up to** an additional 150,000 acre-feet for municipal, industrial, and agricultural waters users in the state of Texas

and **up to** 150,000 acre-feet for municipal, industrial, and agricultural waters users in the state of Oklahoma" (emphasis added).

The only outstanding request for water storage in Lake Texoma is NTMWD's request for 100,000 acre-feet. The GTUA does not currently need additional storage because it is in the process of acquiring the remaining 11,600 acre-feet congressionally set aside for the City of Sherman, Texas. And significantly, "Oklahoma has shown very little interest in contracting for any of the storage set aside for its use." (Reallocation Report, DEA App. F, § 2.5 at p. 11.) Thus, the Proposed Action's determination to reallocate the entire 300,000 acre-feet at this time is inconsistent with WRDA 1986's authorization to reallocate "in increments as needed."

Nor is it necessary to reallocate Oklahoma's 50% share of the 300,000 acre-feet now in order to comply with the Red River Compact. As long as 150,000 acre-feet is reserved for future reallocation to Oklahoma if and when that state develops a need for the storage, there is no inconsistency with either the Compact or Section 838 of WRDA 1986.

Table 1: Annual Power Benefits Foregone (DEA p. 10) – Tex-La disagrees with the values presented in this table for the reasons elaborated upon by SWPA. Among other shortcomings, the HAC's analysis of power benefits foregone utilizes a National Economic Development (NED) system production cost approach, which undervalues the real cost of replacing federal hydropower in the regional energy market.

Table 3: Annual SWPA Credit (DEA p. 10) – Tex-La disagrees with the values presented in this table for the reasons elaborated upon by SWPA and because the HAC's method for crediting SWPA is plainly inconsistent with Section 838(d)(3) of WRDA 1986. This issue is discussed in detail below in connection with Tex-La's comments on the Reallocation Report.

§ 5.4.2 – Air Quality—Proposed Action (DEA p. 33) – The DEA incorrectly concludes that the Proposed Action would not result in any direct effects on air quality. Hydropower capacity and energy lost as a result of the reallocation of conservation storage will have to be replaced with fossil generation. There will be some impact on air quality as a result.

II. Comments on Reallocation Report (Appendix F to DEA)

Executive Summary (Realloc. Rept. pp. v-vi) –

The fourth paragraph of the Executive Summary states: "The present value of the 300,000 acre-feet of water supply storage is considerably more than the present worth of the hydropower revenues foregone." This is

undoubtedly true, but is beside the point because for purposes of pricing the municipal water supply, the relevant comparison is between the updated cost of storage and the value of hydropower benefits (not revenues) foregone. (Revenues foregone are almost always lower than updated storage costs.) Hydropower benefits foregone are equal to the actual replacement cost of hydropower capacity and energy lost to water supply storage, which at current market prices may be slightly greater than the updated cost of storage. (See August 2005 Alternative Power Benefits Foregone Analysis, Appendix A to April 2005 HAC Power Benefits Foregone Study (App 5. to DEA App. F).)

The fifth paragraph of the Executive Summary states: "Because of negative impacts, hydropower will be compensated for revenues foregone." **This statement is flatly inconsistent with Section 838(d)(3) of WRDA 1986, which requires that SWPA be credited for "the replacement cost of the hydropower lost (where replacement cost is defined as the cost to purchase power from existing alternative sources)."**

Action Alternatives (Realloc. Rept. pp. 14-16) –

The same criticisms noted above with respect to Action Alternatives in the main body of the DEA apply equally to the discussion of Action Alternatives in the Reallocation Report. In short, the report:

- Inappropriately dismisses reallocation from flood storage as a viable alternative; and
- Improperly relies on marginally relevant data from a 1990 Restudy that focused on the feasibility of pumped-storage hydropower facilities, in dismissing downstream diversions on the Red River as a municipal water supply alternative

These shortcomings are reflected in the Evaluation Matrix of Preliminary Alternatives on page 16, which should be updated accordingly.

Selected Alternative (Realloc. Rept. p. 18) –

The Corps' justification for the decision to reallocate the entire 300,000 acre-feet appears to rely erroneously on a need to maintain equal water supply allocations as between Texas and Oklahoma interests, in order to satisfy Article IV, Section 4.04 of the Red River Compact. So long as Oklahoma retains an opportunity to request that its share of the 300,000 acre-feet be made available – if, and at such time as a demand develops of that State's share of the water – the Compact's 50-50 apportionment will not be violated. Moreover, the Compact is an agreement solely between

the two States; the Federal Government is not signatory to the Compact and thus is not responsible for its enforcement (Rept. p. 11).

As noted above, there currently is a market for only 100,000 additional acre-feet of water supply storage, and "Oklahoma has shown very little interest in contracting for any of the storage set aside for its use" (Rept. p. 11). Since, as the Report observes, "[s]torage is not considered to be reallocated from its original purpose until a water storage contract is entered into, and the user starts to pay for and use the storage" (Rept. p. 18), there is no compelling need to approve the entire 300,000 a.f. reallocation at this time.

§ 5.1 Hydropower Benefits Foregone (Realloc. Rept. p. 24) –

Tex-La concurs with SWPA's criticism of the method used by HAC to determine the value of hydropower benefits foregone. Consequently, it is Tex-La's view that all of the monetary values shown in Table 7 on p. 25 are inaccurate.

§ 5.2 Hydropower Revenues Foregone (Realloc. Rept. p. 25) –

We concur with SWPA that the computation of revenues foregone should be revised to reflect updated rates for SWPA power. The Energy Charge should be 8.20 mills/kWh, and the Capacity Charge should be $36.36/kW-year, resulting in revenues foregone of $1,223,000 annually. The values in Table 8 on p. 25 are inaccurate for these and other reasons given by SWPA.

§ 5.3 Hydropower Replacement Costs (Realloc. Rept. pp. 25-26) –

This section incorrectly states the basis for crediting SWPA for hydropower benefits foregone in a manner that violates Section 838(d)(3) of WRDA 1986. As noted earlier, the statute requires that SWPA be credited for "the replacement cost of the hydropower lost (where replacement cost is defined as the cost to purchase power from existing alternative sources)." This means **actual replacement costs** over the **entire** term of the water storage reallocation. It does not mean that some NED value other than replacement costs should be substituted; nor does it mean that "revenues foregone" may be substituted for replacement costs at the end of the current SWPA power contracts term.

Although the current contracts for Denison Dam capacity and energy expire in 2015, SWPA's customers have a guaranteed right of renewal to a like amount of capacity and energy upon expiration. SWPA's marketing criteria, published in the Federal Register on March 24, 1980, state that "SWPA will not withdraw any capacity now under contract to a

preference customer in order to sell the capacity to another preference customer. As contracts expire, SWPA will offer to enter into peaking contracts for the sale of a like amount of capacity with 1,200 kWh/kw/yr of associated energy." The Federal Register notice further states that "Capacity that becomes available with the expiration of a preference customer contract is to be used for continued service to that preference customer and is, therefore, not available for allocation to others." SWPA interprets these provisions to provide existing customers with a "permanent right to the capacity and energy" produced at Denison Dam, so long as the customer agrees to accept the amounts allocated with the attendant terms and provided that transmission capacity is available. *See* SWPA Water Storage Reallocations Hydropower Impacts, draft dated 7/18/2005, at p. 7 (attached to HAC Power Benefits Foregone analysis).

Section 838(d)(3) is very explicit that power <u>revenues</u> foregone play <u>no</u> part in the calculation of credits due SWPA, either initially or after the current contracts with preference customers expire. This subsection of WRDA 1986 was carefully written (with SWPA customer involvement), directly on the heels of the 1985 administrative reallocation of storage in Lake Texoma, to insure that SWPA and its customers receive **full compensation for any power benefits lost as a result of the significant additional reallocation authorized in WRDA 1986**. Had Congress intended that the Corps employ its usual practice of crediting the PMA for only revenues foregone after the expiration of then-existing contracts (as per ER 1105-2-100), there would have been no point in including the specific language contained in § 838(d)(3).

Accordingly, section 5.3 of the Report needs to be substantially revised to reflect the correct criteria for crediting SWPA. (We also note that section 5.3 appears to incorrectly use the terms "revenues foregone" and "benefits foregone" interchangeably.) Similarly, the estimates of annual credits reflected in Table 9 on p. 26 are significantly deficient, and the table must therefore be revised consistent with the appropriate criteria (*i.e.*, actual replacement costs at market, over the entire repayment study period).

§ 6.1 Test of Financial Feasibility (Realloc. Rept. p. 28) –

Tex-La understands the need for more potable water in the region served by Denison Dam. Unfortunately, the chemical content of Lake Texoma water requires costly treatment to make it potable. Therefore, increasing demand for municipal water from Lake Texoma is dependent upon future economics of technological desalinization processes. Although the Reallocation Report acknowledges that "The water at Lake Texoma has relatively high concentration of chlorides compared to other water sources in the region," nowhere does the DEA or the Reallocation Report address

the economics of desalinization or the environmental impact of byproducts from the process.

§ 10.0 Recommendation (Realloc. Rept. p. 33) –

The Report's recommendation "that 150,000 acre-feet each for Oklahoma and Texas for municipal, industrial, and agricultural water uses (a total reallocation of 300,000 acre-feet) be allocated from hydropower storage to water supply," is inconsistent with statements elsewhere in the Report, including:

- "Oklahoma has shown very little interest in contracting for any of the storage set aside for its use" (Rept. p. 11).
- "The GTUA has not made a formal request for additional storage because they have a draft storage agreement in the process for the remaining 11,600 acre-feet congressionally set aside for the City of Sherman, Texas" (Rept. p. 11).
- "The Red River Compact is an agreement only between the signatory states. The United States is not signatory to it. Accordingly, the U.S. is not responsible for the administration or enforcement thereof." (Rept. p. 11).
- "Storage is not considered to be reallocated from its original purpose until a water storage contract is entered into, and the user starts to pay for and use the storage" (Rept. p. 18).

III. Comments on HAC Power Benefits Foregone Analysis

Tex-La has already addressed above most of its disagreements with the HAC Power Benefits Foregone analysis (April 2005) (Appendix 5 to the Reallocation Report). Our most significant concern with the Analysis relates to section 7.0, "Credit to Power Marketing Agency." The HAC inappropriately uses the planning guidance criteria from ER 1105-2-100 when Section 838(d)(3) of WRDA 1986 expressly dictates that a different methodology be used with regard to any reallocation of storage in Lake Texoma.

In particular, all references to hydropower "revenues foregone" and to "remaining period of contract" are inapplicable and should be deleted. Section 7 (pp. 36-40), including Tables 7-1, 7-2, and 7-3, should be substantially rewritten and replaced, as should Section 8.4 (SWPA Credit).

In closing, Tex-La reiterates its support for SWPA's comments, and appreciates the Tulsa District's consideration of the supplemental points raised in this letter. We urge

that before any water supply contract is executed, District personnel meet with SWPA representatives in an effort to resolve the issues raised in the comments submitted by SWPA and by its customers.

Very truly yours,

John H. Butts
Manager

cc: Bethel Herrold (SWPA)
Marshall S. Boyken (SWPA)
Ted Coombes (SPRA)
John Kirkland (RCEC)
David Fitzgerald, Esq. (RCEC counsel)
William H. Burchette, Esq. (Tex-La counsel)

TEXAS WATER DEVELOPMENT BOARD

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November 10, 2005

Mr. Stephen Nolen
Chief, Environmental Analysis & Compliance Branch
Tulsa District Corps of Engineers
1645 S. 101st East Avenue
Tulsa, Oklahoma 74128-4629

Re: Draft Environmental Assessment - Lake Texoma Storage Reallocation Study

We have reviewed the Lake Texoma Reallocation Study and have no comments or concerns with the Finding of No Significant Impact (FONSI). In addition, we support the Lake Texoma Reallocation and note that the Region C Initially Prepared Plan (IPP) relies heavily on the reallocation of Lake Texoma water to meet the future needs of residents in the Dallas-Fort Worth and surrounding areas. If the proposed Lake Texoma Reallocation is not completed, the additional water provided by this strategy will be unavailable, leaving Region C with a potentially substantial deficit in future water supply.

For this reason, the Texas Water Development Board supports the Draft Environmental Assessment and the proposed reallocation of 300,000 acre-feet of storage in Lake Texoma from hydropower to water supply. Please contact our office if you need any additional information regarding this matter.

Sincerely,

J. Kevin Ward
Executive Administrator

cs: Jim Parks, Chair, Region C Water Planning Group
Jerry Chapman, Greater Texoma Utility Authority

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APPENDIX F

LAKE TEXOMA WATER SUPPLY STORAGE REALLOCATION REPORT

STORAGE REALLOCATION REPORT
LAKE TEXOMA
OKLAHOMA AND TEXAS

US Army Corps of Engineers ®
Tulsa District

MAY 2006

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Abbreviations and Acronyms

CWCCIS	Civil Works Construction Cost Index System
Cfs	cubic feet per second
DWU	Dallas Water Utilities
EA	Environmental Assessment
ENR	Engineering News Record
FONSI	Finding of No Significant Impact
FY	fiscal year
GTUA	Greater Texoma Utility Authority
kW	Kilowatt
mgd	million gallons per day
MW	Megawatt
NED	National Economic Development
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NTMWD	North Texas Municipal Water District
O&M	Operation and Maintenance
PMA	power marketing administration
RRAT	Red River Authority of Texas
SWPA	Southwestern Power Administration
TRA	Trinity River Authority
TRWD	Tarrant Regional Water District
TXU	Texas Utilities (also known as Texas Power & Light)
UOF	Use of Facilities
USGS	U.S. Geological Survey
UTRWD	Upper Trinity River Water District
WRDA	Water Resources Development Act

STORAGE REALLOCATION REPORT
LAKE TEXOMA
OKLAHOMA AND TEXAS

MAY 2006

EXECUTIVE SUMMARY

Lake Texoma was constructed in 1944 by the Corps of Engineers and has authorized purposes of flood control, water supply, hydroelectric power, regulation of Red River flows, improvement of navigation, and recreation. The project currently provides 150,000 acre-feet of water supply storage of which 148,485 is under contract.

The Water Resources Development Act (WRDA) of 1986 authorizes the Assistant Secretary of the Army for Civil Works (ASA (CW)) to reallocate storage from hydropower to water supply in increments as needed, up to an additional 150,000 acre-feet each for Oklahoma and Texas. Funding to initiate the necessary reallocation studies was provided in fiscal year 2003. This report documents the findings and recommendations of that study.

Analyses conducted for this report include an assessment of the economic and environmental impacts of the authorized reallocation, including an analysis of the potential hydropower benefits foregone as a result of the reallocation. The study also addresses the current and future water supply needs for municipal and industrial uses in Texas and Oklahoma. The North Texas Municipal Water District (NTMWD) has requested an Water Supply Agreement for 100,000 acre-feet of storage, and the Greater Texoma Utility Authority (GTUA) has also requested a Water Supply Agreement for an additional 5,000 acre-feet of storage.

Reallocation of 300,000 acre-feet from hydropower to water supply is the most efficient means to satisfy the projected water demands in Texas and Oklahoma. This would bring the identified total water supply storage to 450,000 acre-feet. A reallocation of water supply storage from hydropower storage does not occur until water supply agreements are signed by all parties and the water supply user starts to pay for the storage. Therefore, the actual reallocation is incremental and is implemented upon execution of water supply agreements. Storage identified for reallocation, but not under contract, is still considered hydropower storage; however, it is no longer considered a dependable source of power.

The study to reallocate 300,000 acre-feet of storage from hydropower to water supply complies with NEPA. An Environmental Assessment (EA) was conducted and a Finding of No Significant Impact was signed in May 2006. Because of negative impacts to hydropower, the Southwestern Power Administration (SWPA) will be compensated for lost hydropower production, as specified in the 1986 WRDA.

Based on the 2006 Environmental Assessment and pursuant to the 1986 Water Resources Development Act, Public Law 99-662, Section 838, it is recommended that 300,000 acre-feet of conservation storage in Lake Texoma be reallocated from hydropower to water supply to meet the future municipal and industrial needs of Oklahoma and Texas communities.

STORAGE REALLOCATION REPORT
LAKE TEXOMA
OKLAHOMA AND TEXAS

MAY 2006

1.0 PURPOSE

In response to the request of several municipalities and water users in north Texas near Lake Texoma, Congress authorized the Corps of Engineers in the 1986 Water Resources Development Act (WRDA) to prepare a reallocation report that would reallocate hydropower storage to water supply at Lake Texoma. Many of these communities and water users in north Texas are served by the North Texas Municipal Water District (NTMWD) and the Greater Texoma Utility Authority (GTUA). WRDA 1986 (Appendix 11.1) authorizes the Assistant Secretary of the Army for Civil Works (ASA (CW)) to reallocate storage from hydropower to water supply in increments as needed, up to an additional 150,000 acre-feet each for Oklahoma and Texas. Funding to initiate the necessary reallocation studies was provided in fiscal year 2003. This report documents the findings and recommendations of that study.

1.1 Reallocation Amount.

Currently, about 148,485 acre-feet of storage is pending agreement or under agreement for water supply at Lake Texoma. With the proposed 300,000 acre-feet reallocation, total water supply storage of 450,000 acre-feet, yielding about 442 million gallons a day (mgd) of water supply, will become available. This proposed 300,000 acre-feet reallocation at Lake Texoma is necessary to meet expanding municipal and industrial water needs that are a result of population and economic growth in the region. Projected municipal and industrial water needs in the region are described in the State of Texas Senate Bill 1 Initially Prepared 2006 Region C Water Plan.

All Water Storage Agreements are made pursuant to the Water Supply Act of 1958 (Public Law 85-500). A copy of the NTMWD and the GTUA letters requesting water supply storage agreements for Lake Texoma are included as Appendix 11.2. The GTUA has requested a Water Storage Agreement for 5,000 acre-feet. A draft Water Storage Agreement with the GTUA is included in the report submittal package as Enclosure 4. The North Texas Municipal Water District (NTMWD) has requested 100,000 acre-feet Water Storage Agreement from the reallocated storage apportioned to the State of Texas. A draft Water Storage Agreement with the NTMWD is included in the report submittal package as Enclosure 5.

Prior to the Water Resources Development of Act (WRDA) of 1986 passed by Congress as Public Law 99-662, nearly all of the water supply storage available to the State of Texas at Lake Texoma was under agreement. After reallocation, total usable conservation storage will be 986,730 acre-feet, including 450,000 acre-feet for water supply and 536,730 acre-feet for hydropower. Section 838(c) of the 1986 WRDA provides:

> "For that portion of the water storage reserved for users in the State of Texas, the Secretary shall contract, in increments as needed, for 50,000 acre-feet with the Greater Texoma Utility Authority and 100,000 acre-feet with other qualified individuals, entities, or water utility systems."

1.2 Authority.

Authorization for this study is provided by the Water Resources Development of Act (WRDA) of 1986 passed by Congress (Public Law 99-662). Section 838 of the 1986 WRDA authorizes the Assistant Secretary of the Army for Civil Works (ASA (CW)) to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 150,000 acre-feet each for Oklahoma and Texas for municipal, industrial, and agricultural water uses (a total reallocation of 300,000 acre-feet).

2.0 PROJECT BACKGROUND

2.1 Authorization and Construction.

Lake Texoma (Denison Dam), Oklahoma and Texas, was authorized for flood control and power by the Flood Control Act approved June 28, 1938, Project Document HD 541, 75th Congress, 3d Session. Subsequent laws in 1940, 1953, 1957, and 1986 made further changes to the original authorization. Public Law 868, 76th Congress, 3d Session, was approved October 17, 1940, to improve navigation, regulate flow of the Red River, control floods, and add other beneficial purposes. Public Law 454, 78th Congress, 2d Session, approved September 30, 1944, designated the name of the impoundment as Lake Texoma. Public Law 273, 83rd Congress, 1st Session, approved August 14, 1953, added water supply storage for the city of Denison, Texas. Public Law 146, 85th Congress, 1st Session, approved August 14, 1957, Project Document HD 541 75th Congress, 3d Session, set aside 22,600 acre-feet of storage for municipal and industrial water supply for the city of Sherman, Texas. Public Law 662, 99th Congress, 2d Session, approved November 17, 1986, added recreation as a project purpose and authorized the reallocation of an additional 300,000 acre-feet of storage for water supply.

Construction of the dam, spillway, and outlet works was started in August 1939 and completed in February 1944. The project was first available to operate for full flood control without any restrictions in January 1944. The first hydroelectric turbine was placed on line in March 1945 and the second in September 1949. Construction of a highway bridge across Lake Texoma at the Willis Ferry site began on April 24, 1958, and was completed on October 30, 1960. The 5,426-foot long bridge replaces a former crossing south of Woodville, Oklahoma, on Oklahoma State Highway 99 and Texas State Highway 91. The roadway surface is about 37 feet above the top of the power pool.

The structure is a rolled earth-filled embankment with a rock-protected upstream slope. Total length along the crest, including the spillway, is 17,200 feet. The main embankment is 15,200 feet long. The maximum height of the structures is 165 feet above the streambed. A rolled earth-filled dike 3,870 feet long and 15 feet high is located in the vicinity of Platter, Oklahoma. The

Cumberland levee is 23,480 feet long with a crest elevation of 647.0 feet. This levee is part of the project.

The uncontrolled spillway is a concrete, gravity, chute-type structure, 2,000 feet long, located in a saddle on the right bank. Spillway capacity at maximum pool (elevation 666.4) is 1,050,000 cubic feet per second (cfs). The outlet works consist of three 20-foot diameter concrete conduits through the embankment and six 9- by 19-foot vertical lift gates and one emergency gate. Capacity of the outlet works is 67,500 cfs at the top of the flood control pool and 60,120 cfs at the top of the power pool. Limiting channel capacity below Denison Dam is about 45,000 cfs. The power intake structure will permit future installation of three additional power units. Pertinent data for Lake Texoma, representing elevations, area, capacity, and equivalent runoff, are shown in Table 1.

TABLE 1
LAKE TEXOMA (DENISON DAM), TEXAS AND OKLAHOMA
PERTINENT DATA

Feature	Elevation (feet)	Area (acres)	Capacity (acre-feet)	Equivalent Runoff (1) (inches)
Top of dam	670.0	--	--	--
Top of flood control pool	640.0	141,418	5,061,062(2)	2.81
Top of conservation pool	617.0	74,686	2,516,232(3)	1.40
Bottom of active conservation pool	590.0	40,434	1,048,949(3)	0.58
Conservation storage	590.0-617.0	--	1,467,283(3)	0.81
Flood control storage	617.0-640.0	--	2,544,830(2)	1.41

NOTE: Data are based on 2002 sedimentation survey.
(1) From 39,719 square miles of drainage area upstream from dam.
(2) Includes storage in Cumberland pool.
(3) Excludes storage in Cumberland pool because the Cumberland storage is not accessible for conservation storage purposes.

2.2 Project Location, Purposes, and Outputs.

Denison Dam is located on the Red River at river mile 725.9, which is approximately 5 miles northwest of Denison in Grayson County, Texas (see Figure 1). The dam, which impounds the Red River to form Lake Texoma, is located on the borders of Texas and Oklahoma. The topography surrounding the lake varies from gently sloping flats to rocky and precipitous cliffs and steep, wooded hillsides.

Five power penstocks were included in the original dam construction (see Figure 2). The first of two existing hydroelectric generating units was placed in operation in 1945; the second in 1949 (see Figure 3). Authorized project purposes are flood control, hydroelectric power, improving navigation, regulating Red River flows, water supply, and recreation. The project also provides habitat for a variety of fish and wildlife species and encompasses several historical and archeological sites.

Figure 1. Vicinity Map, Lake Texoma Storage Reallocation Project

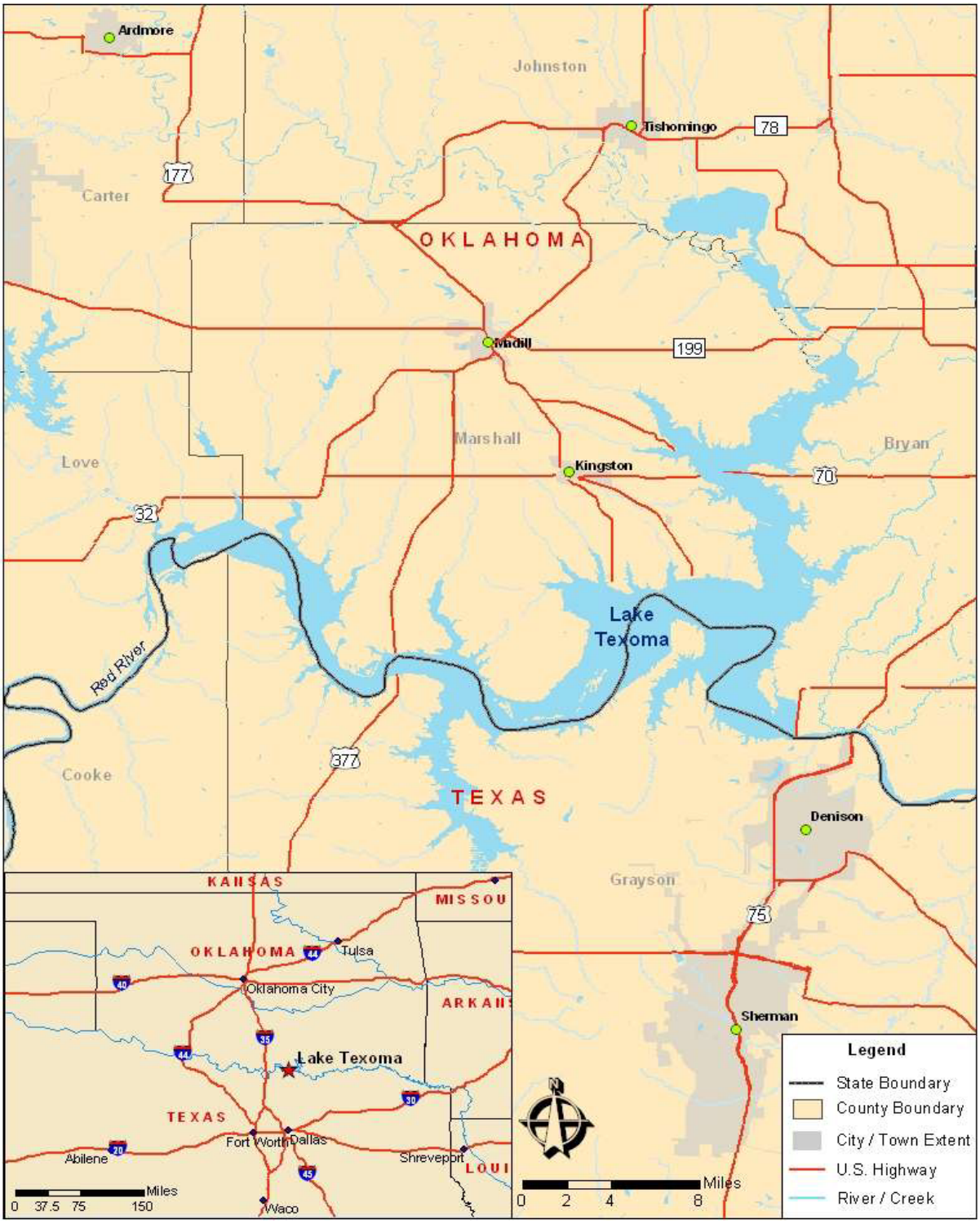

Figure 2. Denison Dam And Power Intake Structure

Figure 3. Hydropower Facility and Outlet Works At Denison Dam

Current estimates of project output include cumulative flood damages prevented in the amount of $180 million as of September 2005. Recreational use of the lake and land resources, including fish and wildlife, is estimated to be about 6 million visitors in Fiscal Year (FY) 2005. A seasonal pool plan at Lake Texoma implemented in April 1992 enhances flood control, hydropower generation, fish and wildlife, and recreation. The GTUA, acting for the city of Sherman, is the only full-time user of Lake Texoma for water supply. All other customers use Lake Texoma water when other water resources are impacted due to low flow periods or as mixing water in other lakes. Because of this, water supply withdrawals from the lake are relatively small compared to the amount of storage under agreement. However, population growth has forced the States of Texas and Oklahoma to secure future water supplies. This significant interest in developing and identifying sufficient water sources for the north-central region of Texas resulted in passage of Texas Senate Bill 1 and a determination that another large reallocation of conservation storage from hydropower to water supply was necessary. Texas Senate Bill 1 enabled the development of regional water plans in the State of Texas. The Initially Prepared Region C Water Plan was first developed in year 2000 and updated in year 2005 and 2006. This plan is the basis for the preparation of water management strategies for future utilization of water resources in the region and the State. The impacts of this reallocation on hydropower and other authorized uses were analyzed using the Corps SUPER modeling tool as part of the hydropower benefits forgone evaluation in 2004. The SUPER modeling tool is a suite of computer programs written for use in the Southwestern Division of the U.S. Army Corps of Engineers to model hydraulic operations of multi-purpose reservoir systems for flood control, hydropower, navigation, and other project purposes.

2.3 Previous Storage Reallocations and Repayment Agreements.

The Water Supply Act of 1958 authorizes the reassignment of usage of existing storage space in a reservoir project to a higher and better use. Authority for the Corps to reallocate to municipal and industrial water supply is contained in Public Law 85-500, Title III, Water Supply Act of 1958, as amended. Guidance for reallocations is found in ER 1105-2-100. Previous water storage reallocations and reports are:

- **1983 Reallocation.** In August 1983, 72,600 acre-feet was reserved for water supply in an integrated hydropower and water supply conservation pool between elevations 590.0 and 617.0 feet National Geodetic Vertical Datum (NGVD). This amount included 50,000 acre-feet that had been contracted for water supply use under the Chief of Engineer's discretionary authority and 22,600 acre-feet reserved for the city of Sherman, Texas, by Public Law 85-146, approved in August 1957.

- **1985 Reallocation.** A reallocation of 77,400 acre-feet of hydropower storage to water supply storage was approved by the Assistant Secretary of the Army (Civil Works) in December 1985. This reallocation report addressed the impacts of reallocating up to a total of 150,000 acre-feet, inclusive of the 72,600 acre-feet, and served as the basis for a 75,000 acre-foot storage agreement with the NTMWD. The 1985 report addressed the impacts of the total reallocation (150,000 acre-feet) on the project to ascertain if the last added increment of water supply storage would seriously affect the purpose for which the project was constructed or if major structural or operational changes would

have been necessary. It was determined that the reallocation neither seriously affected other project purposes nor were any structural or operational changes needed.

- **1992 Supplemental Reallocation Report to the 1983 Letter Report.** The 1992 supplemental reallocation report addressed the impacts of reallocating 5,500 acre-feet of Sherman's authorized 22,600 acre-feet of storage. National Environmental Policy Act (NEPA) documentation and public comment were accomplished under the 1985 Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for Regulatory Permit Application No. TXR3001311.

- **1997 Supplemental Reallocation Report to the 1983 Letter Report.** In 1997, a supplemental reallocation report was accomplished to address not only the impacts of reallocating an additional 5,500 acre-feet of Sherman's authorized storage but to also address the impacts of reallocating the remaining 11,600 acre-feet. NEPA documentation in the form of an EA that included, public comments, and a hydrologic analysis for the entire 22,600 acre-feet was accomplished for that report and concluded in a FONSI. Coordination with the U.S. Fish and Wildlife Service, the Oklahoma Department of Wildlife Conservation, the Oklahoma and Texas Historical Societies, and the Oklahoma Archeological Survey concluded that there would be no impacts due to reallocation of the entire 22,600 acre-feet of storage. This reallocation did not require operation changes or construction modifications to the project.

- **2004 Supplemental Reallocation Report to the 1983 Letter Report.** In 2002, the GTUA requested that the last Sherman's 11,600 acre-feet of storage be placed under agreement. A supplemental reallocation report was accomplished and a determination made that there have been no significant changes in the project since the 1997 reallocation. A draft agreement is currently under review. Once this agreement is finalized, all of Sherman's congressionally set aside storage will be under agreement. If GTUA requires additional storage in the future it will come from the storage set aside for them in Public Law 99-662

2.4 Reservoir Storage.

The amount of storage available in the reservoir is dependent in part upon the rate of sedimentation over time. Sedimentation surveys have been completed at Lake Texoma in 1969, 1985, and 2002. From those surveys, estimates of storage remaining in the conservation pool for year 2044 were estimated. Table 2 displays the year the sediment survey was conducted and the projected storage in the conservation pool between elevation 590.0 and 617.0 NGVD in year 2044.

TABLE 2
CONSERVATION POOL STORAGE
YEAR 2044

Sediment Survey (year)	Conservation Pool Storage (Acre-feet)
1969	880,000
1985	1,114,909
2002	986,730

The storages for each water supply user and project purpose have been adjusted in accordance with an agreement or authorizing language as a result of the 2002 sediment survey. This information and data is summarized in Table 3. The U.S. Army Corps of Engineers, Tulsa District currently has five draft water storage agreements in the approval process, including two draft agreements for 100,000 acre-feet of storage with the NTMWD and 5,000 acre-feet of storage under the GTUA, both of which accompany this report. The other draft agreements involve relatively small amounts of water for irrigation purposes and have not yet been developed and coordinated with the customer. Assuming that all the agreements are approved for final negotiations, the remaining balance of storage identified for reallocation for future water supply for Texas and Oklahoma communities will be 196,515 acre-feet which represents 19.916% of the conservation storage. Hydropower will have use of storage not under contract until it is reallocated through execution of an agreement. When all storage identified for reallocation under this study (450,000 acre-feet) is under agreement, 54.4% of the remaining conservation usable storage will be available for hydropower generation.

TABLE 3
LAKE TEXOMA USABLE STORAGE
YEAR 2044

Purpose	Elevation (feet, NGVD)	Usable Storage (acre-feet)(1)	Usable Storage (percent)	Conservation Storage (percent)
Flood Control	640-617	2,378,908	70.682	
Conservation	617-590	986,730	29.319	100
Water Supply				
Denison		21,300	0.633	2.159
TP&L		16,400	0.487	1.662
RRAT		450	0.013	0.046
RRAT		2,054	0.061	0.208
NTMWD		85,406	2.537	8.656
GTUA (2)		5,500	0.163	0.557
GTUA (2)		5,500	0.163	0.557
GTUA (Final) (2)		11,600	0.345	1.176
OTRD (Final)		275	0.008	0.028
NTMWD (Pending)(3)		100,000	2.971	10.135
GTUA (Pending) (3)		5,000	0.149	0.507
Future Agreements (4)		196,515	5. 839	19.916
Water Supply Total		450,000	13.370	45.605
Power		536,730	15.947	54.395
Total Usable Storage		3,365,638		

(1) Storage remaining after 100 years sedimentation from the date the project became operational based on the 2002 sediment survey.
(2) Public Law 85-146 states rights to storage for Sherman, Texas. Actual law states 41,000 acre-feet, but withdrawal is limited. Amount shown reflects the conservation storage required for the withdrawal limitation during critical hydrologic period.
(3) Section 838 of Public Law 99-662 authorizes the Secretary of the Army to reallocate up to 300,000 acre-feet of storage for water supply from hydropower. Total allocated available water supply is 450,000. From the 1985 reallocation, 1,515 acre-feet of storage remains uncontracted.
(4) Reallocated storage from the 1986 WRDA is 98,485 acre-feet and 1,515 acre-feet remaining from the 1985 reallocation.

2.5 Additional Project Information.

The NTMWD has requested a 100,000 acre-foot water storage agreement from the Texas allocation under Public Law 86-662, Section 838. The only other storage available under the Texas allocation is 50,000 acre-feet specifically set aside for the GTUA. The GTUA has made a formal request for 5,000 acre-feet of storage (Appendix 11.2). The city of Dallas, Texas, has contacted the U.S. Army Corps of Engineers, Tulsa District on numerous occasions concerning available storage from Lake Texoma, but has been informed that there is no additional storage available from the Texas allocation. Oklahoma has shown very little interest in contracting for any of the storage set aside for its use.

2.5.1 Texas and Oklahoma Apportionment.

A related issue being addressed in the reallocation is the apportionment of water supply between Oklahoma and Texas. The State of Oklahoma has expressed concerns regarding previous allocations and whether additional contracts with entities in the State of Texas would be contrary to the terms of the Red River Compact. Corps legal review determined that the proposed reallocation does not provide a basis for altering existing allocations or contracts with any Oklahoma or Texas entity, nor do the existing contracts with Texas provide a basis to diminish the amount of the reallocation made available to entities in the State of Texas for future water supply storage contracts to less than that specified in WRDA 86. The Oklahoma Water Resources Board's letter to the Corps of Engineers dated May 25, 2004, addressed the issue of apportionment and is enclosed in Appendix 11.3.

Section 838(a) of the 1986 WRDA specifically authorizes the reallocation from hydropower storage to water supply storage, in increments as needed, up to 150,000 additional acre-feet for users in the State of Texas and 150,000 additional acre-feet for users in the State of Oklahoma. With regards to the Texas portion of that reallocation, the statute further specifies at 838(c) that the Secretary "shall contract, in increments as needed, for 50,000 acre-feet with the Greater Texoma Utility Authority and 100,000 acre-feet with other qualified individuals, entities, or water utility systems." The statute contains no language that could be construed as limiting the amounts specified for reallocation. The language of Section 838 provides no alternative but to provide each State with up to the 150,000 acre-foot reallocation specified therein. Previous allocations or actual agreements entered into for water supply storage do not affect the amount to be made available to each State under the reallocations specified in Section 838. Conversely, the reallocations specified in Section 838 do not affect or alter the allocations previously made and/or agreements previously entered into with any entity. In other words, the agreements that already exist with Texas cannot be used as a basis to limit the amount made available under the reallocation to less than 150,000 acre-feet, nor can the requirement to reallocate up to 150,000 acre-feet be used as justification by the Corps to abrogate or amend earlier water supply storage agreements. The proposed reallocation will make 150,000 acre-feet of storage available to meet future needs for Lake Texoma storage by Oklahoma.

Section 838(e) of the 1986 WRDA states that "[n]othing in this section shall be construed as amending or altering in any way the Red River Compact." Section 4.04 of the Red River Compact provides that, with regard to the main stem of the Red River and Lake Texoma, water

storage therein is apportioned among the signatory states with 200,000 acre-feet for Oklahoma and 200,000 acre-feet for Texas, and any additional quantities at a ratio of 50% for Oklahoma and 50% for Texas. The Corps is not "amending or altering" the terms of the Red River Compact by complying with the Congressional mandate of reallocating equal amounts of storage to each state from hydropower to water supply storage. What may occur, should Texas enter into agreements for the totality of storage specified to be made available in Section 838, is that Texas will exceed the parameters set out in the Red River Compact. However, the Red River Compact is an agreement only between the signatory states. The United States is not a signatory to it. Accordingly, the U.S. is not responsible for the administration or the enforcement thereof. If Texas attempts to take actions that are contrary to the Red River Compact, it will be the responsibility of the States to address those actions.

2.5.2 Hydrologic Data Information.

The determination of dependable water supply yield was calculated using the Corps SUPER Model. The SUPER modeling tool can simulate flood control operations and conservation pool operations, including hydropower, water supply, water quality, diversions, and returns. In addition to modeling dependable yield, it also was used for baseline data in calculating hydropower energy changes. This hydrologic information was used by the U.S. Army Corps of Engineers Northwestern Division Hydropower Analysis Center (HAC) in its Power Benefits Foregone Water Supply Storage Reallocation Report, April 2005. Findings of the SUPER model simulation indicated that a critical dependable yield of 295 million gallons per day (mgd) would be available from the proposed 300,000 acre-foot reallocation. The Hydrologic SUPER model Hydrology and Hydraulics (H&H) Storage Yield Analysis report is attached as Appendix 11.4.

3.0 PLAN FORMULATION

3.1 Preliminary Alternatives.

During plan formulation the goal is to identify and perform an initial evaluation of preliminary alternatives for water supply. Consideration of all reasonable alternatives is required under the National Environmental Policy Act (NEPA) to create a better decision-making process for implementing projects and programs that could adversely impact the environment. The NEPA requires Federal agencies to incorporate environmental considerations in their planning and decision-making process and requires the use of a systematic and interdisciplinary approach. The Planning Guidance Notebook, Engineering Regulation (ER 1105-2-100), dated April 2000, requires the formulation and evaluation of a full range of reasonable alternative plans. Alternative plans are formulated to take into account the overall problems, needs, and opportunities afforded by the proposed action. Those plans are assessed in a manner consistent with the national objective of contributing to National Economic Development (NED) and protecting the Nation's Environment, and consistent with Federal laws and regulations. The NED objective is to provide the most cost-effective water supply source to meet the region's future municipal and industrial requirements.

Economic development problems in the region include insufficient sources of municipal and industrial water supply at affordable costs to meet future municipal and industrial needs. Due to

time required to evaluate the issues of storage reallocation, and near term need, completion of this Reallocation Report at this point is important for water marketers in Texas. The reallocation opportunity would provide a source of water supply of sufficient quantity and reasonable cost to meet future water demands as the need arises. However, the water available at Lake Texoma for water supply will not meet all the expected future demand for water in the region. Other sources of water supply would be required to meet future demands as well. In addition the lower quality of water at Lake Texoma for municipal and industrial water supply will require blending or additional treatment.

The basis for water supply evaluations in Texas is found in the State of Texas Senate Bill 1 "Initially Prepared 2006 Region C Water Plan," draft version dated June 2005. This report discusses in detail the problems and needs for additional water supply in Region C by water user group, community, and water utility. Future water demands and the availability of existing and potential sources of water supply are presented and evaluated along with water management strategies of major water providers and communities in the North Texas region. These strategies relate to existing and future demand and use of all existing and potential sources of water supply, including Lake Texoma. For Oklahoma, water supply and demand information is taken from studies completed by the Tulsa District for the Oklahoma Water Resources Board (OWRB) in support of the Oklahoma State Water Plan. This study indicates that at this time existing and potential sources of water supply are available to meet future municipal and industrial needs in the Oklahoma region surrounding Lake Texoma.

The identified need examined in this Reallocation Report is the request by the North Texas Municipal Water District (NTMWD) for additional water supply storage of 100,000 acre-feet in Lake Texoma and GTUA. The letter request is shown as Appendix 11.2 to the reallocation report. The Region C Water Plan recommends, as a water management strategy, the reallocation of 100,000 acre-feet of storage in Lake Texoma to the NTMWD and 50,000 acre-feet of storage to the GTUA, as directed in the 1986 WRDA.

The "Denison Dam-Lake Texoma Restudy, Oklahoma and Texas, Feasibility Report," completed by the Corps of Engineers in September 1990, evaluated whether Lake Texoma should be modified to deal with present and projected water resource problems and needs in the region with the focus on increased hydropower production. Although the Restudy focused on increasing hydropower production at Denison Dam, the Restudy is useful in the preliminary plan formulation and evaluation of alternative plans regarding changes in the size of the conservation pool and the flood pool at Lake Texoma and the feasibility of providing additional flood storage above Lake Texoma to compensate for loss of flood storage at Lake Texoma.

3.2 No Action Alternative.

The Council on Environmental Quality (CEQ) regulations implementing the provisions of NEPA requires Federal agencies to consider a No Action Alternative. These regulations define the No Action Alternative as the continuation of existing conditions and their effects on the environment, without implementation of, or in lieu of, a proposed action. The No Action Alternative represents the existing condition, would not result in any new project-related environmental impacts, and serves as the baseline against which to compare the effects of the

other alternatives. The Corps considers the option of "No Action" as one of the alternatives in order to comply with the requirements of the NEPA. The No Action alternative is the condition reasonably expected to prevail over the period of analysis, given current conditions and trends, and assuming that no project would be implemented by the Federal government to achieve the planning objectives. The No Action alternative, which is synonymous with the Without-Project Condition, forms the basis from which all other alternative plans are measured. This alternative would not address the intent of Public Law 99-662, Section 838, which authorized the Secretary of the Army to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 300,000 acre-feet of storage, for municipal, industrial, and agricultural water users in the States of Texas and Oklahoma. The No Action Alternative would not reduce the current need for additional water supply to meet the expanding municipal and industrial water supply demands that are a result of population growth in the region.

3.3 Action Alternatives.

3.3.1 Potential non-structural solutions.

Potential non-structural solutions include those that would alter the demand for increased water supply in the future. These alternatives would at least partially address some of the problems and needs in the region. The non-structural alternative is to conserve water to reduce the need for additional sources of water supply. Water Conservation can include altering the demand for water by water rationing and pricing methods. Communities and major water user groups, such as the NTMWD and the GTUA, already have plans to reduce water consumption as discussed in the "Initially Prepared Region C Texas Water Plan 2006." Water reuse is also a viable non-structural alternative that has been implemented in many areas where permitted. Reuse water in the region is expected to be about 771,000 acre-feet per year by 2060. Those communities and major water utilities, such as the NTMWD, that have undertaken steps to reuse water where feasible are shown in the Region C water plan. Where available, reuse water is utilized prior to development of other sources of water supply.

Potential structural and/or operational solutions to the need for additional water supply are:

3.3.2 Change the limits of the conservation pool.

As evaluated in the 1990 Restudy, one alternative is to change the upper and/or lower limits of the conservation pool to provide additional water supply. Raising the upper limits of the conservation pool would allow higher operating heads for hydropower (when not used for water supply) and higher pool levels for recreation. The need for water supply storage still exists. To address the need for additional water supply, storage would have to be reallocated from hydropower. Recreation was added as a project purpose by the WRDA of 1986. In response to requests to provide a more reliable pool operation for recreation during the high recreation season, a seasonal pool operation was put into effect. Raising both the upper and lower limits of the conservation storage pool would benefit hydropower and water supply and recreation; however, as proposed in the 1990 Feasibility Report flood control storage would be reduced approximately 46%, and existing recreation and wildlife areas around the lake would be adversely impacted. Reduction in flood control storage at Lake Texoma by encroaching on the

flood pool is not acceptable. Lake Texoma now controls the 45-year flood event. Cumulative flood damages prevented by Lake Texoma is about $180 million through FY 2005. Raising the lower limits of the conservation pool would restrict hydropower operations and limit water supply although it might be beneficial to recreation users of the lake. The 1990 Restudy also found that enlarging the flood control capability of the existing project was not feasible due to its adverse in-pool impacts on recreation facilities, wildlife, and cultural resources. The 1990 Study also found that the annual costs with a one-foot rise would be over $2.0 million in 1988 dollars. Reallocating 300,000 acre-feet of storage in the flood control pool would result in a reduction of about 12.6 % of the flood control pool by year 2044.

3.3.3 New reservoirs above Lake Texoma.

New reservoirs above Lake Texoma on the Red River and the Washita River were evaluated in the 1990 Restudy. Both the Marietta site on the Red River and the Durwood site on the Washita River were found to be not economically feasible for development for flood control operation due to high costs relative to economic benefits and adverse environmental effects. These projects would compensate for loss of flood control storage at Lake Texoma if the upper limits of the conservation pool were increased for hydropower and/or water supply storage.

3.3.4 New groundwater wells.

In some counties in Region C, current use of groundwater exceeds or is near the estimate of long-term reliable groundwater supply. The Region C water plan indicates that water suppliers will need to develop alternate sources of water supply since groundwater resources are overused by temporary over drafting. Some entities in the region rely on groundwater to meet existing and future water needs. These users tend to need smaller quantities of water. However, with large users, the quantity of water available from new groundwater wells would not be sufficient to meet long-term future needs for reliable water supply in the region. Temporary over drafting of groundwater can be used only as an interim measure until other supplies are developed.

3.3.5 Existing surface water sources.

The Region C water plan, as a guide to utilization of existing sources of water supply, discusses all existing sources of surface water supply currently used and expected to be used in the region to year 2060 to meet future water demands. The water management strategy in Region C is to use those sources of supply that are the most cost effective and viable alternative to meet expected municipal and industrial demands. Institutional considerations, such as joint use with other water using entities, also must be taken into account.

3.3.6 New surface water sources.

The Region C water plan discusses all new sources of surface water supply currently used and expected to be used in the region to year 2060 to meet future water demands. In addition, the water management strategy and institutional problems are presented by decade and source of supply for the major water users along with their estimated costs of development. In some cases, several water using entities combine their resources to develop a new source of water supply for

a shared use. The reallocation report discusses the water management strategy for the NTMWD and the GTUA regarding existing and new surface sources of water supply. .

3.3.7 Downstream Red River diversion.

The 1990 Restudy addressed pumped storage hydropower facilities at Lake Texoma with an afterbay dam constructed about 7 miles downstream of the existing dam. That study concluded that the afterbay pool would increase the tailwater elevation at the existing units and reduce their efficiency. This option was not economically feasible. Downstream re-regulation dams and offsite storage would be required with the Red River Diversion. Construction of a downstream dam was considered at the Kiamichi River but was removed from further study because evaporation and seepage would result in losses of up to approximately 25% between there and the Denison Dam. Water quality releases from Hugo Dam into the Kiamichi River could not be withdrawn for water supply without increased releases from Hugo to replace water quality flows. This would result in a faster drawdown of Hugo Lake. Releases of water from Lake Texoma would have to be increased by the amount lost to evaporation and seepage which would result in a faster drawdown of Lake Texoma. Withdrawal of water from the Red River below Denison would require communities located in the upper reaches of Lake Texoma to construct extensive pipeline facilities to transport water greater distances rather than withdrawing water from intake structures located much closer within the lake. Downstream water rights would also be an issue. Downstream Red River Diversions were removed from further study.

3.3.8 Evaluation matrix of preliminary alternatives.

The following evaluation matrix displays the screening of preliminary alternatives. The matrix displays potential study alternatives. The alternative of reallocating storage from the existing conservation pool to water supply was found to be the only reasonable alternative based on the results of the screening criteria.

Table 4
Evaluation Matrix of Preliminary Alternatives

Alternative	Potential Study Alternatives	Screening Criteria and Results								Conclusion	Appropriate for Detailed Evaluation
		Meet Future Water Demands	Hydropower Impacts	Environmental Impacts	Flood Control Impacts	Recreation Impacts	Economic Costs	Legislative Direction (WRDA 1986)	Evaluated in Previous Studies		
1	No Action	No	None	None	None	None	Low	No	Yes	Does not meet legislative requirements Does not meet region and water management strategy	No
2	Conservation	No	None	None	None	None	Low	No	No	Conservation incorporated into Region C water management strategy prior to use of Lake Texoma	No
3	Change in Pools	Yes	None	High	Yes	Yes	High	No	Yes	Contrary to legislative directives. High environmental impacts	Yes
4	New Reservoirs above Lake Texoma	Yes	None	High	None	None	High	No	Yes	Difficult to justify based on high costs and environmental impacts	No
5	New Groundwater Wells	No	None	None	None	None	High	No	Yes	Production not sufficient to meet high municipal and industrial demands.	No
6	Existing Surface Water Sources	Yes	None	None	None	None	High	No	Yes	Accounted for in Texas State Water Plan, Region C	Yes
7	New Surface Water Sources	Yes	None	High	Yes	Yes	High	No	Yes	Accounted for in Region C in Texas State Water Plan	Yes
8	Downstream Red River Diversion	Yes	None	Medium	None	Yes	High	No	Yes	Economically unfeasible, excessive water loss, extensive pipeline construction.	No
9	Reallocation from Existing Conservation Pool	Yes	High	Low	None	None	Low	Yes	Yes	Legislative mandate to reallocate hydropower storage to water supply storage.	Yes

3.4 Selected Alternative.

The selected alternative would require no change in pool elevations at Lake Texoma. In accordance with the Water Resources Development Act of 1986, 300,000 acre-feet of water currently in hydropower storage would be reallocated to water supply storage. The reallocation would provide up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the state of Oklahoma and up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the state of Texas. This apportionment of the reallocation is consistent with Section 4.04 of Article IV of the Red River Compact, which states that water storage in Lake Texoma, as well as flow from the main stem of the Red River into Lake Texoma, will be divided equally between the states of Oklahoma and Texas.

Water supply at Lake Texoma was not an original project purpose. Several special congressional authorizations have made storage available to users throughout the years. Public laws in 1953 and in 1957 authorized the city of Denison and the city of Sherman, Texas, to receive water supply from Lake Texoma. When the Federal government realized that there was an increasing demand for water supply storage, studies were conducted (in 1983 and 1985) to reallocate a total of 150,000 acre-feet of storage from the hydropower purpose to water supply. The cost charged to the user for the storage is based on the highest either of benefits or revenues foregone, replacement costs (as a result of reallocating hydropower storage), or updated cost of storage. The cost of the storage not under contract, will continue to increase in value annually until a water storage contract is signed. Storage is not considered to be reallocated from its original purpose until a water storage contract is entered into, and the user starts to pay for and use the storage.

4.0 ECONOMIC ANALYSIS

4.1 Water Supply Demand Analysis.

4.1.1 Study Area.

The study area includes the counties and water systems or districts in the North Texas region that are currently using Lake Texoma water or may use Lake Texoma water in the future. The basis for evaluation of water supply and demands for the region is the "Initially Prepared Texas State Water Plan for Region C 2006," June 2005 draft. Region C includes Grayson County adjacent to Lake Texoma mainly in the Red River Basin and the Dallas-Fort Worth metropolitan area, lying mostly in the Trinity River Basin. Appendix 11.5 presents more detailed water supply demand analysis information for both Texas and Oklahoma. The Oklahoma information was developed by the U.S. Army Corps of Engineers, Tulsa District and others for the 2005 update of the Oklahoma State Water Plan.

There are over 34 reservoirs in Region C with conservation storage over 5,000 acre-feet. Additional reservoirs outside the region provide water supply to the region. Although use of groundwater has been decreasing, the Trinity Aquifer supplies most of the groundwater used in this region, mainly in rural areas. Ninety percent of the total water supplied in the region is from surface sources. Municipal supply accounts for about 85% of current water use. Little

wastewater is treated and returned for use although municipalities are considering reuse as a source of future supply. In addition to the GTUA serving the Sherman-Denison communities in Grayson County, there are five major water providers in the region. They are: a) the NTMWD, b) DWU, c) the TRWD, d) the city of Fort Worth, and e) the TRA. Since the NTMWD has requested additional water supply storage at Lake Texoma, existing and potential sources of water supply for the NTMWD are discussed below.

4.1.2 Water Demand.

Although all 16 counties in Region C are evaluated in the State Water Plan, five counties (Collin, Dallas, Denton, Grayson, and Tarrant) stand out for comparative purposes relative to probable future use of Lake Texoma water. There are 35 wholesale water providers and 351 water user groups in Region C. Major water providers serve all or portions of other counties as well. These counties have as their major providers of water the NTMWD (Collin County), the DWU (Dallas County), and the GTUA (Grayson County). Two other counties, Denton (DWU) and Tarrant (TRWD), also account for expected large future municipal water demands. Water conservation is also built into the demand projections. Currently implemented water conservation strategies and water conservation assumption are implicit in the water demand projections for the region.

Table 5 shows historical and future water demand for selected counties in Region C. These counties represent the majority of the demand for water in the region.

TABLE 5
HISTORICAL AND PROJECTED WATER DEMAND BY SELECTED COUNTIES
(acre-feet)

County	Year				
	1996	2000	2020	2040	2060
Collin	89,230	138,306	287,247	402,383	526,315
Dallas	505,423	623,535	785,788	879,106	1,055,030
Denton	65,075	93,982	212,211	307,951	406,700
Grayson	29,152	32,478	45,954	55,613	66,715
Tarrant	291,406	331,066	451,536	559,650	718,098
Total	980,286	1,219,367	1,782,736	2,204,703	2,772,858
Region C Total	1,126,621	1,380,556	2,100,519	2,622,513	3,311,217
Municipal	946,454	1,196,452	1,828,831	2,294,491	2,915,773

Source: Initially Prepared Region C Water Plan 2006, June 2005 draft.

4.2 North Texas Municipal Water District.

The NTMWD supplies wholesale water and wastewater service to member cities and customers in Collin, Denton, Fannin, Dallas, Rockwall, Hunt and Kaufman counties in north-central Texas. The cities of Plano, Richardson, Garland, Mesquite, and McKinney are a few of the larger municipalities receiving all or part of their service from the NTMWD. Water demand is expected to double between 2010 and 2060, with a shortage of about 100,000 acre-feet by 2010, based on current available supplies, increasing to 534,000 acre-feet by 2060. The main water treatment

plant for the NTMWD is located near Lake Lavon. The NTMWD receives its surface water supply from three primary sources, Lake Lavon, Cooper Lake, and Lake Texoma.

4.2.1 Existing Sources of Water Supply: NTMWD.

- **Lake Lavon.** Lake Lavon is located on the East Fork of the Trinity River approximately 1 mile northwest of Lavon, Texas, in Collin County. The Corps of Engineers built Lake Lavon in 1953 for flood control and water supply. The lake has conservation storage of 380,000 acre-feet with a dependable yield of about 92.0 mgd. The entire yield is allocated and contracted to the NTMWD which has a water right to 104,000 acre-feet of storage. The lake also receives up to 24.0 mgd of effluent from the Wilson Creek Wastewater Treatment Plant and is the receiving point for inter-basin transfers of water from Lake Texoma and Lake Cooper. Facilities are in place to utilize the entire available yield of Lake Lavon.

- **Jim Chapman Lake/Cooper Dam.** Jim Chapman Lake/Cooper Dam is a Corps of Engineers reservoir on the South Sulphur River, 4 miles southeast of Cooper, Texas, in Hopkins and Delta counties. Jim Chapman Lake was completed in 1992. The reservoir has conservation storage of 273,120 acre-feet with a dependable yield of ±107.1 mgd. The NTMWD, the city of Irving, and the Sulphur River Water District (SRWD) hold water rights in Lake Chapman totaling 146,250 acre-feet per year, of which 127,320 acre-feet per year can be exported for use in Region C. The NTMWD receives 57,214 acre-feet per year; the city of Irving, 54,000 acre-feet per year; and the Upper Trinity Regional Water District (UTRWD) (purchased from the SRWD), 16,106 acre-feet per year. The SRWD has contracted a portion of its yield to the UTRWD for use in the Denton County, Texas, area. Currently available water from Lake Jim Chapman for the NTMWD is 50,802 acre-feet per year in 2000 decreasing to 45,843 acre-feet per year by 2060. The city of Irving receives 47,948 acre-feet per year in 2000 decreasing to 43,268 acre-feet in 2060. Finally, the UTMWD receives 14,301 acre-feet per year in 2000 decreasing to 12,905 acre-feet per year by 2060. Each entity is permitted to divert at a maximum rate of 122% of allocated yield. The NTMWD has facilities in place to transfer up to 110 mgd of water from Cooper Lake to Lake Lavon.

- **Lake Texoma.** Lake Texoma, on the Red River near Denison, Texas, is the third surface water source utilized by the NTMWD. The reservoir has 1,467,000 acre-feet of conservation storage. Lake Texoma is expected to have 986,730 acre-feet of conservation storage by year 2044. The RRAT, the GTUA, the city of Denison, the NTMWD, and Texas Utilities (TXU) have water rights in Lake Texoma. Lake Texoma water is pumped and then gravity flowed to Lake Lavon and blended for subsequent use. The NTMWD has contractual rights to divert up to 77,300 acre-feet or about 75.0 mgd of water from Lake Texoma. Other entities that have storage at Lake Texoma are the GTUA, acting for the city of Sherman, Texas, 22,600 acre-feet; the city of Denison, 21,300 acre-feet; the TXU, 16,400 acre-feet; and the RRAT, 2,473 acre-feet.

Groundwater sources for the NTMWD area are of poor quality or limited quantity and, therefore, are not considered adequate potential sources of water supply.

4.2.2 Potential Sources of Water Supply.

Major regional wholesale water providers, such as the NTMWD, the DWU, the TRWD, and the UTRWD, have similar strategies. These strategies include water conservation, reuse water, installation of connections to existing sources already under contract, connection to other existing sources, and development of new reservoirs. In the Region C Water Plan, three new reservoirs are proposed: Muenster Reservoir (Cooke County), Lake Ralph Hall (Fannin County), and Lower Bois d'Arc Reservoir (Fannin County). Lower Bois d'Arc, formerly known as New Bonham Reservoir, will provide supplies for the NTMWD. The water plan also includes two lakes outside the region that will provide supplies to the region, Marvin Nichols Reservoir and Fastrill Reservoir. Even with these and other recommended projects, the 2006 Region C Water Plan shows that supplies are needed from Lake Texoma. Toledo Bend Reservoir, and Oklahoma water are possible sources of new supply for the NTMWD as well as for the other major providers. Oklahoma water remains a promising source of supply for the North Texas region although the Oklahoma legislature has a current moratorium on export of water from the state. Although the long term (year 2060) recommended strategy in the Water Plan is to consider Oklahoma water as an additional source of water supply for the TRWD and the NTMWD, discussions with the State of Oklahoma have precluded this water being available to meet immediate needs. Oklahoma water is also considered an alternate strategy for the DWU and the city of Irving if the water becomes available in the future.

4.2.3 Water Supply Alternatives.

Water supply alternatives other than those joint efforts discussed above are:

- **NTMWD Conservation.** Conservation is the projected conservation savings for the NTMWD's existing and potential customers based on the Region C recommended water conservation program.

- **Interim Treated Water Purchase from Dallas Water Utilities.** The NTMWD is negotiating with the DWU to purchase an annual average of up to 10 mgd (11,210 acre-feet per year) of treated water.

- **Additional Wilson Creek Reuse Project.** The NTMWD currently has a water right allowing the reuse of up to 35,941 acre-feet per year (32 mgd) of actual discharges from the Wilson Creek Wastewater Treatment Plant.

- **East Fork Reuse Project.** The NTMWD has applied for a water right to divert treated wastewater from the East Fork of the Trinity River near Crandall. The estimated supply available from this project will increase with increasing wastewater flows to 102,000 acre-feet per year.

- **Additional Lake Lavon Yield.** The NTMWD currently has a water right allowing the diversion of up to 104,000 acre-feet per year from Lake Lavon (in addition to water delivered to the lake from return flows, Lake Texoma, and Lake Chapman).

- **Interim Purchase of Lake Texoma Water from GTUA/Sherman.** The NTMWD has reached an agreement with the city of Sherman and the GTUA to purchase surplus Lake Texoma water.

- **Upper Sabine Basin Supply.** The NTMWD is negotiating with the Sabine River Authority to divert water from Lake Tawakoni or Lake Fork on an interim basis.

- **New Supply from Lake Texoma.** The NTMWD has requested a contract for additional storage in Lake Texoma from the U.S. Army Corps of Engineers, Tulsa District and has applied for a Texas water right to impound up to 100,000 acre-feet in Lake Texoma and divert up to 113,000 acre-feet per year from the lake. The U.S. Congress has authorized the reallocation of 150,000 acre-feet of storage in Lake Texoma from hydroelectric power generation to municipal use in Texas, with 50,000 acre-feet per year reserved for the GTUA. The NTMWD has expressed interest in an agreement for 100,000 acre-foot reallocation for municipal use not reserved for the GTUA and would blend the water with higher quality supplies from other sources or develop a desalination plant. At this time, blending appears to be the more economical approach. It is assumed that the NTMWD will use one part of Lake Texoma supply for four parts of other imported water. The NTMWD would deliver the water directly from Lake Texoma and/or from the Red River downstream of the lake. (Downstream diversions would require a longer pipeline but offer the advantage of reduced levels of dissolved solids.)

- **Lower Bois d'Arc Creek Reservoir.** The Lower Bois d'Arc Creek Reservoir is a proposed reservoir on Bois d'Arc Creek in the Red River Basin. It was included in the 2001 Region C Water Plan as a supply for the NTMWD, and the NTMWD has continued to study the project. The Lower Bois d'Arc Creek Reservoir would provide up to 123,000 acre-feet per year for the NTMWD and Fannin County. The Lower Bois d'Arc Creek Reservoir would be developed by 2020.

- **Fannin County Water Supply System.** The NTMWD would cooperate with Fannin County entities to develop a treated water supply system for Fannin County water users after the Lower Bois d'Arc Creek Reservoir is developed in 2020.

- **Marvin Nichols Reservoir** is another potential two-stage impoundment on the Sulphur River and White Oak Creek in southwestern Bowie and Morris counties. The total yield of water supply is about 612,300 acre-feet per year, assuming that Ralph Hall Lake is senior to Marvin Nichols Reservoir and that Marvin Nichols Reservoir is operated as a system with Lake Wright Patman. With about 489,430 acre-feet available for Region C, the NTMWD share would be about 174,840 acre-feet, while the TRWD would receive the largest amount at 280,000 acre-feet per year. Phase 1 would be developed by 2030 and Phase 2 by 2050. Most of the cost is in the pipelines and pump stations.

- **Toledo Bend Reservoir** in East Texas is recommended for the TRWD and the NTMWD as a primary strategy and for the DWU and the UTRWD as an alternate strategy. The NTMWD's share would be 200,000 acre-feet per year of the total 500,000 acre-feet available by 2050.

- **Oklahoma water** remains a promising source of supply for the North Texas region although the Oklahoma legislature has a current moratorium on export of water from the state.

4.2.4 Summary of Water Supply Alternatives.

Nearly 790,000 acre-feet per year of new supplies are recommended in the Region C water plan for the NTMWD, leading to a total supply of 1.02 million acre-feet per year in 2060. A summary of current water supplies and potential water management alternatives or strategies and projected demand is presented in Table 5. Interpolation of data in Table 5 for year 2015 would indicate that about 295,000 acre-feet of water would be required from new sources of supply. Some existing sources of water supply would diminish over time due to sedimentation. Projected demands exceed current available supplies as shown in Table 5 requiring the consideration of alternative water management strategies over time. Costs for the alternative strategies are shown in Table 6. The water management strategy for Region C prepared for the Region C Water Planning Group by Freese and Nichols, Consulting Engineers, and others, anticipates new Lake Texoma water would be required by year 2015. Capital costs for the projects in Table 6 are typically financed by 30-year bonds. Pre-amortization costs refer to the 30 year period during which debt service payments on the bonds are being made. Post-amortization costs refer to the period after the bonds are paid off in which there are no debt service costs.

TABLE 6
SOURCES OF WATER SUPPLY AND WATER DEMAND BY DECADE
RECOMMENDED WATER MANAGEMENT STRATEGIES
North Texas Municipal Water District (acre-feet)

	Year					
Source	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Current Available Supplies						
Lake Lavon	104,000	104,000	104,000	104,000	104,000	104,000
Lake Texoma	77,300	77,300	77,300	77,300	77,300	77,300
Lake Chapman	49,976	49,150	48,324	47,498	46,672	45,843
Wilson Creek Reuse (permitted)	35,941	35,941	35,941	35,941	35,941	35,941
Lake Bonham	5,340	5,340	5,340	4,850	4,250	3,650
Total Current Available Supplies	272,557	271,731	270,905	269,589	268,163	266,734
Water Management Strategies						
Conservation	12,366	32,071	45,646	58,274	70,220	83,096
Interim DWU Supply	11,210	11,210	0	0	0	0
Wilson Creek Reuse (new)	26,956	35,941	35,941	35,941	35,941	35,941
East Fork Reuse	81,400	96,400	102,000	102,000	102,000	102,000
Additional Lake Lavon Yield	11,000	10,000	9,000	8,000	7,000	6,000
Interim GTUA Supply	20,000	0	0	0	0	0
Upper Sabine Basin	50,000	30,000	20,000	10,000	10,000	10,000
New Lake Texoma	0	38,250	57,105	54,105	100,460	112,460
Lower Bois d'Arc Creek Reservoir	0	123,000	121,000	119,000	117,000	115,000
Marvin Nichols Reservoir	0	0	87,420	87,420	174,840	174,840
Toledo Bend Phase 1	0	0	0	0	100,000	100,000
Oklahoma Water	0	0	0	0	0	50,000
Treatment and Distribution Losses	-10,028	-17,240	-21,623	-20,823	-32,362	-35,312
Total Supplies from Strategies	212,932	376,872	478,112	474,740	717,461	789,337
Total Current and Strategy Supplies	475,461	631,363	727,394	723,506	953,262	1,020,759
Total from Reuse and Conservation	156,663	200,353	219,528	232,156	244,102	256,978
Percent from Reuse and Conservation	32.9%	31.7%	30.2%	32.1%	25.6%	25.2%
Projected Demands	370,499	482,185	567,185	649,440	721,491	801,513

Source: Initially Prepared Region C Water Plan 2006, June 2005 draft.

TABLE 7

SOURCES OF WATER SUPPLY AND WATER DEMAND BY DECADE
COSTS OF RECOMMENDED WATER MANAGEMENT STRATEGIES
Texas State Water Plan 2006
North Texas Municipal Water District

Water Management Strategies	Develop Dates	Quantity for NTMWD (acre-feet/year)	(mgd)	NTMWD Share of Capital Cost($)	Unit Cost ($/kGal) Pre-Amort	Post-Amort
Treatment and Distribution Improvements	2005-2060	N/A	N/A	1,290,523,000	N/A	N/A
Interim DWU Supply	2006	11,210	10	1,350,000	$0.75	$0.72
Wilson Creek Reuse (new)	2005	35,491	32	1,150,000	$0.01	$0.00
East Fork Reuse	2010	102,000	91	288,879,000	$0.92	$0.21
Additional Lake Lavon Yield	2006	11,000	10	270,000	$0.01	$0.00
Interim GTUA Supply	2006	20,000	18	104,000	$0.09	$0.09
Upper Sabine Basin	2010	50,000	45	60,232,000	$0.52	$0.25
New Lake Texoma	2015	113,000	101	201,829,000	$0.58	$0.18
Lower Bois d'Arc Creek Reservoir	2020	123,000	110	399,190,000	$0.87	$0.14
Fannin County Water Supply System	2020	0	0	55,458,000	$1.96	$0.52
Marvin Nichols Reservoir	2030	174,840	156	534,125,000	$0.94	$0.26
Toledo Bend Phase 1	2050	200,000	179	886,002,000	$1.56	$0.57
Oklahoma Water	2060	50,000	45	128,898,000	$0.95	$0.37
Total Capital Costs				3,848,010,000		

Source: Initially Prepared Region C Water Plan 2006, June 2005 draft (2002 prices levels).

4.3 Greater Texoma Utility Authority (GTUA)

The Greater Texoma Utility Authority, also known as "the Authority" or "GTUA," is a local political subdivision of the State and is governed by a Board of Directors. The Authority is a special-law district organized under Article XVI, Section 59, of the Texas constitution. The Authority operates under the provisions of Chapter 49 of the Texas Water Code. The Authority has no taxing power, but may incur debt by the issuance of bonds supported by revenues from the operations it finances. The Authority may enter into contracts to provide services for member cities and others when requested. The GTUA is located in Denison, Texas.

While the State Legislature may have enacted a law to authorize the Authority, the cities of Denison and Sherman actually created the district by a confirmation election held on August 19, 1979. Since that time, the cities of Bailey, Collinsville, Gainesville, Gunter, Howe, Leonard, Muenster, Pottsboro, Tioga, Tom Bean, Valley View, Van Alstyne, Whitesboro, and Whitewright have also joined as member cities of the Authority.

The Authority provides its member cities with assistance in financing and construction of water and wastewater facilities. The Authority may also be requested to provide operations services for water and wastewater facilities by member cities and others. The Authority has been designated as a cooperating local sponsor to negotiate with the U.S. Army Corps of Engineers for purchase of water from Lake Texoma on behalf of the cities in this area, which enables the Authority, controlled by local municipalities, to have greater influence in obtaining future water supplies.

4.3.1 Existing Sources of Water Supply: GTUA

Lake Texoma, on the Red River near Denison, Texas, is the primary surface water source utilized by the GTUA. The reservoir has 1,467,000 acre-feet of conservation storage. Lake Texoma is expected to have 986,730 acre-feet of conservation storage by year 2044. The RRAT, the GTUA, the city of Denison, the NTMWD, and Texas Utilities (TXU) have water rights in Lake Texoma. The GTUA, acting as an agent for Sherman, Texas, has contractual rights to divert up to 22,600 acre-feet of water from Lake Texoma. The 1986 WRDA reserves another 50,000 acre-feet for the GTUA. Lake Texoma water is pumped to a desalinization facility near the Grayson County Airport for treatment prior to distribution. Other entities that have storage at Lake Texoma are the city of Denison, 21,300 acre-feet; the TXU(TP&L), 16,400 acre-feet; and the RRAT, 2,473 acre-feet.

4.3.2 Potential Sources of Water Supply: Water Management Strategies.

Lake Texoma, on the Red River near Denison, Texas, is the only potential surface water source that can be utilized by the GTUA at this time. Therefore, as discussed above, the GTUA relies on Lake Texoma for future supplies of water to serve its member cities.

Groundwater resources in Grayson County are of poor quality or limited quantity and, therefore, are not considered adequate potential sources of water supply. Groundwater resources are generally over-drafted as noted in the regional water plan.

5.0 DERIVATION OF USER COST

5.1 Hydropower Benefits Foregone.

The loss of project benefits that would result from the reallocation of 300,000 acre-feet of storage is computed based on current price levels, interest rates, and conditions projected for the remaining economic life of the project. Benefits were calculated assuming a 70-megawatt (MW) power capacity at 5-1/8% interest for a 50-year period of analysis. The annual energy loss based on SWD-SUPER stream flow data for 1938-2000 is 23,792 MWh. (See Table 3-1, Water Supply Storage Reallocation Power Benefits Foregone report dated April 2006 (revised), Appendix 11.6). The annual hydropower benefits foregone is the sum of annual energy benefits foregone and annual capacity benefits foregone. The total annual benefits foregone for a 150,000 acre-feet reallocation is $756,800. Annual hydropower benefits foregone for a 150,000 acre-feet and 300,000 acre-feet water supply reallocation (300,000 and 450,000 acre-feet of total water supply) is shown in Table 8. See section 3.2 of Appendix 11.6 for alternative discussion. Alternative designations are for cumulative reallocation to water supply purposes. Current and pending

Water Supply Agreements amount to about 150,000 acre-feet of storage. Additional reallocation for Texas brings the cumulative reallocation to water supply to 300,000 acre-feet. A 150,000 acre-feet reallocation was calculated for meeting long-term water supply needs in Oklahoma. The 300,000 acre-feet reallocation satisfies the water supply demands of the Texas communities.

TABLE 8
ANNUAL HYDROPOWER BENEFITS FOREGONE *

Allocation Alternatives	150,000 Acre-Feet	300,000 Acre-Feet
Annual Energy Losses (MWh)	11,995	23,792
Energy Value ($/MWh)	$41.62	$41.62
Annual Energy Benefit Foregone	$499,284	$990,326
Capacity Losses (kW)	2,310	5,472
Capacity Value ($/kW)	$111.48	$111.48
Annual Capacity Benefit Foregone	$257,514	$610,007
Total Annual Benefits Foregone	$756,798	$1,600,333

* Impacts for the 150,000 and the 300,000 acre-feet reallocation. Base already includes 150,000 acre-feet.

5.2 Hydropower Revenues Foregone.

The hydropower revenues foregone or lost because of the storage reallocation were evaluated based on current Southwestern Power Administration (SWPA)contract rates. The rates that are in effect, obtained from SWPA comments dated 20 December 2005, are as follows:

Energy Charge: 8.20 mills/kWh
Capacity Charge: $36.36/kW-year

To compute revenues foregone, the energy charge is applied to the average annual energy losses calculated in section 3 of the HAC report appendix. The capacity charge is applied to the loss in dependable capacity in 1964, SWPA's most critical operating year, calculated in section 4 of the HAC appendix. Under SWPA's current marketing procedures, the amount of marketable capacity at Denison Dam (Lake Texoma) is based on the capacity that can be supported during the 1964 peak demand period. The loss is marketable capacity is shown in Table 9 as 12,730 kW and 28,263 kW. The annual revenues foregone for a 300,000 acre-feet reallocation (450,000 acre-feet of total water supply) is $1,222,750. A summary of hydropower revenues foregone assuming 300,000 and 450,000 acre-feet of total available water supply is shown in Table 9.

TABLE 9
HYDROPOWER REVENUES FOREGONE *

Allocation Alternatives	150,000 Acre-Feet	300,000 Acre-Feet
Annual Energy Losses (MWh)	11,995	23,792
Energy Charge ($/MWh)	$8.20	$8.20
Annual Energy Revenues Foregone	$98,358	$195, 092
Capacity Losses (kW)	12,730	28,263
Capacity Charge ($/kW)	$36.36	$36.36
Annual Capacity Revenues Foregone	$462,866	$1,027,658
Total Annual Revenues Foregone	$561,224	$1,222,750

* Impacts for the 150,000 and the 300,000 acre-feet reallocation. Base already includes 150,000 acre-feet.

5.3 Hydropower NED Replacement Costs.

Replacement cost, discussed in the HAC Report, Section 1.7, is identical to the power benefits foregone, which are based on an estimate of market prices. In the case of hydropower, the replacement cost of power was used for computing an National Economic Development (NED) cost of reallocated storage. The NED cost of replacement power is identical to the power benefits foregone.

5.4 Credit to Power Marketing Agency.

Project costs originally allocated to hydropower are being repaid through power revenues which are based on rates designed by the Federal power marketing agency (SWPA) to recover allocated costs plus interest within 50 years of the date of commercial power operation. If a portion of the storage is reallocated from hydropower to water supply, SWPA's repayment obligation will be reduced, a credit made annually based on an estimate of the reduced energy and marketable capacity.

Planning Guidance Notebook, Appendix E-57d (3) of ER 1105-2-100 (22 April 2000) states that,

> "If hydropower revenues are being reduced as a result of the reallocation, the power marketing agency will be credited for the amount of revenues to the Treasury foregone as a result of the reallocation assuming uniform annual repayment."

Also, paragraph d(2)(b) states that,

> "Revenues foregone to hydropower are the reduction in revenues accruing to the Treasury as a result of the reduction in hydropower outputs based on the Baseline rates charged by the power marketing agency. Revenues foregone from other project purposes are the reduction in revenues accruing to the Treasury based on any Baseline repayment agreements."

For purposes of estimating what this cost will be, the energy and marketable capacity values and energy and capacity charges from Section 6 of the HAC appendix are used. No annual escalation

rate is applied to the energy and capacity charges to cover SWPA's estimated real increase in rates in the future, in accordance with paragraph 4-32d(2)(b) of ER 1105-2-100 cited above.

ER 1105-2-100 also allows the marketing agency additional credit for costs above the annual credit to recover costs of purchased power to meet the obligations of the current power sales contract(s) relating to the marketing of power from the hydro project(s) where storage is being reallocated. The continuation of Appendix E-57d(3), provides the following guidance:

> "In instances where Baseline contracts between the power marketing agency and their customer would result in a cost to the Federal Government to acquire replacement power to fulfill the obligations of contracts, an additional credit to the power marketing agency can be made for such costs incurred during the remaining period of the contracts."

In both cases the credit in each year will be based on the revenue actually lost or the replacement costs actually incurred (and documented) by the power marketing agency. However, for purposes of providing an estimate of this credit, the cost of replacement power will be based on the same power values and energy and average capacity losses as were used in the benefits foregone calculations.

5.4.1 Remaining Period of Contract.

The length of time remaining under the current power sales contracts had to be identified to determine how many years the SWPA credit would be based on cost of replacement power. Contract information provided by SWPA indicated that current contracts for all power marketed from the Lake Texoma (Denison Dam) project will expire in 2015. For this reason, the annual SWPA credit is computed (estimated) using revenue foregone until the present contracts expire in 2015, then benefits foregone for the remaining 50 years of the analysis period (greater of either remaining project life or 50 years). Additional credit may be due based on costs for replacement power which may be greater than the annual credit to the power marketing administration (PMA).

Compensation based on the reallocation of hydropower storage to water supply at Lake Texoma is governed by a reconciliation of applicable language in the WRDA 1986, Section 838(d)(3). . SWPA will receive an annual credit for the amount of hydropower lost until the present contracts expire in 2015. Additional credits to the PMA can be made for replacement cost during the remaining period of the contract where there is a cost to the Federal Government to acquire replacement power to fulfill the obligation of sales contracts.

Table 10 is an estimate of credit due the PMA for the 150,000 acre-feet and 300,000 acre-feet total water supply alternatives. The PMA has already received or will receive full credit for the 150,000 acre-feet of hydropower storage reallocated in 1983, 1985, 1992, 1997, and 2004.

TABLE 10
ANNUAL CREDIT DUE POWER MARKETING AGENCY*

Allocation Alternative	150,000 Acre-Feet	300,000 Acre-Feet
Energy Credit	$270,179	$535,899
Capacity Credit	$374,860	$848,669
Annual Credit to PMA	$645,039	$1,384,567

* Impacts for the 150,000 and the 300,000 acre-feet reallocation. Base already includes 150,000 acre-feet.

5.5 Compensation according to the 1986 WRDA.

Reallocating 300,000 acre-feet hydropower storage to water supply will have an impact on hydropower production as water supply agreements are implemented over time. This impact will be mitigated by compensation for future lost hydropower production as a result of the reallocation will be made in accordance with Section 838(d)(3) of the 1986 WRDA which states:

> "With respect to any water supply contract entered into by the Secretary under this section after June 1, 1985, the Secretary shall determine (A) the amount of hydropower lost, if any, as a result of the implementation of such contract, and (B) the replacement cost of the hydropower lost (where replacement cost is defined as the cost to purchase power from existing alternative sources). If hydropower is lost as a result of the implementation of such contract, the Secretary shall provide credits to the Southwestern Power Administration of amounts equal to such replacement costs. Such credits shall be against sums required to be paid by the Southwestern Power Administration for costs of the project allocated to hydropower. In each such case the Southwestern Power Administration shall reimburse each preference customer for an amount equal to the customer's actual replacement cost for hydropower lost as a result of the implementation of such contract, less the costs such customer would have had to pay to the Southwestern Power Administration for such hydropower."

Furthermore, water supply storage is not considered reallocated until a water supply user enters into an agreement with the Federal government and starts to pay for the storage.

Section 838(d)(2) of the 1986 WRDA states:

> "No payment shall be required from and no interest shall be charged to users in the States of Oklahoma or Texas for the reallocation authorized by this section until such time as the water supply storage reserved under such reallocation is actually first used. Any contract entered into for the use of the water received under this section shall require the contracting entity to begin principal and interest payments on that portion of the water allocated under the contract at the time the entity begins the use of such water. Until such time, storage for which reallocation is authorized in this section may be used for hydropower production."

5.6 Updated Cost of Storage.

In regards to the repayment of storage costs, the Corps of Engineers policy on pricing storage reallocated from one authorized project purpose to another is based on the "Use of Facilities" (UOF) method. The price of one (1) acre-foot of the total storage is established as the highest of the benefits or revenues foregone, the replacement costs, or the updated cost of storage. Storage is not considered to be reallocated until a water supply user signs an agreement and starts to make payments. Until such time, storage will be used for all project purposes at no cost. The cost of reallocated storage changes each government fiscal year. Section 932 of the 1986 WRDA changed the number of years to repay storage investment costs from 50 years to 30 years; did away with the 10-year interest free period which would not affect reallocated storage; and requires recalculation of the interest rate at 5-year intervals. The only way costs would have been more favorable on the first 150,000 acre-feet of reallocated storage at Lake Texoma would have been if a user entered into an agreement for storage at an earlier date.

The value of the entire 300,000 acre-feet of storage being identified for reallocation in this report is estimated at $100,547,121 based on the updated cost of storage. The value of the storage was determined by first computing the cost at the time of construction by using the use of facilities cost allocation procedure as follows:

$$\frac{\text{(Project joint-use const. cost x Storage reallocated (acre-feet)}}{\text{Total usable storage}}$$

The cost allocated to the storage on this basis is then to be escalated to present day price levels using the estimated 2004 Civil Works Construction Cost Index System. Computations to determine the value of the 300,000 acre-feet of reallocated storage are:

($1,206,034,800 (FY 2006)) (300,000 acre-feet/3,365,638 acre-feet) = $107,457,701

A storage cost update for FY 2006 for Lake Texoma is shown in Table 11.

5.7 User Cost.

The present worth of the 300,000 acre-feet of water supply storage is considerably more than the present worth of hydropower benefits or revenues foregone. The total reallocated water supply storage of 300,000 acre-feet is valued at $107,457,701, which equals an annual payment of $6,398,415 per year for 30 years if water supply agreements for the full reallocation were signed by one water supply user. NTMWD has requested a Water Supply Agreement for 100,000 acre-feet of storage at a cost of $35,831,294. Based on a 30 year repayment at the water supply interest rate of 4.625% for fiscal year 2006, the annual payment would be $2,133,524, with an estimated annual operation and maintenance cost of $65,326, and a total estimated annual cost of $2,198,850.

GTUA has requested a Water Storage Agreement for 5,000 acre-feet of storage at a cost of $1,796,992. Based on a 30-year repayment at the water supply interest rate of 4.625% for FY 2006, the annual payment would be $106,999, an annual operation and maintenance cost of $3,276, and a total estimated annual cost of $110,275.

TABLE 11
UPDATED STORAGE COSTS FOR FY 2006 ($1,000)

Project, Denison Dam - Construction Initiated, August 1939; Construction Completed, June 1944; Construction Mid-point, January 1942

	Actual Joint-Use As of January1942	Mid-point January 1942 ENR Index	October 1967 ENR Index	Update Factor	October 1967 Joint Use Costs	October ENR(1) or CWCCIS(2) 1967 Index	October ENR(1) or CWCCIS(2) 2005 Index	Update Factor	October 2005 Joint Use Costs
Lands and Damages	6,442.0	268	1,096	4.0896	26,345.2	100 (2)	627 (3)	6. 274	165,289.8
Relocations	13,670.1	268	1,096	4.0896	55,905.2	1,096 (1)	7563 (1)	6.901	385,801.8
Reservoir	3,703.9	268	1,096	4.0896	15,147.5	100 (2)	664 (2)	6.640	100,579.4
Dam and Spillway	15,622.7	268	1,096	4.0896	63,890.6	100 (2)	609 (2)	6.090	389,093.8
Outlet Works	0.0	268	1,096	4.0896	0.0	100 (2)	609 (2)	6.090	0.0
Roads	271.3	268	1,096	4.0896	1,109.5	100 (2)	625 (2)	6.250	6,934.4
Levees	5,633.5	268	1,096	4.0896	23,038.8	100 (2)	630 (2)	6.300	145,144.4
Buildings, grounds, and utilities	258.0	268	1,096	4.0896	1,055.1	1,096 (1)	7563 (1)	6. 901	7,281.2
Permanent operating equipment	209.4	268	1,096	4.0896	856.4	1,096 (1)	7563 (1)	6.901	5,910.0
TOTAL	45,810.9								1,206,034.8
Specific Costs Water Supply Conduit	0.0	268	1,096	4.0896	0.0	100 (2)	579 (2)	5.790	0.0

(1) Engineering News Record Index
(2) Civil Works Construction Cost Index System
(3) Updated by the weighted average of other project features

6.0 OTHER CONSIDERATIONS

6.1 Test of Financial Feasibility.

6.1.1 Most Likely, Least Costly Alternative.

Upon review of the alternatives, it is evident that reallocation of 300,000 acre-feet of hydropower storage from Lake Texoma is the most likely, least costly alternative. The No Action alternative will not meet future water demand of the area communities served by the NTMWD and the GTUA and is not consistent with the Initially Prepared Region C Water Plan 2006.

6.1.2 Alternative Non-Federal Project.

The reallocation of storage to water supply requires a test of financial feasibility. This test is a comparison of the annual cost of storage of Lake Texoma to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water which the non-Federal sponsor would develop in the absence of utilizing the Federal project at Lake Texoma. The water at Lake Texoma has relatively high concentration of chlorides compared to other water sources in the region. The Region C Texas State Water Plan evaluated water management strategies for the major providers and estimated the capital costs required to implement that strategy. As discussed in the economic analysis, the next most likely alternative for the NTMWD in the time frame the water is required is the reservoir project on the Lower Bois d'Arc Creek in Fannin County, Texas. Table 7 in this report refers to the time frame when water is needed and shows estimated costs for each alternative.

6.1.2.2 Cost of Lower Bois d'Arc Creek Reservoir and Conveyance Facilities.

Cost estimates for the new reservoir project and conveyance facilities on the Lower Bois d'Arc Creek have two components:

- Project or capital costs for the dam and reservoir, the pipeline, pumping, and storage facilities include construction, land acquisition, mitigation, engineering, and contingency costs. The project costs for the Lower Bois d'Arc Creek Reservoir project are updated from 2002 price levels as found in the *Initially Prepared 2006 Region C Water Plan*, Table U-49. Those detailed costs were consolidated and updated to 2005 price levels using the Civil Works Construction Cost Index System (CWCCIS). Detailed costs are shown in the Region C Water Plan. Interest during construction is also a cost for the utilization of capital over the estimated 3-year construction period. Interest during construction was calculated at the FY 2006 Federal discount rate of 5-1/8% interest using Corps of Engineers methodologies.

- Average annual costs represent annual operation and maintenance costs and debt service. Annual costs were calculated based on a 100-year amortization period for major reservoir projects at 5-1/8% interest for fiscal year 2006, the interest rate used for planning and formulation studies.

Table 12 shows the consolidated project costs for the dam and reservoir, pipeline, pumps, and storage facilities along with other mitigation costs at 2006 price levels. Also shown are the annualized costs at 2006 price levels.

TABLE 12
LOWER BOIS D'ARC CREEK RESERVOIR SITE
PROJECT COST AND ANNUAL COSTS

PROJECT COSTS	**Cost ($1,000)**
Category	
Dam and Reservoir	$66,500
Land Acquisition	$39,100
Conflicts	$20,600
Conveyance Facilities	
Pipeline	$180,400
Intake Pump Station	$39,300
Terminal Storage Facilities	$21,500
Mitigation/Permitting	$56,800
Total Project Cost	**$424,200**
ANNUAL COSTS	
Total Project Cost	$424,200
Interest During Construction	$30,800
Total Gross Investment	$457,600
Annual Charges	
Interest & Amortization	$23,600
Operation & Maintenance	$7,200
Major Replacement	$0
Total Annual Charges	**$30,800**
UNIT COSTS	
Quantity	123,000 acre-feet/year
Unit Costs per acre-foot	$250
Unit Costs per thousand gallons	$0.72

Note: Price levels at 3rd quarter 2006.
Difference in annual costs attributed to 100-year period of analysis instead of 30-year, as found in the Region C Water Plan.

7.0 COST ACCOUNT ADJUSTMENTS

7.1 NTMWD Payment.

NTMWD will initially enter into an agreement for 100,000 acre-feet of the 300,000 acre-feet of storage being reallocated. The cost to the NTMWD for 100,000 acre-feet of storage is estimated as follows:

Storage Cost*	
100,000/3,365,638 = 2.971% X $1,206,034,800 =	$35,831,294
Annual Operation and Maintenance (FY 06)	
Joint-use **100,000/3,365,638 = 2.971% x $2,198,779 =	65,326
Replacement and Rehabilitation (FY 06)	
Joint-use **100,000/3,365,638 = 2.971% x $0 =	0

* See Table of Updated Costs. To be adjusted to reflect the Civil Works Construction Cost Index System (CWCCIS) at the beginning of the fiscal year in which the first payment on the storage is made.
** Joint-Use Operation and Maintenance costs are an annual reimbursement.

The annual payment for NTMWD is $2,133,523 with the operations and maintenance payment of $65,326. The total estimated annual payment is $2,198,850.

7.2 GTUA Payment.

GTUA will initially enter into an agreement for 5,000 acre-feet of the 300,000 acre-feet of storage being reallocated. The cost to the GTUA for 5,000 acre-feet of storage is estimated as follows:

Storage Cost*	
5,000/3,365,638 = 0.149% X $1,206,034,800 =	$1,796,992
Annual Operation and Maintenance (FY 06)	
Joint-use **5,000/3,365,638 = .149% x $2,198,779 =	3,276
Replacement and Rehabilitation (FY 06)	
Joint-use **5,000/3,365,638 = .149% x $0 =	0

* See Table of Updated Costs. To be adjusted to reflect the CWCCIS at the beginning of the fiscal year in which the first payment on the storage is made.
** Joint-Use Operation and Maintenance costs are an annual reimbursement.

The annual payment for GTUA is $106,999 with the annual operations and maintenance payment of $3,276. The total estimated annual payment is $110,275.

7.3 Compensation to the Federal Hydropower Purpose.

All the funds received from the sale of the 100,000 acre-feet of storage to the NTMWD and the 5,000 acre-feet of storage to the GTUA will be deposited into the U.S. Treasury by the Corps of Engineers. Those revenues that represent hydropower revenues foregone and replacement costs, in accordance with WRDA 1986, will be credited to the project's hydropower income account. The SWPA will be provided an amortization of credits for the 30-year repayment period by the water supply user. The SWPA will be notified in writing within 30 days after the agreement between the United States of America and NTMWD and the GTUA, or any future water supply user. If the revenues representing hydropower revenues foregone and replacement costs exceed the projects annual operation and maintenance (O&M) allocated to hydropower, the excess revenues will be applied to other hydropower projects in the U.S. Army Corps of Engineers, Tulsa District as directed by the SWPA.

7.4 HAC and SWPA Methodology Differences

SWPA and the Corps of Engineers Hydropower Analysis Center (HAC) have had numerous discussions concerning the appropriate methodologies used for evaluating impacts to energy and capacity benefits when hydropower storage is reallocated to other uses. Differences center primarily on six issues:

(1) Computation of dependable capacity
(2) Energy value used to compute power benefits foregone
(3) SWPA's contract rates used to compute revenue forgone
(4) Calculation of energy loss
(5) Value applied to the capacity
(6) Time period used when calculating the compensation for benefits foregone

Attached in Appendix 11.7 are comments supplied by Southwestern Power which outline SWPA concerns regarding compensation for lost hydropower from the proposed water storage reallocation.

Appendix A, attached to the April 2006(revised) HAC report, uses methods similar to those used by SWPA in calculating annual energy and capacity benefits foregone. The primary concern of the SWPA involves the amount and compensation credit for hydropower revenue foregone and the procedures for how that compensation is determined. The HAC reports dated April 2005 and April 2006(revised) used Corps policy and procedures in determining the credits that are due. Appendix A to the 2005 report used methodologies similar to those proposed by SWPA to determine the credits that are due.

Appendix A calculations present an alternative approach to quantifying power benefits foregone based on comments received (Appendix 11.6) from SWPA and may not exactly follow the procedures and values used by SWPA. The total annual power benefits foregone for the reallocated storage of 300,000 acre-feet is $1.7 million for energy from combustion turbines only and $1.4 million for energy from both the combined cycle and combustion turbine alternative. For a 450,000 acre-feet reallocation these values would range from $3.5 million for energy from

the combustion turbine alternative, and $2.9 million for energy from both the combined combustion turbine and combustion turbine alternative. The computation of benefits shown in Appendix A does not follow current Corps of Engineers policy and guidelines. Appendix A was not used, nor is it recommended in this report. It is provided in the spirit of partnership to allow further consideration of policy at the highest levels of Corps of Engineers.

8.0 ENVIRONMENTAL CONSIDERATION

The NEPA of 1969 requires all Federal agencies to address the environmental impacts of any major Federal action on the natural and human environment. An EA was completed in 2005 to assure that the proposed storage reallocation project complies with the intent of the NEPA. The EA 30-day public review process was coordinated with Federal, State, and/or local interests affected by reallocation that had legislative and administrative responsibilities for environmental protection. This EA determined that no cumulative environmental impacts are anticipated to occur as a result of the proposed reallocation action.

9.0 CONCLUSIONS

Reallocation of 300,000 acre-feet from hydropower to water supply is the most efficient means to satisfy the projected water demands in Texas and Oklahoma. The rapid growth in the North Texas Region C as expressed in the Initially Prepared 2006 Region C Water Plan identified the need for establishing future water sources because of a projected 50% population increase within the region. The demand for additional water supply sources resulted in Congressional authorization through the 1986 WRDA passed by Congress (Public Law 99-662). Section 838 of the 1986 WRDA authorized the Secretary of the Army to reallocate 150,000 acre-feet each for Oklahoma and Texas for municipal, industrial, and agricultural water uses. A total reallocation of 300,000 acre-feet was evaluated based on the congressional authorization. This would bring the identified total water supply storage to 450,000 acre-feet. A reallocation of water supply storage from hydropower storage does not occur until water supply agreements are signed by all parties and the water supply user starts to pay for the storage. Therefore, the actual reallocation is incremental and is implemented upon execution of water supply agreements. Storage identified for reallocation, but not under agreement, is still considered hydropower storage; however, it no longer becomes a dependable source of power.

The study to reallocate 300,000 acre-feet of storage from hydropower to water supply complies with NEPA. An EA was conducted and a determination made that no significant environmental impacts are anticipated to occur as a result of the proposed reallocation action. Impacts will occur to hydropower production at Denison Dam, however, compensation will be received by SWPA based on authorizing legislation (1986 WRDA).

10.0 RECOMMENDATION

Based on the 2005 Environmental Assessment and pursuant to the 1986 Water Resources Development Act, Public Law 99-662, Section 838, it is recommended that 150,000 acre-feet each for Oklahoma and Texas for municipal, industrial, and agricultural water uses (a total reallocation of 300,000 acre-feet) be reallocated from hydropower storage to water supply. As expressed in WRDA 1986, it is recommended that 300,000 acre-feet of storage between elevations 590.0 and 617.0 feet NGVD in Lake Texoma be reallocated from hydropower storage to water supply to meet the municipal and industrial needs of Oklahoma and Texas communities.

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APPENDIX 11.1

WATER RESOURCES DEVELOPMENT ACT OF 1986
PUBLIC LAW 99-662-NOVEMBER 17, 1986

SECTION 838

DENISON DAM (LAKE TEXOMA), RED RIVER, TEXAS AND OKLAHOMA

(a) The project for Denison Dam (Lake Texoma), Red River, Texas and Oklahoma, authorized by the Flood Control Act approved June 28, 1938 (52 Stat. 1219), is modified to provide that the Secretary is authorized to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 150,000 acre-feet for municipal, industrial, and agricultural water users in the State of Texas and up to 150,000 acre-feet for municipal, industrial and agricultural water users in the State of Oklahoma.

(b) For that portion of the water storage reserved for users in the State of Oklahoma, the Secretary may contract, in increments as needed, with qualified individuals, entities, or water utility systems for use within the Red River Basin; except that for any portion of that water to be utilized outside the Red River Basin, the Secretary shall contract with the Red Ark Development Authority.

(c) For that portion of the water storage reserved for users in the State of Texas, the Secretary shall contract, in increments as needed, for 50,000 acre-feet with the Greater Texoma Utility Authority and 100,000 acre-feet with other qualified individuals, entities, or water utility systems. Nothing in the preceding sentence shall supersede any requirement of State law with respect to the use of any water subject to a contract.

(d) (1) All contracts entered into by the Secretary under this section shall be under terms in accordance with section 301(b) of the Water Supply Act of 1958 (Public Law 85-500), as amended by section 932 of this Act.

(2) No payment shall be required from and no interest shall be charged to users in the States of Oklahoma or Texas for the reallocation authorized by this section until such time as the water supply storage reserved under such reallocation is actually first used. Any contract entered into for the use of the water received under this section shall require the contracting entity to begin principal and interest payments on that portion of the water allocated under the contract at the time the entity begins the use of such water. Until such time; storage for which reallocation is authorized in this section may be used for hydropower production.

(3) With respect to any water supply contract entered into by the Secretary under this section after June 1, 1985, the Secretary shall determine (A) the amount of hydropower lost, if any, as a result of the implementation of such contract, and (B) the replacement cost of the hydropower lost (where replacement cost is defined as the cost to purchase power from existing alternative sources). If hydropower is lost as a result of the implementation of such contract, the Secretary shall provide credits to the Southwestern Power Administration of amounts equal to such replacement costs. Such credits shall be against sums required to be paid by the Southwestern Power Administration for costs of the project allocated to hydropower. In each such case the Southwestern Power Administration shall reimburse each preference customer for an amount equal to the customer's actual replacement cost for hydropower lost as a result of the implementation of such contract, less the cost such customer would have had to pay the Southwestern Power Administration for such hydropower.

(4) The Secretary may not increase payments of water users under a water supply contract under this section on account of the credits and reimbursement required to be provided under this section.

(e) Nothing in this section shall be construed as amending or benefits in connection with such reallocation and usage of municipal, industrial, and agricultural water, all benefits that can be assigned to the Red River chloride control project, Texas and Oklahoma, or the Red River and tributaries multipurpose study, Oklahoma, Texas, Arkansas, and Louisiana, and any individual projects arising from such study, shall be reserved for such projects. Nothing in this section shall affect water rights under the laws of the State of Texas and Oklahoma.

(f) Such project is further modified to include recreation as a project purpose.

APPENDIX 11.2

LETTER REQUESTS FROM NTMWD AND GTUA FOR WATER SUPPLY STORAGE

NORTH TEXAS MUNICIPAL WATER DISTRICT

Regional Service Through Unity

March 17, 2004

Colonel Robert L. Suthard, Jr.
Department of Army
Corps of Engineers, Tulsa District
1645 South 101st East Ave.
Tulsa, Oklahoma 74128-4609

Re: Reallocation of Conservation Storage in Lake Texoma

Dear Colonel Suthard:

I am in receipt of your November 25, 2003 letter wherein you have outlined the status of the U.S. Army Corps of Engineer's ("USACE") reallocation of storage in Lake Texoma pursuant to the Water Resources Development Act of 1986. After receiving your letter, District staff met with Ms. Jan Hotubbee to further explore the option of purchasing additional water in Lake Texoma from the USACE. Based on our meeting with Ms. Hotubbee, and based on subsequent meetings with the Texas Commission on Environmental Quality (the "Commission") regarding authorization of a state water right to divert and use stored water from Lake Texoma, the District would like to accept your offer to develop and submit a draft Water Supply Contract in conjunction with the draft Reallocation Report. As you have suggested, District staff will work with Ms. Hotubbee to develop a draft contract, and to coordinate efforts to obtain a surface water right from the Commission upon approval of the Reallocation Report.

The District appreciates the spirit of cooperation exhibited by the USACE on this matter, and looks forward to continuing its relationship with the USACE for stored water in Lake Texoma. If you have any questions regarding this matter, please feel free to contact me at your convenience.

Sincerely,

James M. Parks
Executive Director

cc: Ms. Jan Hotubbee
Mr. Martin C. Rochelle

505 E. Brown St., P.O. Box 2408, Wylie, Texas 75098-2408 Telephone: 972/442-5405 Fax: 972/442-5405

DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

December 16, 2004

Planning, Environmental, and Regulatory Division
Planning Branch

Mr. James Parks
North Texas Municipal Water District
505 East Brown Street
P.O. Box 2408
Wylie, Texas 75098

Dear Mr. Parks:

This is in response to a conversation between Mr. Brad Castleberry, Mr. Martin Rochelle and Ms. Janet Hotubbee on December 15, 2004, regarding the North Texas Municipal Water Districts request for a water storage contract at Lake Texoma.

As discussed, I have enclosed a prototype agreement that the Federal government will use to negotiate an agreement with the North Texas Municipal Water District (the "District") for additional water supply storage in Lake Texoma. As you have previously indicated, the District is seeking the right to acquire an additional 100,000 acre-feet of water supply storage in Lake Texoma pursuant to the reallocation authorization in Section 838 of the Water Resources Development Act of 1986. We will forward the District's request and a draft water storage agreement to our higher authorities when we submit the draft Reallocation Report for approval. Ms. Hotubbee will prepare a draft water storage agreement in early 2005 that will include estimated costs and other matters specific to the District's acquisition of such storage. Until then, please review and consider the enclosed document in preparation of the draft agreement. The draft will have to be approved by our Headquarters in Washington, D.C. before we can finalize the agreement.

If you have any questions, please contact Ms. Janet Hotubbee at (918) 669-7089.

Sincerely,

G. David Steele, P.E.
Chief, Planning, Environmental
and Regulatory Division

Enclosure

GREATER TEXOMA UTILITY AUTHORITY

5100 AIRPORT DRIVE
DENISON, TEXAS 75020
903/786-4433
FAX: 903/786-8211

April 19, 2006

Ms. Jan Hotubbee
U.S. Army Corps of Engineers
1645 S. 101st East Avenue
Tulsa OK 74128-4609

RE: Water Storage Contract – Lake Texoma

Dear Jan:

Earlier this week we had a conversation regarding the Authority's interest in pursuing a portion of the 50,000 acre-feet of water storage that will become available to the Authority under the provisions of the Water Resources Act of 1986. After our telephone conversation, I discussed this matter with some of our municipal water users and have determined we do need to pursue a water storage contract in the amount of 5,000 acre-feet at this time.

Please accept this letter as our official request to include 5,000 acre-feet water storage contract in the submission to be made by the Tulsa District with the Reallocation Study report. Should you or Ms. Kitchens need additional information, please advise.

Sincerely,

Jerry Chapman

Jerry W. Chapman
General Manager

JWC:lb

cc: Ms. Cynthia Kitchens

APPENDIX 11.3

LETTER FROM OKLAHOMA WATER RESOURCES BOARD
TO
U.S. ARMY CORPS OF ENGINEERS
REGARDING PROPOSED REALLOCATION APPORTIONMENT

DUANE A. SMITH
EXECUTIVE DIRECTOR

BRAD HENRY
GOVERNOR

STATE OF OKLAHOMA
WATER RESOURCES BOARD

May 25, 2004

Mr. Larry Hogue, P.E.
Chief, Planning, Environmental,
and Regulatory Division
Environmental Analysis and Compliance Branch
Department of the Army
Corps of Engineers, Tulsa District
Tulsa, OK 74128-4609

Re: Proposed reallocation – Lake Texoma

Dear Mr. Hogue:

Thank you for the opportunity to comment on the proposed reallocation of the storage at Lake Texoma.

As you know, the State of Oklahoma is a party to the Red River Compact. Accordingly, the State of Oklahoma has a significant interest in ensuring compliance with the apportionment provisions of the Red River Compact. Article IV of the Compact, specifically Section 4.04, apportions the water of the mainstem of the Red River and Lake Texoma between the State of Oklahoma and the State of Texas. Basically, the Compact apportions the storage of Lake Texoma and flow of the mainstem of the Red River into Lake Texoma on a 50/50 basis between Oklahoma and Texas. Any reallocation of storage at Lake Texoma must be consistent with the apportionment provisions of the Compact.

Unfortunately, the Compact Commission has not finalized rules to implement the apportionment provisions of the Compact. Until such rules are adopted by the Commission, it will not be possible to determine whether a proposed reallocation of storage is consistent with the Compact's apportionment provisions. The Oklahoma Commissioners and Texas Commissioners of the Red River Compact Commission are aware of the need for rules, and we hope to consider proposed rules at the Commission's annual meeting scheduled during April, 2005. Staff of the Corps' Tulsa District are routinely invited to the Commission's annual meetings, and therefore, will be notified of the Commission's determination regarding the apportionment rules.

A related issue that should be addressed in the reallocation study is the costs of the water supply storage. It is our understanding that the original water supply storage allocation for Lake Texoma was 150,000 acre-feet. Therefore, under the terms of the 50/50 apportionment provision, the Compact apportions 75,000 acre-feet of the original water supply storage

OWRB
3800 N. CLASSEN BOULEVARD • OKLAHOMA CITY, OKLAHOMA 73118 • TELEPHONE (405) 530-8800 • FAX (405) 530-8900

allocation to Oklahoma and the other 75,000 acre-feet to Texas. Based on plain readings of the Water Supply Act of 1986 and the Red River Compact, we believe that Oklahoma users remain entitled to enter into contracts for up to a total of 75,000 acre-feet of water supply storage under terms and conditions available prior to the Water Supply Act of 1986. An explanation is in order.

Section 838 of the Water Resources Development Act of 1986 provides authority for the Corps to reallocate 300,000 acre-feet of storage in Lake Texoma from hydropower to water supply, with 150,000 acre-feet for Oklahoma users and 150,000 acre-feet for Texas users (this is consistent with the 50/50 apportionment provision of the Compact). Paragraph (d)(1) of Section 838 then indicates that all contracts for the reallocated storage shall be under the new water supply contract terms set forth in Section 932, which terms are substantially less favorable than terms in contracts entered pursuant to the Water Supply Act of 1958. However, paragraph (e) of Section 838 controls the situation by providing that nothing in Section 838 of the Water Resources Development Act of 1986 shall be construed as amending or altering in any way the Red River Compact. As noted above, the Red River Compact split the storage at Lake Texoma and flow from the mainstem of the Red River on a 50/50 basis, as follows: "Oklahoma 200,000 acre-feet and Texas to 200,000 acre-feet, which quantities shall include existing allocations and uses" (emphasis added). The emphasized language in the Compact makes it clear that the 50/50 apportionment provision of the Compact applies to the original 150,000 acre-feet allocation for water supply storage. Therefore, Oklahoma users are entitled to contract for up to 75,000 acre-feet of the original allocation amount without triggering less favorable repayment terms that will apply to contracts for the reallocated storage.

The Environmental Assessment should address both the apportionment rules to be adopted by the Compact Commission and the costs of the storage.

Please keep us informed of the progress of the Environmental Assessment work. Thank you again for the opportunity to provide input.

Sincerely,

Duane A. Smith
Executive Director

cc: Secretary Miles Tolbert
Charles Dobbs, Oklahoma Commissioner
Mark Nichols
Gordon W. Fassett, Federal Commissioner
William A. Abney, Texas Commissioner
Randy Young, Arkansas Commissioner

APPENDIX 11.4

RED RIVER SUPER MODEL
TEXOMA YIELD ANALYSIS AND
WATER SUPPLY REALLOCATION AT
TEXOMA

APPENDIX 11.4

Red River SUPER Model, Texoma Yield Analysis, and Water Supply Reallocation at Texoma

There has been significant interest in developing and identifying sufficient water sources for the north central region of Texas due to continued population growth and development in the region. Also, the passage of Texas Senate Bill 1, which is a comprehensive water resource planning initiative the state of Texas has undertaken, has also created an interest in future water supply availability. Due to the current and future interest in M&I water supply in the region, it was determined that another large reallocation of conservation storage from hydropower to water supply use was appropriate at Lake Texoma. This current reallocation will be for a total of 300,000 ac-ft of conservation storage. 150,000 ac-ft will be set aside for Oklahoma use, and the remaining 150,000 ac-ft will be designated for Texas use. The impacts of this reallocation on hydropower and other authorized uses will need to be determined. SUPER was chosen as the modeling tool to provide yield and impact analysis.

Overview of SUPER Model

The SUPER Model is a suite of computer programs written for use in the Southwestern Division of the U.S. Army Corps of Engineers to model multi-purpose reservoir system regulation. The programs were developed over a thirty-year period by Ronald L. Hula, primarily as a planning tool to perform period-of-record analysis, to evaluate changes in operational scenarios. The model has the ability to simulate flood control operations, and conservation pool operations including hydropower, water supply, water quality, diversions, and returns. In addition to period-of-record analysis, it has the capability to perform conservation pool yield analysis, and firm energy analysis. It also has the capability to develop unregulated conditions models, simulating systems with some or all reservoirs “dummied” out or non-existent. Besides system modeling, SUPER can perform economic analyses of impacts between plans. It can also provide a wide variety of output from which to evaluate scenarios including tabular or graphical formats of hydrographs, duration plots, and frequency curves at all reservoirs and control points within the system model.

SUPER is a daily simulation model that assumes all reservoirs are in place for the entire period of record specified for each model, based on data availability. For each SUPER model, a complex set of intervening area flows is developed for the entire period of record. This is the culmination of the pre-processing of data, before any simulation is done. When simulation is begun, headwater reservoir inflows and subsequent derived releases based on current and future forecast conditions, are then routed through the system on a daily basis. These routed flows are combined with intervening area flows at all control point locations. Reservoir releases are made for flood control, hydroelectric power generation, water supply requirements, and stream flow requirements such as water quality and irrigation. Other regulating considerations include channel capacities and bank stability. All releases are analyzed to determine their impact on current and future forecasted conditions, and are adjusted as needed to meet predefined system constraints. In addition to the above requirements, SUPER works to achieve a target uniform balance between all competing reservoirs during the draw down of system flood storage, and a

target uniform balance in system conservation storage remaining during a conservation pool draw down. SUPER has evolved to meet the complex challenge of modeling system operations while meeting system and local constraints, and balancing requirements.

SUPER Hydrologic Development

Prior to this study, the Red River SUPER model had a hydrologic period-of-record from January 1938 to December 1990. Although there had not been any significant floods along the Red River through most of the 1990's, there had been some drier years, and enough additional years of record, that the model needed to be updated. The goal of this update was to extend the period of record to 2000.

This required collecting and formatting an additional ten years of daily inflows for the 20 reservoirs within the model, and daily flows for numerous flow gages used to develop the period-of-record hydrology. Monthly evaporation and precipitation at numerous locations was also collected and formatted. The data was extracted as much as possible from the USGS published data. Reservoir inflows, data for unpublished gages, and some evaporation data was taken from the internal Corps of Engineers databases. All required data was input into the Red River SUPER database.

After the Red River SUPER database was updated and complete, extensive editing of the hydrologic files was done to incorporate and utilize the additional ten years of daily data that was available. Hydrologic building files were then run through a series of programs to develop the updated period-of-record hydrology or local flows.

With the updated hydrology files, a natural conditions run, simulating no reservoirs in place, was made. As a final check to spot errors in building the hydrology file, a volume checking program was run, which performs a volume comparison between the natural condition flows developed from SUPER and observed gaged flow data. This required building an extensive input file to perform the volume checking analysis. Problems were corrected as required.

Texoma Yield Analysis Using SUPER

With the updated SUPER model, it was desired to determine the true yield of the conservation storage available at the end of the project life. The yield of the conservation storage is required to determine the critical dependable water supply demand that will occur if the entire reallocated storage is used for water supply. This will provide a worse case demand for water supply during the critical drought. At Lake Texoma the conservation storage lies between El. 590 and 617. The end of the project life at Texoma is the year 2044. The water supply yield run was made using an updated elevation-area-capacity table based on the 2002 sediment resurvey of Lake Texoma, with projected future sedimentation to the year 2044. This projected future storage is considered "usable storage". The true yield of the conservation storage at Lake Texoma for the projected 2044 conditions was determined to be 1502.5 cfs. The critical dependable yield for the conservation storage allocated to water supply is determined based on the following equation:

$$\text{Critical Dependable Yield for Allocated Water Supply Storage} = \frac{\text{Total Allocated Water Supply Storage}}{\text{Total "Usable" Conservation Storage(in 2044)}} * \text{True Yield}$$

For the full 300,00 ac-ft reallocation, the Critical Dependable Water Supply Yield = 150,000 ac-ft (past) + 300,000 ac-ft (present) / 986,730 ac-ft * 1502.5 cfs

= 685.2 cfs or 442.1 mgd

Current water supply contracts based on the 1985 sediment survey with sediment projections to the year 2044 will need to be updated to the current "usable storage" based on the 2002 sediment survey at Texoma.

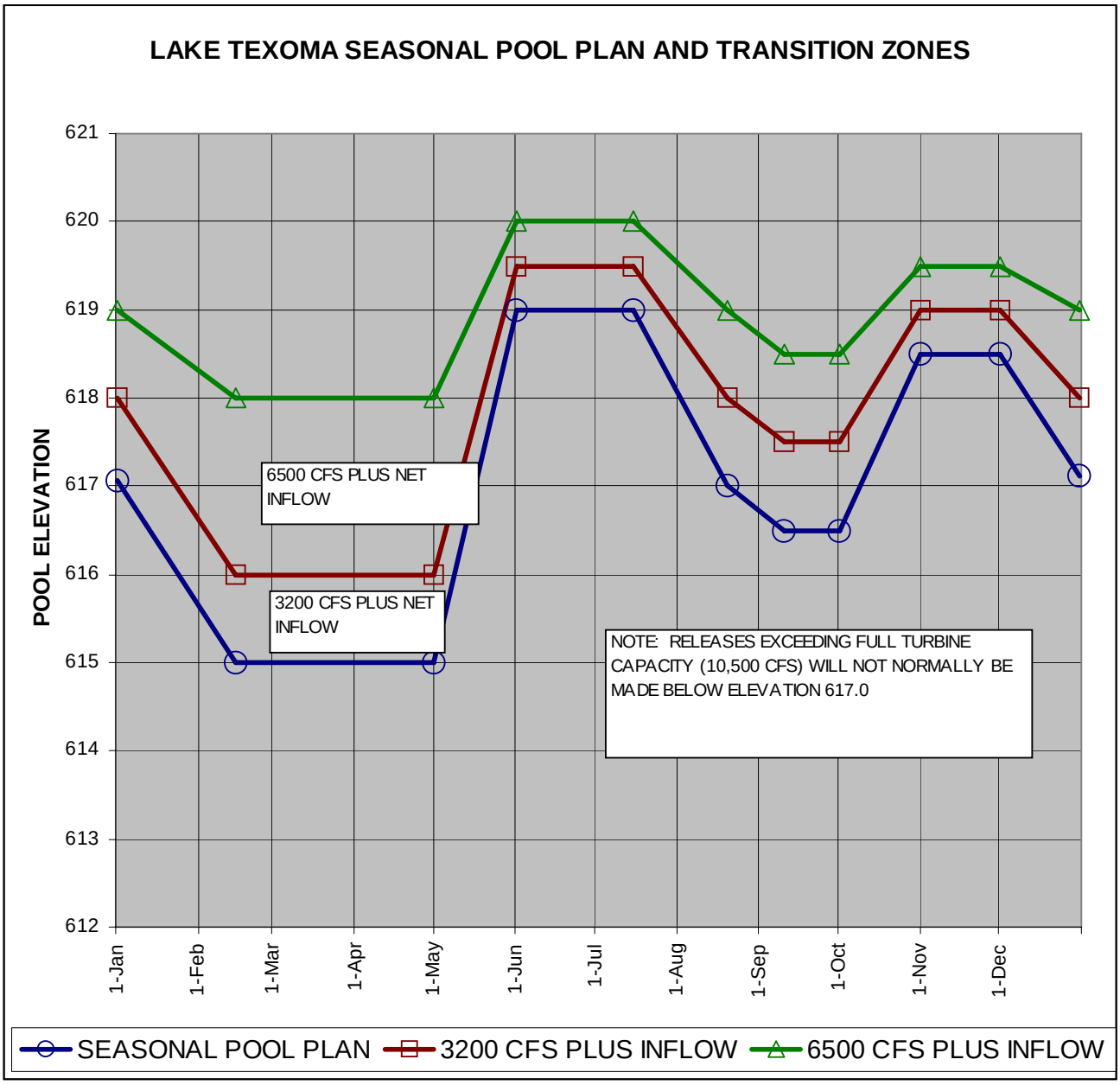
Texoma Water Supply Reallocation Runs Using SUPER

Three SUPER runs were made to model impacts at Texoma due to the current reallocation of hydropower to water supply. The critical dependable water supply demand is the only input parameter that varies between the runs. The runs made are as follows:

1) Existing conditions in which the full 150,000 ac-ft previously reallocated from hydropower to water supply at Texoma is utilized. The water supply demand modeled = 228.4 cfs
2) Modified conditions in which the previous 150,000 ac-ft of reallocated water supply storage is utilized at Texoma plus half of the current Texoma water supply reallocation of 300,000 ac-ft (150,000 ac-ft for Texas and 150,000 ac-ft for Oklahoma). Therefore the total water supply demand for Texoma modeled in this run is 300,000 ac-ft. This modified conditions run basically models Texas fully utilizing their water supply demand. The water supply demand modeled = 456.8 cfs
3) Modified conditions in which the previous 150,000 ac-ft of reallocated water supply storage is utilized at Texoma plus all of the current Texoma water supply reallocation of 300,000 ac-ft. The total water supply demand for Texoma modeled in this run is 450,000 ac-ft. This run models fully utilized water supply conditions at Texoma or the worst case scenario, for demands on Texoma. The water supply demand modeled = 685.2 cfs.

These runs were all done with the updated 2002 Lake Texoma Elevation-Area-Capacity table, with the updated Texoma seasonal pool guide curve (see Figure 1), and the extended period of record hydrology through 2000. To avoid too large a drawdown at Texoma with the larger water supply demands, Southwest Power Administration modified their hydropower loads input into SUPER, to reflect more realistically how they would operate, given the greater water supply demands. Therefore, these runs reflect modified hydropower loads for each scenario. The water supply demand at Texoma is modeled as a constant year-round demand. Results of the runs are provided in both graphical and tabular form in the Appendix.

Figure 1. Texoma Seasonal Pool



Appendix

Figure 1 Texoma Comparative Elevation-Frequency Curve between Super Runs R03X07A, R03X08A, and R03X09A

Figure 2 Texoma Comparative Elevation-Duration Curve between Super Runs R03X07A, R03X08A, and R03X09A

Figure 3 Texoma Outflow Comparative Flow-Frequency Curve between Super Runs R03X07A, R03X08A, and R03X09A

Figure 4 Texoma Outflow Comparative Flow-Duration Curve between Super Runs R03X07A, R03X08A, and R03X09A

Figure 5 Arthur City Comparative Flow-Frequency Curve between Super Runs R03X07A, R03X08A, and R03X09A

Figure 6 Arthur City Comparative Flow-Duration Curve between Super Runs R03X07A, R03X08A, and R03X09A

Figure 7 Texoma Comparative Minimum Elevation-Frequency Curve between Super Runs R03X07A, R03X08A, and R03X09A

Figure 8 Arthur City Comparative Minimum Flow-Frequency Curve between Super Runs R03X07A, R03X08A, R03X09A

Note: Tabular Data for the above plots is provided in the following computer files:

Text Files – Note x axis on the minimum frequency files should be reversed.
TEXEL07A – Texoma elevation-frequency and elevation-duration data for run R03X07A
TEXEL08A – Texoma elevation-frequency and elevation-duration data for run R03X08A
TEXEL09A – Texoma elevation-frequency and elevation-duration data for run R03X09A
TEXOUT07A- Texoma outflow flow-frequency and flow-duration data for run R03X07A
TEXOUT08A- Texoma outflow flow-frequency and flow-duration data for run R03X08A
TEXOUT09A- Texoma outflow flow-frequency and flow-duration data for run R03X09A
ARTH07A – Arthur City flow-frequency and flow-duration data for run R03X07A
ARTH08A– Arthur City flow-frequency and flow-duration data for run R03X08A
ARTH09A– Arthur City flow-frequency and flow-duration data for run R03X09A

Excel File
TexWSReal-FreqDurA – All tabular data for the three SUPER runs plus minimum frequency files with corrected x axis (Figures 7 and 8)

Power Point File
TexomaWSReallocA – Figures 1-6

Figure 1

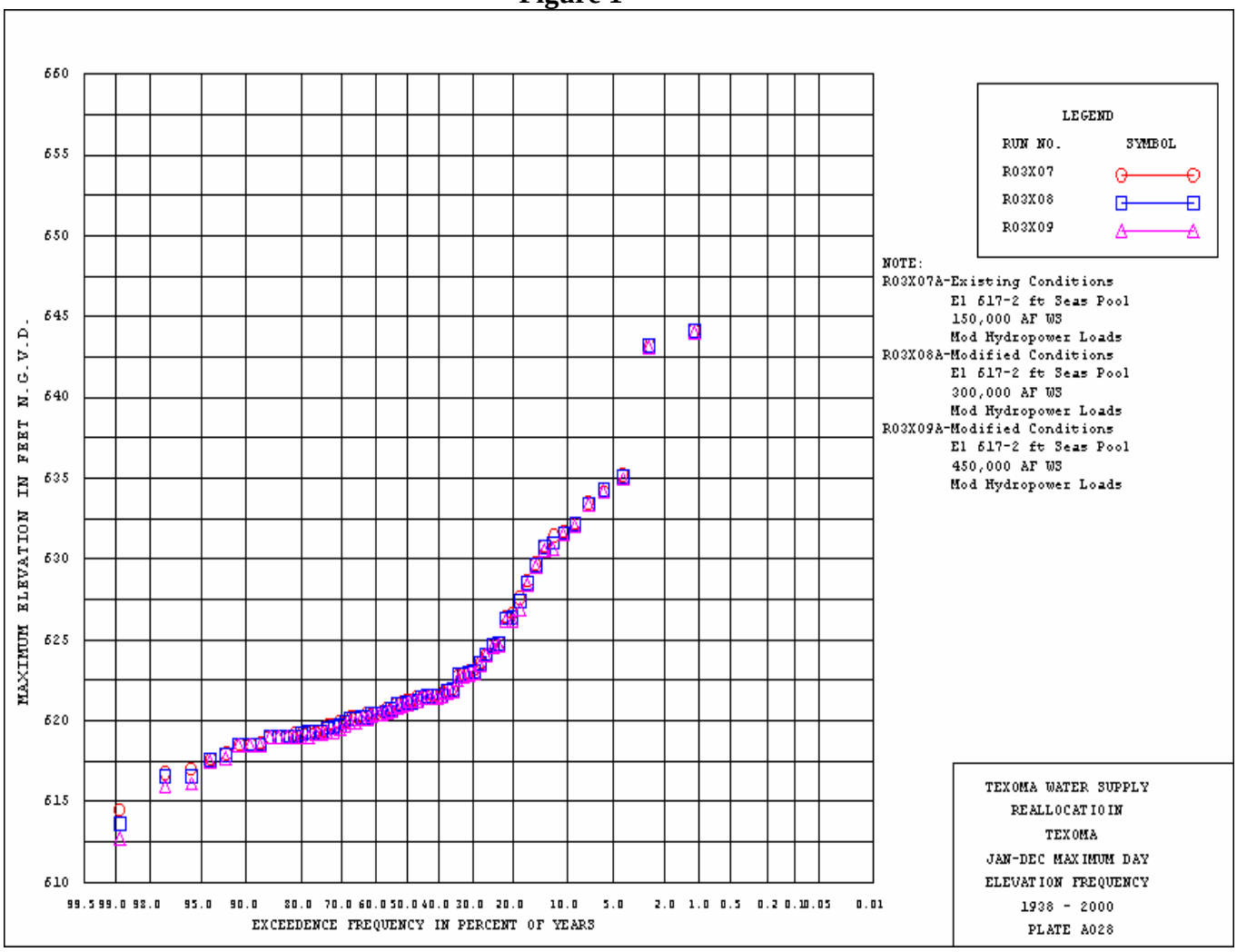
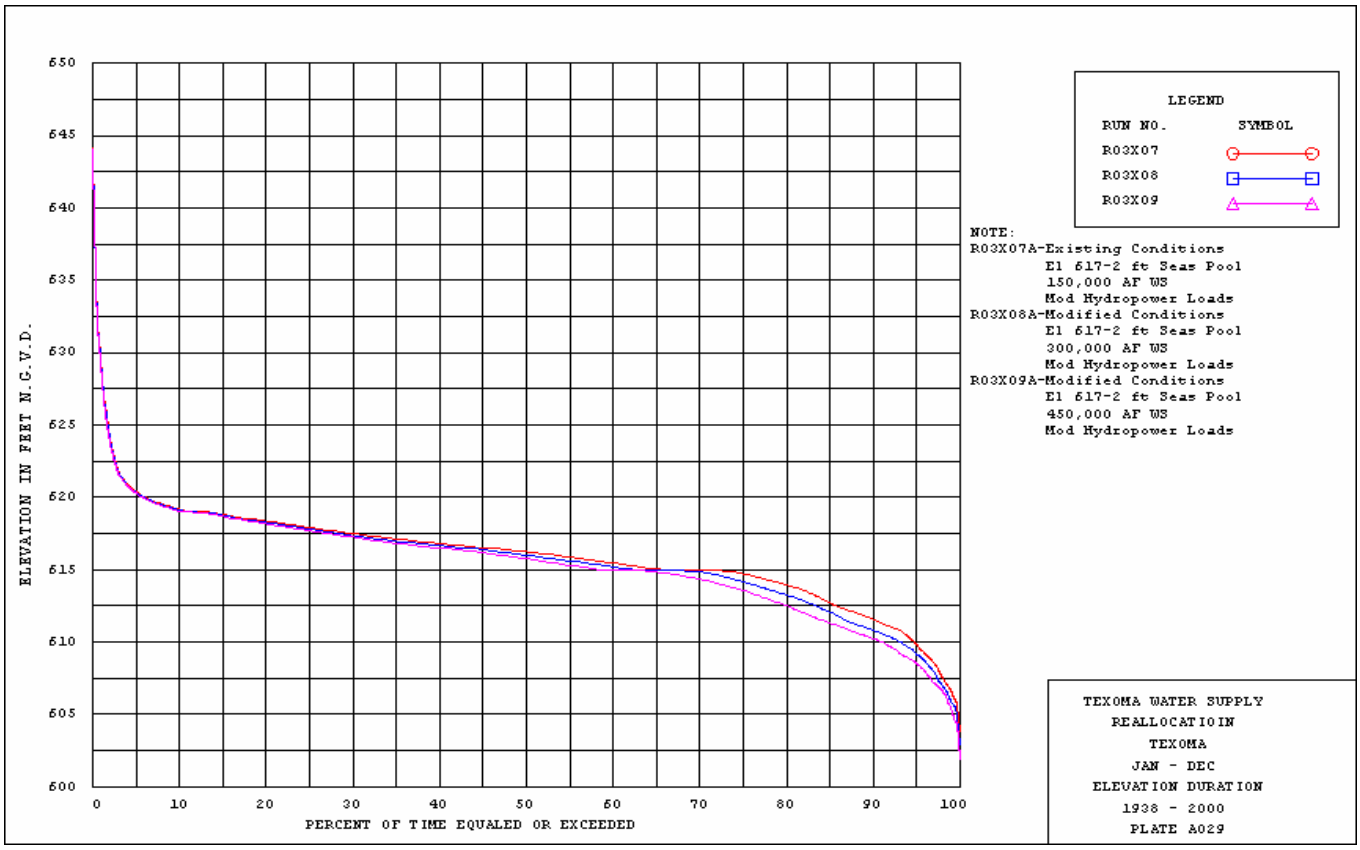

MAXIMUM ELEVATION IN FEET N.G.V.D.
660
655
650
645
640
635
630
625
620
615
610
99.5 99.0 98.0 95.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 5.0 2.0 1.0 0.5 0.2 0.1 0.05 0.01
EXCEEDENCE FREQUENCY IN PERCENT OF YEARS
LEGEND
RUN NO. SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA
JAN-DEC MAXIMUM DAY
ELEVATION FREQUENCY
1938 - 2000
PLATE A028

Figure 2


650
645
640
635
630
625
620
615
610
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600
ELEVATION IN FEET N.G.V.D.
0
10
20
30
40
50
60
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80
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PERCENT OF TIME EQUALED OR EXCEEDED
LEGEND
RUN NO.
SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA
JAN - DEC
ELEVATION DURATION
1938 - 2000
PLATE A029

Figure 3

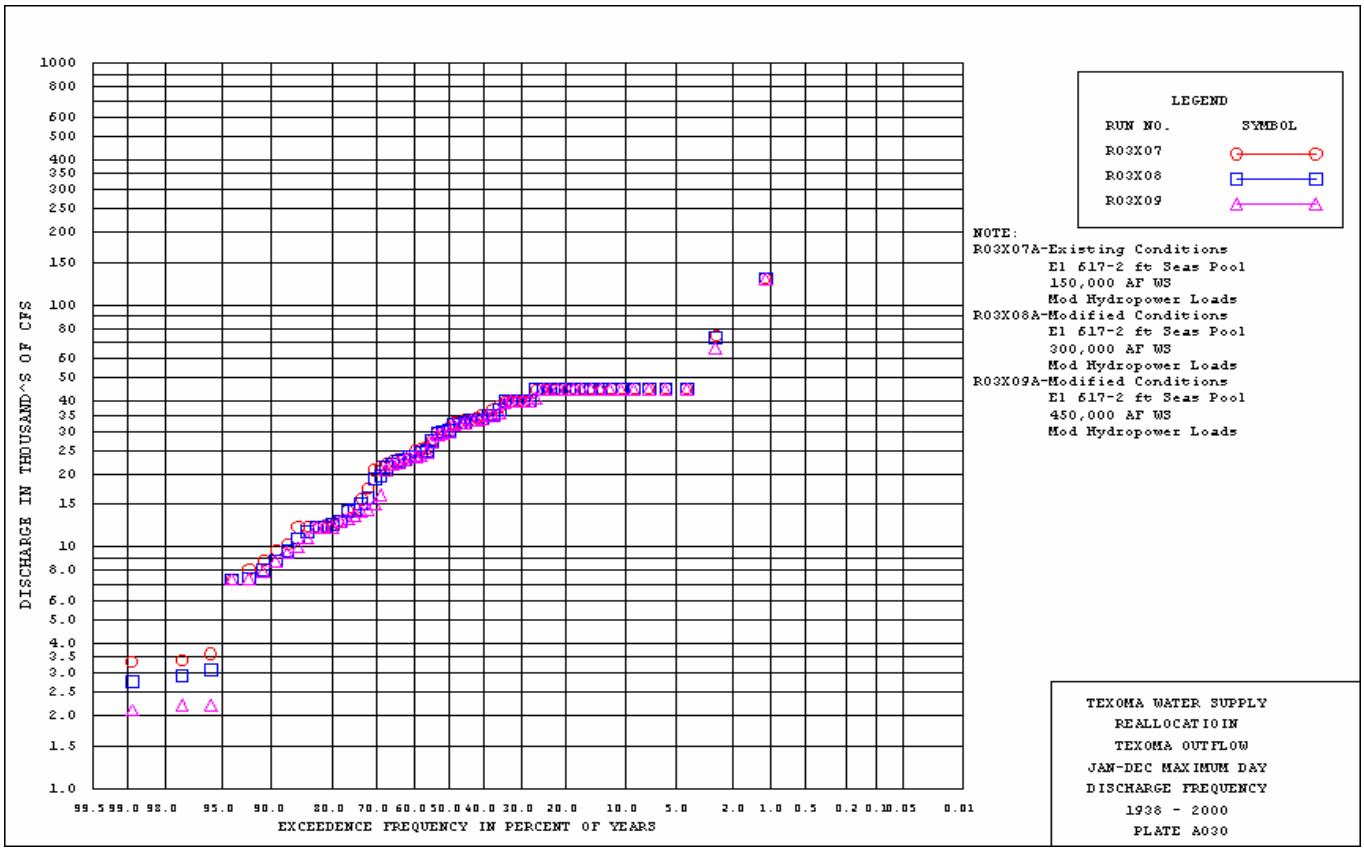

LEGEND
RUN NO.
SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
DISCHARGE IN THOUSAND^S OF CFS
EXCEEDENCE FREQUENCY IN PERCENT OF YEARS
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA OUTFLOW
JAN-DEC MAXIMUM DAY
DISCHARGE FREQUENCY
1938 - 2000
PLATE A030

Figure 4

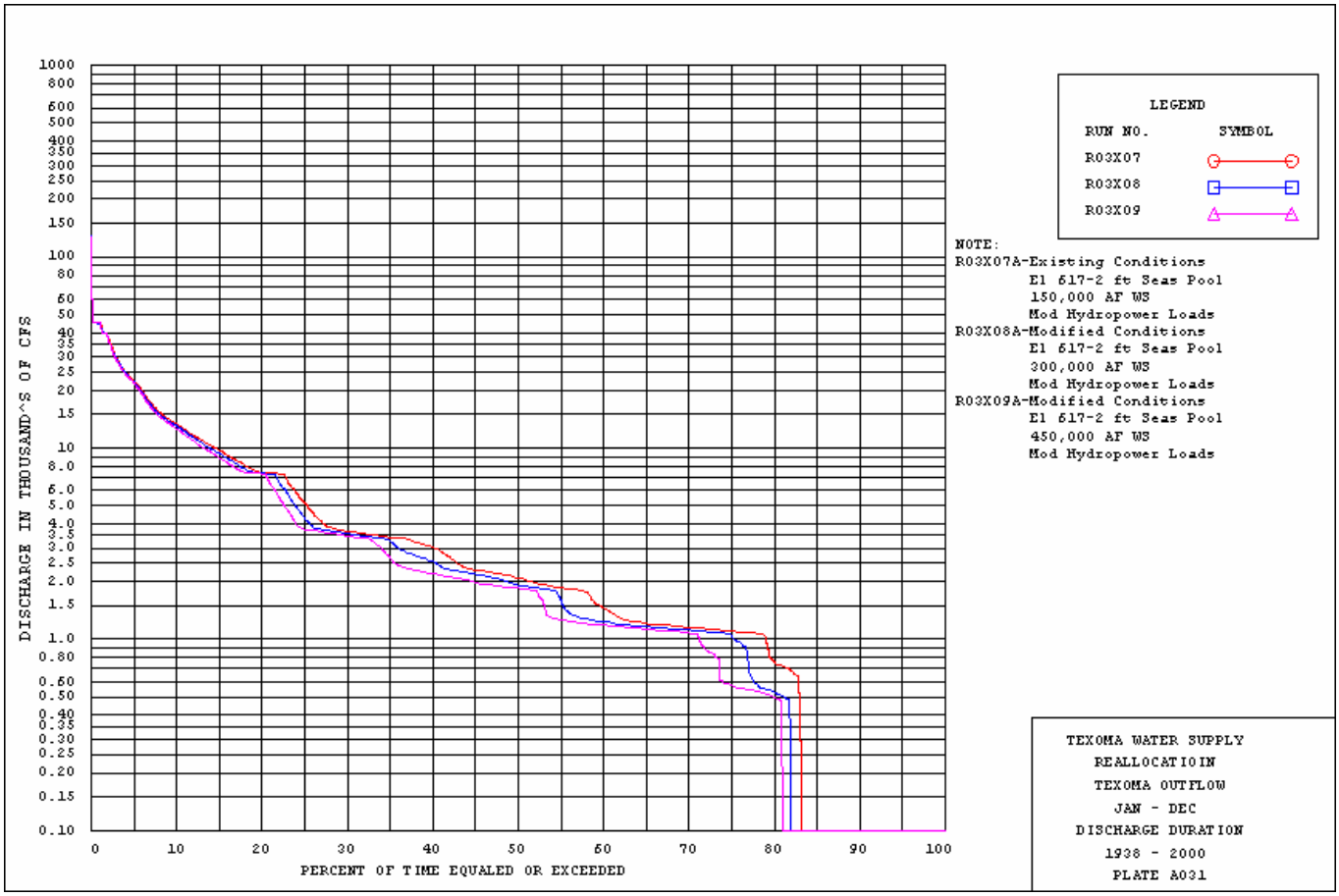
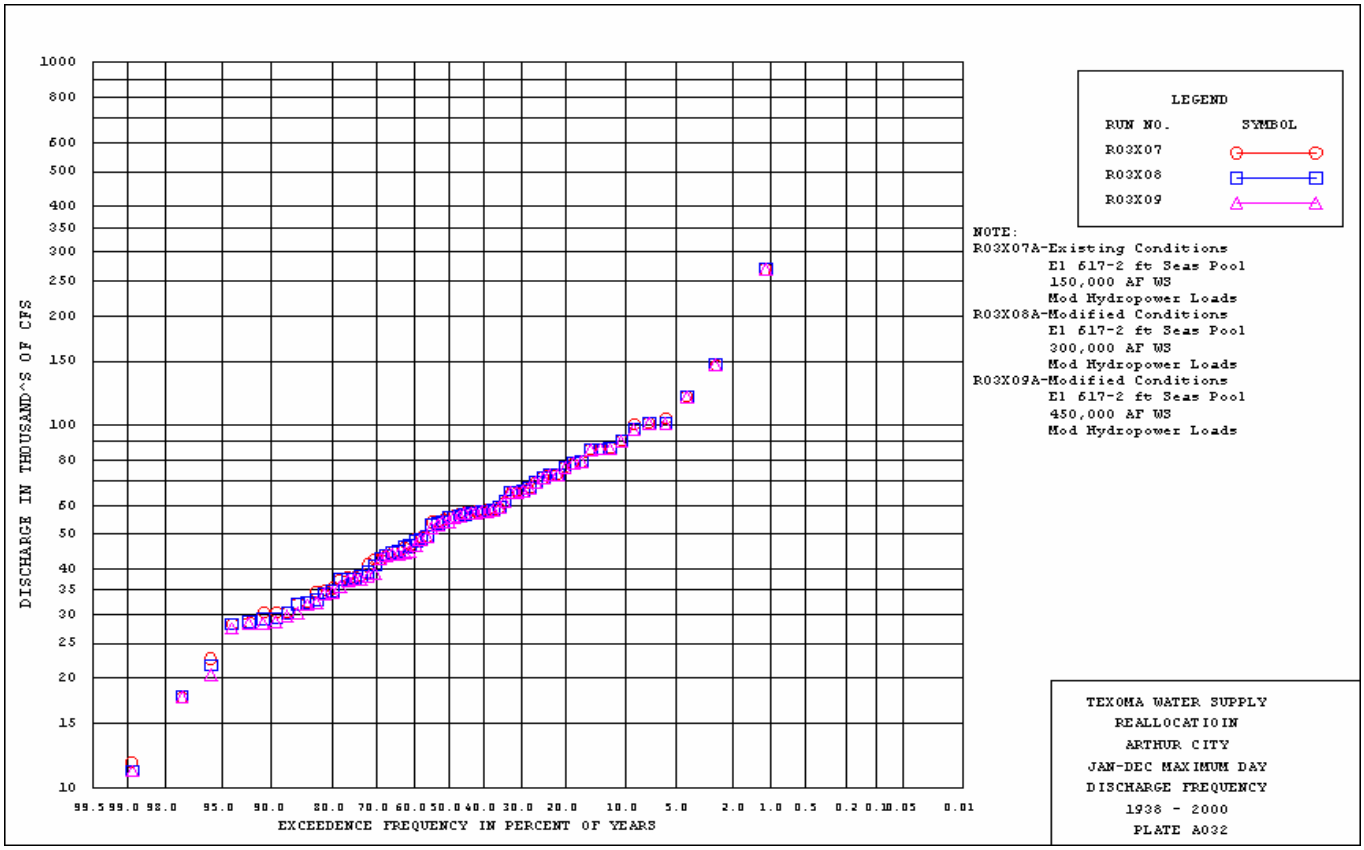

DISCHARGE IN THOUSAND^S OF CFS
PERCENT OF TIME EQUALED OR EXCEEDED
LEGEND
RUN NO.
SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 517-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 517-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 517-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
TEXOMA OUTFLOW
JAN - DEC
DISCHARGE DURATION
1938 - 2000
PLATE A031

Figure 5


DISCHARGE IN THOUSAND^S OF CFS
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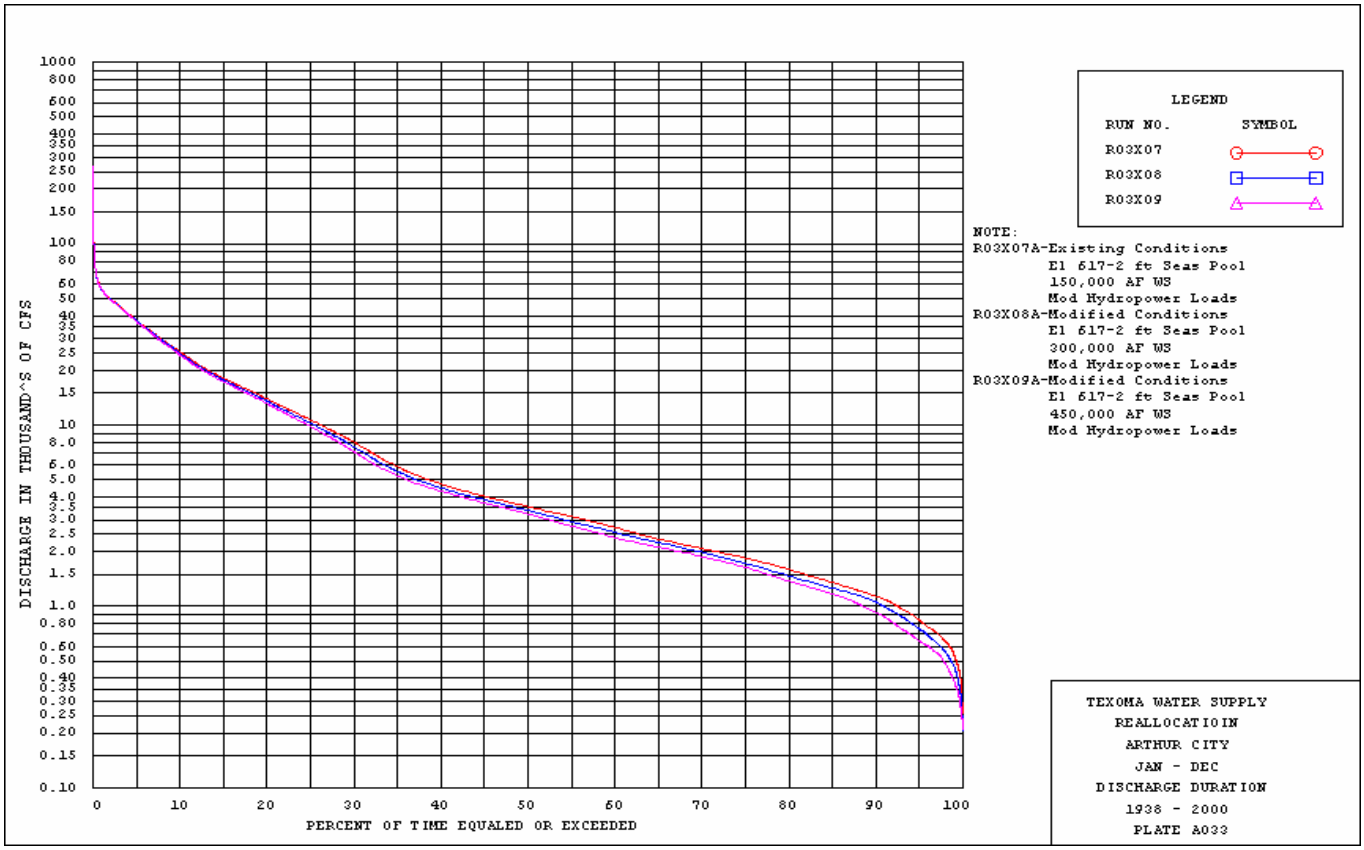
99.5 99.0 98.0 95.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 5.0 2.0 1.0 0.5 0.2 0.1 0.05 0.01
EXCEEDENCE FREQUENCY IN PERCENT OF YEARS
LEGEND
RUN NO. SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
ARTHUR CITY
JAN-DEC MAXIMUM DAY
DISCHARGE FREQUENCY
1938 - 2000
PLATE A032

Figure 6


DISCHARGE IN THOUSAND^S OF CFS
1000
800
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200
150
100
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60
50
40
35
30
25
20
15
10
8.0
6.0
5.0
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.80
0.60
0.50
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0
10
20
30
40
50
60
70
80
90
100
PERCENT OF TIME EQUALED OR EXCEEDED
LEGEND
RUN NO.
SYMBOL
R03X07
R03X08
R03X09
NOTE:
R03X07A-Existing Conditions
El 617-2 ft Seas Pool
150,000 AF WS
Mod Hydropower Loads
R03X08A-Modified Conditions
El 617-2 ft Seas Pool
300,000 AF WS
Mod Hydropower Loads
R03X09A-Modified Conditions
El 617-2 ft Seas Pool
450,000 AF WS
Mod Hydropower Loads
TEXOMA WATER SUPPLY
REALLOCATIOIN
ARTHUR CITY
JAN - DEC
DISCHARGE DURATION
1938 - 2000
PLATE A033

Figure 7

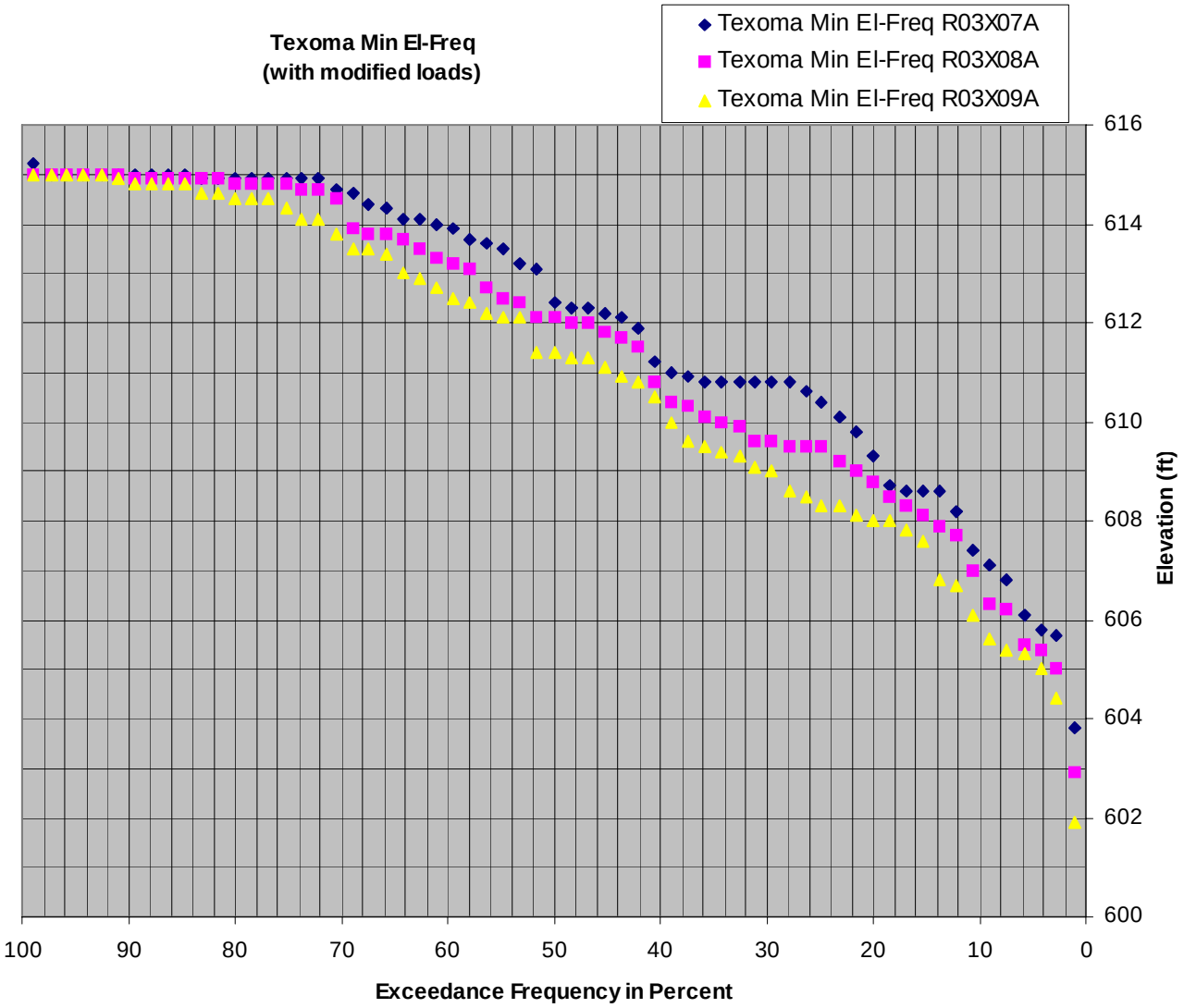
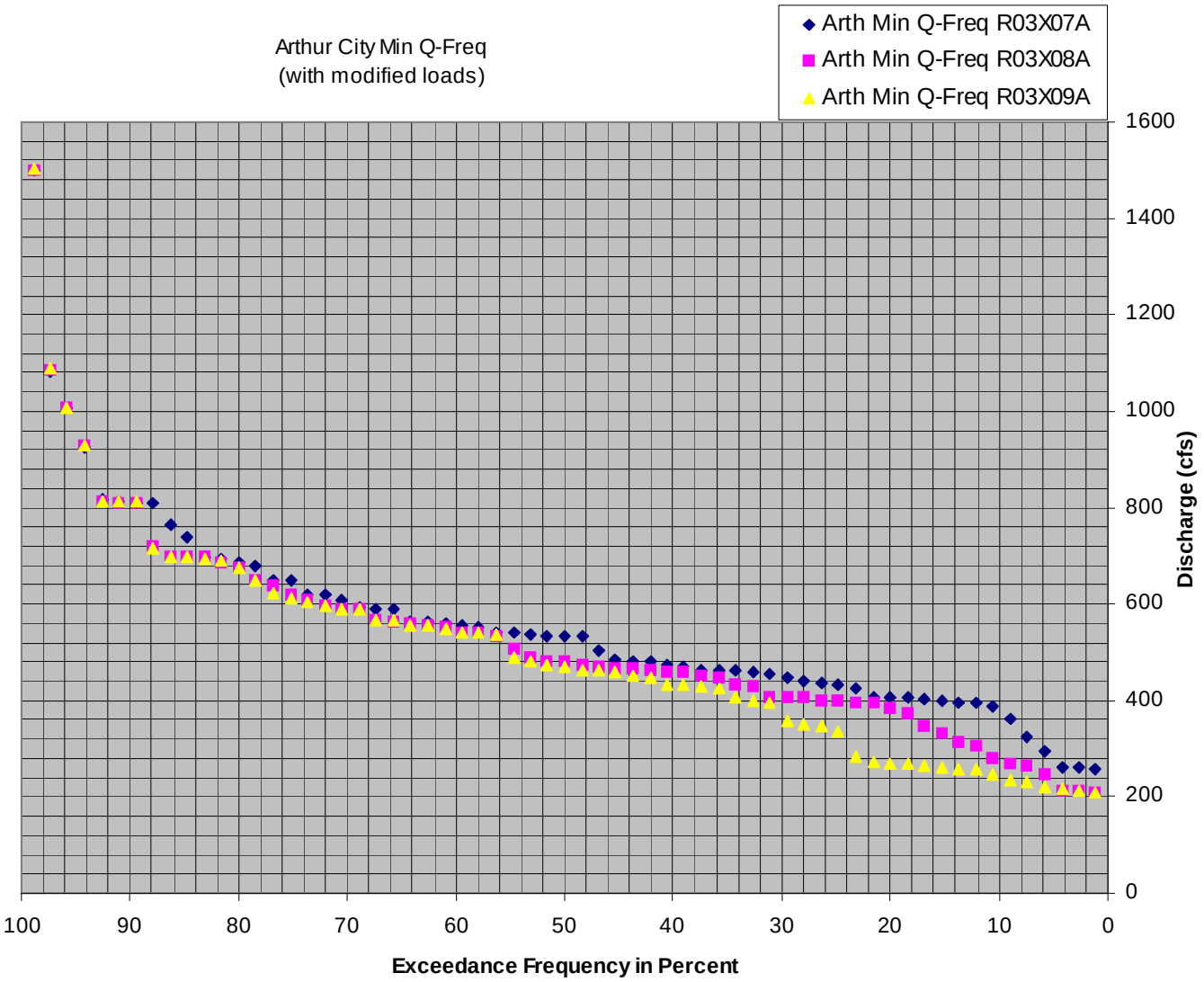

Texoma Min El-Freq
(with modified loads)
Texoma Min El-Freq R03X07A
Texoma Min El-Freq R03X08A
Texoma Min El-Freq R03X09A
616
614
612
610
608
606
604
602
600
Elevation (ft)
100
90
80
70
60
50
40
30
20
10
0
Exceedance Frequency in Percent

Figure 8


Arthur City Min Q-Freq
(with modified loads)
Arth Min Q-Freq R03X07A
Arth Min Q-Freq R03X08A
Arth Min Q-Freq R03X09A
1600
1400
1200
1000
800
600
400
200
0
Discharge (cfs)
100
90
80
70
60
50
40
30
20
10
0
Exceedance Frequency in Percent

APPENDIX 11.5

LAKE TEXOMA WATER SUPPLY
DEMAND AND ANALYSIS

APPENDIX 11.5

LAKE TEXOMA WATER SUPPLY DEMAND AND ANALYSIS

11.5.1 Lake Texoma Water Reallocation Study - Water Supply Demand Analysis and Analysis of Water Supply Alternatives

11.5.1.1 Introduction.

The following sections discuss water supply and demand in Texas and Oklahoma, for those areas are most likely to be impacted by the availability of water supply from Lake Texoma. The Texas portion is derived, in part, from the "Initially Prepared 2006 Region C Water Plan," dated June 2005, with the focus on the NTMWD and the GTUA. Information presented in the Oklahoma portion is taken from information developed by the U.S. Army Corps of Engineers, Tulsa District and others for the 2005 update of the Oklahoma State Water Plan.

11.5.1.2 Water Demand and Supply: Texas - Initially Prepared Texas State Water Plan for Region C, 2006.

11.5.1.2.1 Study Area.

The study area includes the counties and water systems or districts in the North Texas region that are currently using Lake Texoma water or may use Lake Texoma water in the future. In addition to the Texas counties, those Oklahoma counties that may currently be using or expect to use Lake Texoma water in the future will be discussed. The focus will be on the Texas counties and major water systems that have an expressed need for water from Lake Texoma. The basis for the evaluation of water supply and demands for the region is the "Initially Prepared 2006 Region C Water Plan," June 2005 draft. Region C includes Grayson County adjacent to Lake Texoma mainly in the Red River Basin and the Dallas-Fort Worth metropolitan area, lying mostly in the Trinity River Basin. The population of Region C was about 5,000,000 in 2000, with Dallas and Tarrant counties accounting for over 70% of the region's population. This area has shown strong population and economic growth over the last decade. Although Region C contains about 25% of the State's population, only about 7% of Texas' water use occurs in the region due to the lack of irrigation in the region. Figure 4 shows Region C with major water resources identified.

Figure 1. Region C And Outside Water Supplies Currently Used In Region C

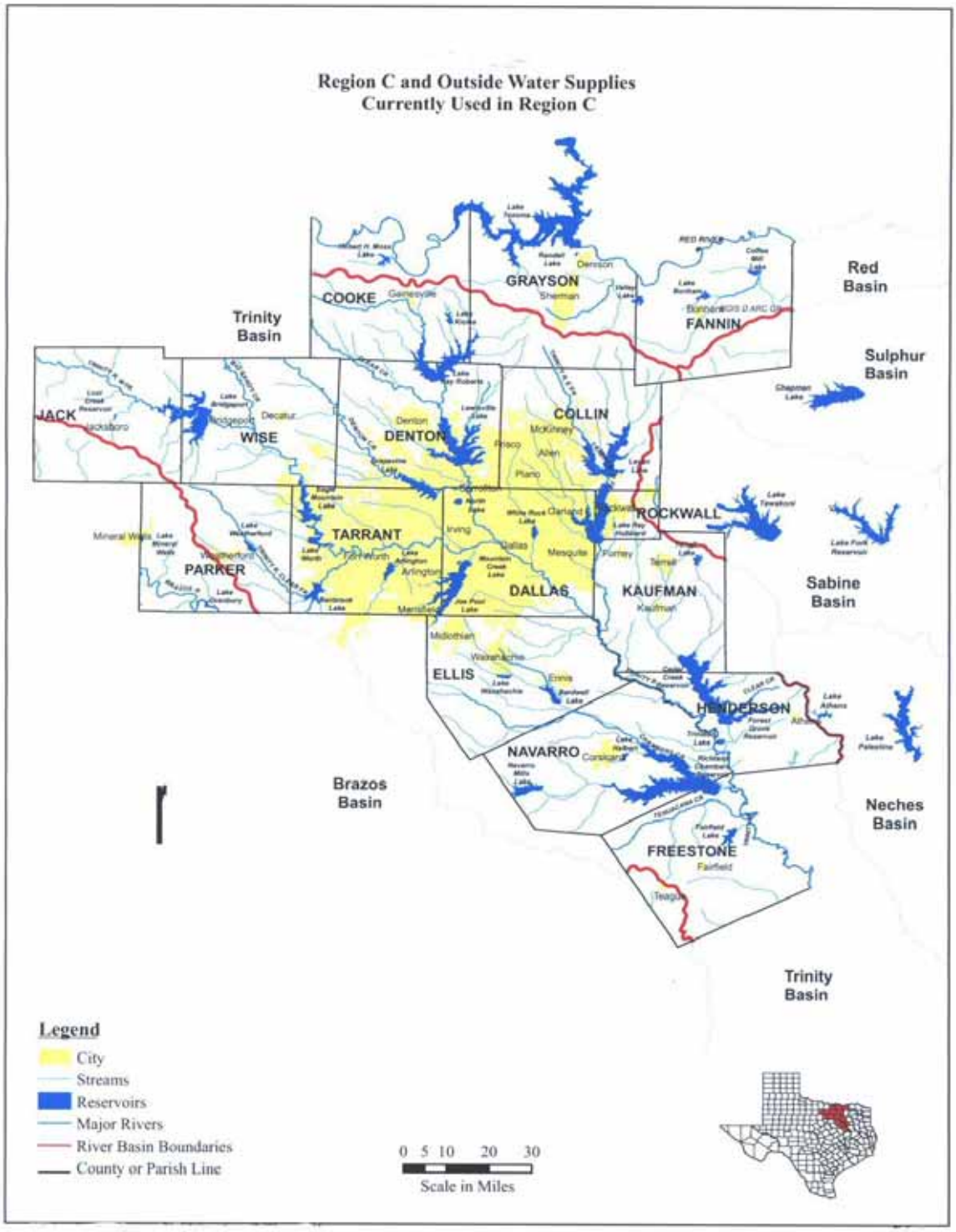


Table 1 shows historical and future populations for selected counties in Region C. Projections are made by 20-year increments from 2020 to 2060. Although this table doesn't display all counties (the Texas State Water Plan shows all counties), it represents most of the expected population counts in the region.

TABLE 1
HISTORICAL AND POPULATION PROJECTIONS BY SELECTED COUNTIES
REGION C
TEXAS STATE WATER PLAN 2006

County	Year				
	1990	2000	2020	2040	2060
Collin	264,036	491,774	1,033,173	1,512,261	2,033,981
Dallas	1,852,810	2,218,774	2,883,564	3,338,498	4,032,056
Denton	273,525	432,976	953,668	1,392,575	1,870,472
Grayson	95,021	110,595	163,711	208,936	253,568
Tarrant	1,170,103	1,446,219	1,956,163	2,454,046	3,146,721
Total	3,655,495	4,700,338	6,990,279	8,906,316	11,336,798
Region C Total	4,077,565	5,254,722	7,966,389	10,246,795	13,087,849

Source: Initially Prepared 2006 Region C Water Plan, June 2005 draft.

11.5.1.2.2 Water Demand.

Five counties (Collin, Dallas, Denton, Grayson, and Tarrant) stand out for comparative purposes relative to probable future use of Lake Texoma water. There are 35 wholesale water providers and 351 water user groups in Region C. Major water providers serve all or portions of other counties as well. These counties have as their major providers of water the NTMWD (Collin County), the Dallas Water Utilities (DWU) (Dallas County), and the GTUA (Grayson County). Two other counties, Denton (DWU) and Tarrant (TRWD), also account for expected large future municipal water demands. Water demand projections for Region C were categorized by use as municipal, manufacturing, steam-electric power, mining, irrigation, and livestock. Region-wide projections are consistent with Texas Water Development Board (TWDB) planning guidelines. These projections now incorporate a substantial slowing in the rate of population growth over the next 50 years. Water conservation is also built into the demand projections. Currently implemented water conservation strategies and water conservation assumption are implicit in the water demand projections for the region. For example, by 2060 low flow plumbing devices would reduce future water demand about 5% of total regional demand. More efficient power plants will also reduce water consumption in the future.

A significant increase in per capita water use in the region occurred in 1996 and 1998 despite conservation efforts and the impact of low flow plumbing fixtures. Although per capita water use has been increasing for many communities, conservation measures will partially offset this increase. Rapid development in communities and in commercial development accounts for part of this increase. Projected municipal water demand is a function of per capita use rates and population growth. Water reuse and other conservation measures will reduce the per capita

municipal use rate from 197 gallons per capita day (gpcd) in 2000 to less a normal year value of 121 gpcd by 2020 (after crediting for reuse).

The vast majority of historical and future water use will occur in the municipal sector. The historical year 1996 use for municipal was about 947,000 acre-feet (846 mgd) out of a total of 1,127,000 acre-feet (1,006.3 mgd) for Region C. Projected municipal water demand by 2050 for the region is expected to be 2,125,000 acre feet (1,897.3 mgd) out of a total of 2,537,000 acre-feet (2,265.2 mgd). These data indicate a strong demand for water in the future, mainly for municipal purposes.

Table 2 shows historical and future water demand for selected counties in Region C. Projections are made by 20-year increments and water use category from 2020 to 2060. Although this data does not display all counties, it represents most of the future water demand in the region.

TABLE 2
HISTORICAL AND PROJECTED WATER DEMAND BY SELECTED COUNTIES
REGION C WATER PLAN 2006
(acre-feet)

County	Year				
	1996	2000	2020	2040	2060
Collin	89,230	138,306	287,247	402,383	526,315
Dallas	505,423	623,535	785,788	879,106	1,055,030
Denton	65,075	93,982	212,211	307,951	406,700
Grayson	29,152	32,478	45,954	55,613	66,715
Tarrant	291,406	331,066	451,536	559,650	718,098
Total	980,286	1,219,367	1,782,736	2,204,703	2,772,858
Region C Total	1,126,621	1,380,556	2,100,519	2,622,513	3,311,217
Municipal	946,454	1,196,452	1,828,831	2,294,491	2,915,773

Source: Initially Prepared 2006 Region C Water Plan, June 2005 draft.

11.5.1.2.3 Existing and Potential Sources of Water Supply by Major Provider.

There are over 34 reservoirs in Region C with conservation storage over 5,000 acre-feet. Additional reservoirs outside the region provide water supply to the region. Although use of groundwater has been decreasing, the Trinity Aquifer supplies most of the groundwater used in this region, mainly in rural areas. Ninety percent of the total water supplied in the region is from surface sources. Municipal supply accounts for about 85% of current water use. Little wastewater is treated and returned for use although municipalities are considering reuse as a source of future supply. In addition to the GTUA serving the Sherman-Denison communities in Grayson County, there are five major water providers in the region. They are Dallas Water Utilities (DWU), Tarrant Regional Water District (TRWD), the NTMWD, the city of Fort Worth, and the Trinity River Authority (TRA).

Total water use in Region C in 2000 was over 1.38 million acre-feet (1,231 mgd), of which about 60% came from in-region reservoirs and 28% was imported from other regions. By 2060, total

water supply from reliable sources will be about 1,927,000 acre-feet (1,720 mgd). In–region reservoirs, as a source of water supply for Region C in 2060, are expected to total about 1,127,000 acre-feet (1,006 mgd), or about 58% of the total supply. Other sources of water supply in the region include 106,000 acre-feet (95 mgd) from groundwater, 44,000 acre-feet (39 mgd) from local supplies, 103,000 acre-feet (92 mgd) from reuse, and 546,000 acre-feet (487 mgd) (28% of total supply) from other regions. The expected supply from existing sources in 2060 is significantly less than expected demand. Nine of the regional wholesale water suppliers provide about 77% of the supply available to the region, and by 2060 will continue to have about 77% of the water supply currently available in the region. The amount of current water supply available to the region will decline about 4% by 2060. The Texas Region C Water Plan indicates that in 2000, Cooke, Dallas, and Parker counties show a net need for additional supplies, with additional supplies needing to be connected by 2010. By 2060, 11 out of 16 Region C counties show a need for the development of additional supplies to meet projected demands.

a. North Texas Municipal Water District (NTMWD).

The NTMWD supplies wholesale water and wastewater service to member cities and customers in Collin, Denton, Fannin, Dallas, Rockwall, Hunt, and Kaufman counties in north-central Texas. The cities of Plano, Richardson, Garland, Mesquite, and McKinney are a few of the larger municipalities receiving all or part of their service from the NTMWD. Water demand is expected to double between 2010 and 2060, with a shortage of about 100,000 acre-feet by 2010, increasing to 534,000 acre-feet by 2060. The main water treatment plant for the NTMWD is located near Lake Lavon. The district receives its surface water supply from three primary sources, Lake Lavon, Cooper Lake, and Lake Texoma.

(1) Existing Sources of Water Supply: NTMWD.

Lake Lavon. Lake Lavon is located on the East Fork of the Trinity River approximately 1 mile northwest of Lavon, Texas, in Collin County. The Corps of Engineers built Lake Lavon in 1953 for flood control and water supply. The lake has conservation storage of 380,000 acre-feet with a dependable yield of about 92.0 mgd. The entire yield is allocated and contracted to the NTMWD which has a water right to 104,000 acre-feet of storage. The lake also receives up to 24.0 mgd of effluent from the Wilson Creek Wastewater Treatment Plant and is the receiving point for inter-basin transfers of water from Lake Texoma and Lake Cooper. Facilities are in place to utilize the entire available yield of Lake Lavon.

Jim Chapman Lake/Cooper Dam. Jim Chapman Lake/Cooper Dam is a Corps of Engineers reservoir on the South Sulphur River, 4 miles southeast of Cooper, Texas, in Hopkins and Delta counties. Jim Chapman Lake was completed in 1992. The reservoir has conservation storage of 273,120 acre-feet with a dependable yield of ±107.1 mgd. The NTMWD, the city of Irving, and the Sulphur River Water District (SRWD) hold water rights in Lake Chapman totaling 146,250 acre-feet per year, of which 127,320 acre-feet per year can be exported for use in Region C. The NTMWD receives 57,214 acre-feet per year; the city of Irving, 54,000 acre-feet per year; and the Upper Trinity Regional Water District (UTRWD) (purchased from the SRWD), 16,106 acre-feet per year. The SRWD has contracted a portion of its yield to the UTRWD for use in the Denton County, Texas, area. Currently available water from Lake Jim Chapman for the NTMWD is

50,802 acre-feet per year in 2000 decreasing to 45,843 acre-feet per year by 2060. The city of Irving receives 47,948 acre-feet per year in 2000 decreasing to 43,268 acre-feet in 2060. Finally, the UTMWD receives 14,301 acre-feet per year in 2000 decreasing to 12,905 acre-feet per year by 2060. Each entity is permitted to divert at a maximum rate of 122% of allocated yield. The NTMWD has facilities in place to transfer up to 110 mgd of water from Cooper Lake to Lake Lavon.

Lake Texoma. Lake Texoma, on the Red River near Denison, Texas, is the third surface water source utilized by the NTMWD. The reservoir has 2,722,000 (is this current conservation pool?) acre-feet of conservation storage (does this include the Cumberland pool? I don't think the Cumberland pool is included in the integrated hydropower and water supply pool. Otherwise I thought the conservation storage was 1,002,070 AF.) The RRAT, the GTUA, the city of Denison, the NTMWD, and Texas Utilities (TXU) have water rights in Lake Texoma. Lake Texoma water is pumped and then gravity flowed to Lake Lavon and blended for subsequent use. The NTMWD has contractual rights to divert up to 77,300 acre-feet or about 75.0 mgd of water from Lake Texoma. Other entities that have storage at Lake Texoma are the GTUA, acting for the city of Sherman, Texas; 22,600 acre-feet; the city of Denison, 21,300 acre-feet; the TXU, 16,400 acre-feet; and the RRAT, 2,473 acre-feet.

Groundwater sources for the NTMWD area are of poor quality or limited quantity and, therefore, are not considered adequate potential sources of water supply.

(2) Potential Sources of Water Supply: Water Management Strategies.

Major regional wholesale water providers, such as the NTMWD, the DWU, the TRWD, and the UTRWD, have similar water management strategies. These strategies include water conservation, reuse water, installation of connections to existing sources already under contract, connection to other existing sources, and development of new reservoirs. Lower Bois d'Arc Reservoir, Marvin C. Nichols Reservoir, Toledo Bend Reservoir, and Oklahoma water are under consideration by the NTMWD are possible sources of new supply for the NTMWD as well as for the other major providers. The Fannin County Water Supply System is also a potential water management strategy.

New Supply from Lake Texoma. The NTMWD has requested a contract for additional storage in Lake Texoma from the U.S. Army Corps of Engineers, Tulsa District and has applied for a Texas water right to impound up to 100,000 acre-feet in Lake Texoma and divert up to 113,000 acre-feet per year from the lake. The U.S. Congress has authorized the reallocation of 150,000 acre-feet of storage in Lake Texoma from hydroelectric power generation to municipal use in Texas, with 50,000 acre-feet per year reserved for the GTUA. The NTMWD would contract for the 100,000 acre-foot reallocation for municipal use not reserved for the GTUA and would blend the water with higher quality supplies from other sources or develop a desalination plant. At this time, blending appears to be the more economical approach. It is assumed that the NTMWD will use one part of Lake Texoma supply for four parts of other imported water. The NTMWD would deliver the water directly from Lake Texoma and/or from the Red River downstream of the lake. (Downstream diversions would require a longer pipeline but offer the advantage of reduced levels of dissolved solids.)

Lower Bois d'Arc Creek Reservoir. The Lower Bois d'Arc Creek Reservoir is a proposed reservoir on Bois d'Arc Creek in the Red River Basin. It was included in the 2001 Region C Water Plan (0) as a supply for the NTMWD, and the NTMWD has continued to study the project. The Lower Bois d'Arc Creek Reservoir would provide up to 123,000 acre-feet per year for the NTMWD and Fannin County. The Lower Bois d'Arc Creek Reservoir would be developed by 2020.

Marvin Nichols Reservoir is another potential two-stage impoundment on the Sulphur River and White Oak Creek in southwestern Bowie and Morris counties. The total yield of water supply is about 612,300 acre-feet per year, assuming that Ralph Hall Lake is senior to Marvin Nichols Reservoir and that Marvin Nichols Reservoir is operated as a system with Lake Wright Patman. With about 489,430 acre-feet available for Region C, the NTMWD share would be about 174,840 acre-feet, while the TRWD would receive the largest amount at 280,000 acre-feet per year. Phase 1 would be developed by 2030 and Phase 2 by 2050. Most of the cost is in the pipelines and pump stations.

Toledo Bend Reservoir in East Texas is recommended for the TRWD and the NTMWD as a primary strategy and for the DWU and the UTRWD as an alternate strategy. The NTMWD's share would be 200,000 acre-feet per year of the total 500,000 acre-feet available by 2050. The TRWD would also receive 200,000 acre-feet per year.

Oklahoma water remains a promising source of supply for the North Texas region although the Oklahoma legislature has a current moratorium on export of water from the state. The recommended strategy in the Water Plan is to pursue Oklahoma water, of which 50,000 acre-feet each is for the TRWD and the NTMWD. Oklahoma water is considered an alternate strategy for the DWU and the city of Irving.

Water management strategies other than those joint efforts discussed above are:

NTMWD Conservation. Conservation is the projected conservation savings for the NTMWD's existing and potential customers based on the Region C recommended water conservation program. Not including savings from low flow plumbing fixtures (which amount to about 5% of demand and are built into the demand projections) and not including reuse, conservation by NTMWD customers is projected to reach 84,124 acre-feet per year by 2060.

Interim Treated Water Purchase from Dallas Water Utilities (DWU). The NTMWD is negotiating with the DWU to purchase an annual average of up to 10 mgd (11,210 acre-feet per year) of treated water. The water would be delivered to the NTMWD by a connection between Dallas' water distribution system and the NTMWD treated water distribution system, and a meter would be installed.

Additional Wilson Creek Reuse Project. The NTMWD currently has a water right allowing the reuse of up to 35,941 acre-feet per year (32 mgd) of actual discharges from the Wilson Creek Wastewater Treatment Plant. The NTMWD has applied for a water right to reuse an additional

35,941 acre-feet per year of discharges from the plant. This was a recommended water management strategy in the 2001 Region C Water Plan.

East Fork Reuse Project. The NTMWD has applied for a water right to divert treated wastewater from the East Fork of the Trinity River near Crandall. The water would be diverted to a constructed wetland for treatment, pumped through a pipeline to Lake Lavon, and redirected from Lake Lavon for treatment and use. The estimated supply available from this project will increase with increasing wastewater flows to 102,000 acre-feet per year. This water management strategy was added to the 2001 Region C Water Plan by an amendment in 2005.

Additional Lake Lavon Yield. The NTMWD currently has a water right allowing the diversion of up to 104,000 acre-feet per year from Lake Lavon (in addition to water delivered to the lake from return flows, Lake Texoma, and Lake Chapman). The Trinity River Water Availability Model (6) shows that the yield of Lake Lavon is greater than 104,000 acre-feet per year. The NTMWD has applied for a water right to divert up to an additional 14,840 acre-feet per year from Lake Lavon. Based on estimated area and capacity conditions in the lake, the additional supply from this measure will vary from 11,000 acre-feet per year in 2010 to 6,000 acre-feet per year in 2060.

Interim Purchase of Lake Texoma Water from GTUA/Sherman. The NTMWD has reached an agreement with the city of Sherman and the GTUA to purchase surplus Lake Texoma water. The water would be delivered through the NTMWD's existing pump station and pipeline from Lake Texoma. This supply is expected to be available for up to 20 years, and only water surplus to the in-basin needs of GTUA and Sherman would be purchased. The GTUA has applied for an interbasin transfer permit to allow the proposed sale and transfer.

Upper Sabine Basin Supply. The NTMWD is negotiating with the Sabine River Authority to divert water from Lake Tawakoni or Lake Fork on an interim basis. The NTMWD would divert only water surplus to the needs of other users and would eventually replace this water with supplies from other sources. The NTMWD would seek an interbasin transfer and would build a pump station and pipeline to deliver water from Lake Tawakoni or Lake Fork to Lake Lavon.

Fannin County Water Supply System. The NTMWD would cooperate with Fannin County entities to develop a treated water supply system for Fannin County water users after the Lower Bois d'Arc Creek Reservoir is developed in 2020. The system would involve one or more water treatment plants and a treated water distribution system.

As shown on Table 6, nearly 790,000 acre-feet per year of new supplies are recommended for the NTMWD, leading to a total supply of 1.02 million acre-feet per year in 2060. Over 30% of the projected water supply through 2040 is from reuse and conservation. This percentage reduces to 25% as new supplies are developed in 2050. The NTMWD's share of the total capital cost for the recommended plan is $3.9 billion.

The following alternative water management strategies are recommended:

- Toledo Bend Reservoir Phase 2 (accelerated to occur before 2060)

- Lake O' the Pines
- Wright Patman Lake
- Lake Texoma with desalination rather than blending
- Ogallala groundwater in Roberts County (Region A)
- Carrizo-Wilcox groundwater in Brazos County Area (Region G)
- George Parkhouse North Reservoir
- Lake Livingston

A summary of current water supplies and potential water management strategies and projected demand is presented in Table 3.

Costs for the alternative strategies are shown in Table 4. Capital costs for the projects are financed by 30-year bonds. Pre-amortization costs refer to the 30-year period during which debt service payments on the bonds are being made. Post-amortization costs refer to the period after the bonds are paid off, in which there are no debt service costs.

b. Greater Texoma Utilities Authority (GTUA).

The Greater Texoma Utility Authority, also known as "the Authority" or "GTUA", is a local political subdivision of the State and is governed by a Board of Directors. The Authority is a special-law district organized under Article XVI, Section 59, of the Texas constitution. The Authority operates under the provisions of Chapter 49 of the Texas Water Code. The Authority has no taxing power, but may incur debt by the issuance of bonds supported by revenues from the operations it finances. The Authority may enter into contracts to provide services for member cities and others when requested. The GTUA is located in Grayson county Texas.

While the State Legislature may have enacted a law to authorize the Authority, the cities of Denison and Sherman actually created the district by a confirmation election held on August 19, 1979. Since that time, the Cities of Bailey, Collinsville, Gainesville, Gunter, Howe, Leonard, Muenster, Pottsboro, Tioga, Tom Bean, Valley View, Van Alstyne, Whitesboro, and Whitewright have also joined as member cities of the Authority.

The Authority is governed by a Board of Directors appointed by its member cities. Places 1, 2, and 3 are appointed by the city of Denison. Places 4, 5, and 6 are appointed by the city of Sherman. The city of Gainesville appoints a member for Place 7, with Place 8 open for a home-rule member city. Place 9 is appointed by the general law member cities. Board members serve two-year terms. Half of them are appointed each year so that the terms overlap. The Board of Directors is responsible for all of the business of the Authority.

The Authority provides its member cities with assistance in financing and construction of water and wastewater facilities. The Authority may also be requested to provide operations services for water and wastewater facilities by member cities and others. The Authority has been designated as a cooperating local sponsor to negotiate with the U.S. Army Corps of Engineers for purchase of water from Lake Texoma on behalf of the cities in this area, which enables the Authority, controlled by local municipalities, to have greater influence in obtaining future water supplies.

The GTUA serves the Sherman-Denison area in Grayson County. The GTUA provides water to Sherman and manufacturing water to Grayson County. The GTUA will participate in the Grayson County Water Supply Project and the Collin-Grayson Municipal Alliance Pipeline that will provide water to 19 water user groups in Grayson and Collin counties. The GTUA will also provide the NTMWD with up to 25,000 acre-feet of raw water per year, with plans for 20,000 acre-feet per year. The GTUA has an existing water right for 25,000 acre-feet from Lake Texoma, which is currently limited by a treatment plant capacity of 11,210 acre-feet per year.

(1) Existing Sources of Water Supply: GTUA.

Lake Texoma. Lake Texoma, on the Red River near Denison, Texas, is the primary surface water source utilized by the GTUA. The reservoir has 1,467,000 acre-feet of conservation storage. Lake Texoma is expected to have 986,730 acre-feet of conservation storage by year 2044. The RRAT, the GTUA, the city of Denison, the NTMWD, and Texas Utilities (TXU) have water rights in Lake Texoma. The GTUA, acting as an agent for Sherman Texas, has contractual rights to divert up to 11,000 acre-feet of water from Lake Texoma with another 11,600 acre-feet of storage pending. The 1986 WRDA reserves another 50,000 acre-feet for the GTUA. Lake Texoma water is pumped to a desalinization facility near the Grayson County Airport for treatment prior to distribution. Other entities that have storage at Lake Texoma are the city of Denison, 21,300 acre-feet; the TXU, 16,400 acre-feet; and the RRAT, 2,473 acre-feet.

The lake is high in total dissolved solids (TDS) and chlorides (Cl), which exceed the U.S. Environmental Protection Agency (EPA) drinking water standards for public water supplies. The water requires either desalination treatment, using the electro-dialysis reversal (EDR) method, or blending prior to conventional water treatment for potable use.

Lake Randell. Lake Randell, with a dependable yield of 4.7 mgd, is used to regulate diversions from Lake Texoma for treatment and use by the city of Denison, and requires demineralization. Groundwater in this area is high in TDS, although some smaller communities continue to use it out of necessity and lack of alternative sources. Sherman obtains about 60% of its water from wells, with the remaining water that is desalinized by the EDR method coming from Lake Texoma. The city of Denison obtains about 0.12 mgd of its 3.5 mgd (3,920 acre-feet) average demand from wells with the capacity to transfer 6 mgd from Lake Texoma to Lake Randell.

TABLE 3

SOURCES OF WATER SUPPLY AND WATER DEMAND BY DECADE
RECOMMENDED WATER MANAGEMENT STRATEGIES
Texas State Water Plan 2006
North Texas Municipal Water District

Source	Year					
	2010	2020	2030	2040	2050	2060
Current Available Supplies						
Lake Lavon	104,000	104,000	104,000	104,000	104,000	104,000
Lake Texoma	77,300	77,300	77,300	77,300	77,300	77,300
Lake Chapman	49,976	49,150	48,324	47,498	46,672	45,843
Wilson Creek Reuse(permitted)	35,941	35,941	35,941	35,941	35,941	35,941
Lake Bonham	5,340	5,340	5,340	4,850	4,250	3,650
Total Current Available Supplies	272,557	271,731	270,905	269,589	268,163	266,734
Water Management Strategies						
Conservation	12,366	32,071	45,646	58,274	70,220	83,096
Interim DWU Supply	11,210	11,210	0	0	0	0
Wilson Creek Reuse(new)	26,956	35,941	35,941	35,941	35,941	35,941
East Fork Reuse	81,400	96,400	102,000	102,000	102,000	102,000
Additional Lake Lavon Yield	11,000	10,000	9,000	8,000	7,000	6,000
Interim GTUA Supply	20,000	0	0	0	0	0
Upper Sabine Basin	50,000	30,000	20,000	10,000	10,000	10,000
New Lake Texoma	0	38,250	57,105	54,105	100,460	112,460
Lower Bois d'Arc Creek Reservoir	0	123,000	121,000	119,000	117,000	115,000
Marvin Nichols Reservoir	0	0	87,420	87,420	174,840	174,840
Toledo Bend Phase 1	0	0	0	0	100,000	100,000
Oklahoma Water	0	0	0	0	0	50,000
Treatment and Distribution Losses	-10,028	-17,240	-21,623	-20,823	-32,362	-35,312

TABLE 3.
SOURCES OF WATER SUPPLY AND WATER DEMAND BY DECADE (Continued)

Source	Year					
	2010	2020	2030	2040	2050	2060
Total Supplies from Strategies	212,932	376,872	478,112	474,740	717,461	789,337
Total Current and Strategy Supplies	475,461	631,363	727,394	723,506	953,262	1,020,759
Total from Reuse and Conservation	156,663	200,353	219,528	232,156	244,102	256,978
Percent from Reuse and Conservation	32.9%	31.7%	30.2%	32.1%	25.6%	25.2%
Projected Demands	370,499	482,185	567,185	649,440	721,491	801,513

Source: Initially Prepared 2006 Region C Water Plan, June 2005 draft.

TABLE 4

SOURCES OF WATER SUPPLY AND WATER DEMAND BY DECADE
COSTS OF RECOMMENDED WATER MANAGEMENT STRATEGIES
Texas State Water Plan 2006
North Texas Municipal Water District
(2002 Price Levels)

Water Management Strategies	Develop Dates	Quantity for NTMWD (acre-feet/year)	Quantity for NTMWD (mgd)	NTMWD Share of Capital Cost($)	Unit Cost($/kGal) Pre-Amort	Unit Cost($/kGal) Post-Amort
Treatment and Distribution Improvements	2005-2060	N/A	N/A	1,290,523,000	N/A	N/A
Interim DWU Supply	2006	11,210	10	1,350,000	$0.75	$0.72
Wilson Creek Reuse(new)	2005	35,941	32	1,150,000	$0.01	$0.00
East Fork Reuse	2010	102,000	91	288,879,000	$0.92	$0.21
Additional Lake Lavon Yield	2006	11,000	10	270,000	$0.01	$0.00
Interim GTUA Supply	2006	20,000	18	104,000	$0.09	$0.09
Upper Sabine Basin	2010	50,000	45	60,232,000	$0.52	$0.25
New Lake Texoma	2015	113,000	101	201,829,000	$0.58	$0.18
Lower Bois d'Arc Creek Reservoir	2020	123,000	110	399,190,000	$0.87	$0.14
Fannin County Water Supply System	2020	0	0	55,458,000	$1.96	$0.52
Marvin Nichols Reservoir	2030	174,840	156	534,125,000	$0.94	$0.26
Toledo Bend Phase 1	2050	200,000	179	886,002,000	$1.56	$0.57
Oklahoma Water	2060	50,000	45	128,898,000	$0.95	$0.37
Total Capital Costs				3,848,010,000		

Source: Initially Prepared 2006 Region C Water Plan, June 2005 draft.

Note: Capital costs for water supply projects are typically financed by 30- year bonds. Pre-amortization costs refer to the 30 year period during which debt service payments on the bonds are being made. Post-amortization costs refer to the period after the bonds are paid off, in which there are no debt service costs.

(2) Potential Sources of Water Supply: Water Management Strategies.

The Region C Water Plan 2006 indicates that the GTUA will need to develop 6,000 acre-feet of new supply per year by 2010, and 43,000 acre-feet of new supplies per year by 2060. To meet these future needs, the Water Plan recommends the following strategies:

Conservation. Water conservation is expected to save about 4,800 acre-feet per year by 2060.

Changing permitted Lake Texoma water to municipal and industrial. The existing water right for diversion of water from Lake Texoma is 15,000 acre-feet per year for municipal/domestic purposes and 10,000 acre-feet per year for industrial purposes. The GTUA has submitted an application to the Texas Council on Environmental Quality (TCEQ) for an amendment to this water right that would allow an additional 25,000 acre-feet of water for municipal or industrial purposes. This amendment will also make water available for sale to the NTMWD as an interim supply.

Obtain additional Lake Texoma water. The GTUA has a contract with the NTMWD to provide an interim supply of up to 25,000 acre-feet per year of raw water from Lake Texoma. About 20,000 acre-feet of water will be supplied by 2010. The GTUA has applied for an interbasin transfer authorization. The GTUA will then contract with the Corps of Engineers for storage in Lake Texoma of about 50,000 acre-feet. A new water right, for about 56,000 acre-feet per year, to divert water from Lake Texoma will also be necessary from the TCEQ. This new water right will also support the Grayson County Water Supply Project.

Develop the Collin-Grayson Municipal Alliance Pipeline Project. By 2006, the GTUA will purchase water from the NTMWD for supply to customers of the Collin-Grayson Alliance Pipeline Project. This pipeline project is currently under design to meet a demand for about 15 mgd or 16,813 acre-feet of water, and will transmit water from McKinney to the customer cities. The city of McKinney will also be compensated for its pumping facilities.

Develop the Grayson County Water Supply Project. By 2020, due to limited groundwater availability, the GTUA will provide treated surface water from Lake Texoma to Grayson County customers. Phase 1 of this project to be constructed by 2020 includes a 25-mgd water treatment plant expansion, a new 1-mgd water treatment plant in northwestern Grayson County, and a water transmission system. Phase 2 is the construction of a 20-mgd water treatment plant expansion by 2040. This strategy will use all currently permitted water under the GTUA's existing water right in Lake Texoma and would also require that the GTUA obtain an additional water right (with interbasin transfer authorization) in Lake Texoma.

Summary of Existing and Potential Sources of Water Supply. Potential water supply sources and projected demand by decade for the GTUA are shown in Table 5.

TABLE 5
RECOMMENDED WATER MANAGEMENT STRATEGIES
WATER SUPPLIES AND DEMANDS
Texas State Water Plan 2006
Greater Texoma Utility Authority (GTUA)

Source	Year					
	2010	2020	2030	2040	2050	2060
Current Available Supplies						
Lake Texoma	11,210	11,210	11,210	11,210	11,210	11,210
Water Management Strategy						
Customer Water Conservation	177	102	1,901	2,812	3,868	4,774
Change Permitted Lake Texoma Use to Municipal or Industrial	0	0	0	0	0	0
Add Lake Texoma(Interim NTMWD Supply)	20,000	0	0	0	0	0
Collin-Grayson Municipal Alliance Pipeline Project	2,408	6,935	10,523	13,705	16,813	16,813
Additional Lake Texoma						
Grayson County Water Supply Project -Phase 1	0	14,572	14,572	14,572	14,572	14,572
Grayson County Water Supply Project -Phase 2	0	0	0	11,443	11,443	11,443
Total Supplies from Strategies	22,585	21,609	26,996	42,532	46,696	47,602
Total Supplies	33,795	32,819	38,206	53,742	57,906	58,812
Projected Demand	31,357	23,158	30,534	38,749	47,930	54,038

Source: Initially Prepared 2006 Region C Water Plan, June 2005 draft.

The anticipated capital costs and the unit costs are shown in Table 6.

TABLE 6
RECOMMENDED WATER MANAGEMENT STRATEGIES
SUMMARY OF COSTS
Texas State Water Plan 2006
Greater Texoma Utility Authority (GTUA)
(2002 Price Levels)

Water Management Strategy	Develop Date	2060 Quantity	Capital Cost	Unit Cost ($/kGal.)	
				Pre-Amort	Post-Amort.
Customer Water Conservation	2010	4,774	$0	N/A	N/A
Change Permitted Lake Texoma Use to					
Municipal or Industrial	2005	0	$50,000	N/A	N/A
Add Lake Texoma (Interim NTMWD Supply)	2006	20,000	$15,729,000	$0.18	$0.00
Collin-Grayson Municipal Alliance Pipeline Project	2006	16,813	$16,382,000	$1.46	$1.25
Additional Lake Texoma					
Grayson County Water Supply Project - Phase 1	2020	14,572	$168,859,000	$4.55	$1.96
Grayson County Water Supply Project - Phase 2	2040	11,557	$55,894,000	$2.40	$1.50
Total Capital Costs			$256,914,000		

Source: Initially Prepared 2006 Region C Water Plan, June 2005 draft.

c. Dallas Water Utilities (DWU).

The city of Dallas/DWU is the major water wholesale service supplier for a service area that includes most of Dallas, Denton, and portions of Rockwall and Kaufman counties. Several other wholesale water suppliers are also in these counties, including the city of Denton, the UTRWD, and the TRA. The cities of Dallas, Irving, Grand Prairie, Carrollton, and many others receive all or part of their water service from the DWU. The DWU is supplied from six major existing reservoirs, with three other existing reservoirs awaiting connection and/or completion of their transmission systems. The projected water demands on the DWU are expected to increase from 640,000 acre-feet in 2010 to 1.06 million acre-feet by 2060.

The currently available supply is about 457,000 acre-feet. By 2010, the DWU will need an additional 182,000 acre-feet per year increasing to an additional 624,000 acre-feet per year by 2060. Conservation and reuse and connections to existing sources of supply are some of the 25 water management strategies to be utilized. Other than conservation and reuse, the connections of Lake Fork, which would supply about 120,000 acre-feet by 2010, and Lake Palestine, which would provide about 114,000 acre-feet by 2020, are two major connections. Existing reservoirs will continue to be over-drafted. The DWU is expected to continue to use return flows, estimated at 50,000 acre-feet per year in 2000; however, these are not expected to be available by 2050.

The DWU is part of a group of providers that will participate in the Marvin Nichols I Reservoir, a major new reservoir in the Sulphur River (Region D) with a yield of abut 619,100 acre-feet per year of which the DWU would receive about 94,000 acre-feet per year. Cost is expected to be about $1.5 billion. The DWU will also develop the Southside Reuse project (68,300 acre-feet per year). The DWU has also shown some interest in Lake Texoma as an alternate water management strategy. This alternate water management strategy includes future use of Lake Texoma by blending and desalination at a cost of over $800 million. Other alternate strategies include Marvin Nichols, Toledo Bend Reservoir, and Oklahoma water among others, if the recommended water management strategies are not workable.

d. Tarrant Regional Water District (TRWD).

The TRWD is mainly comprised of Tarrant County, Texas, and is the predominant wholesale supplier to the city of Fort Worth, the city of Arlington, the TRA, and many other municipalities within Tarrant County. The TRWD provides water, directly or indirectly, to 104 water user groups with an additional 13 water user groups planned for the future. The projected water demand is 416,200 acre-feet per year in 2010 increasing to 863,600 acre-feet per year by 2060. The total available water supply from the TRWD system is 447,000 acre-feet per year in 2010, decreasing to 394,000 acre-feet per year by 2060 based on the operational safe yield analysis. The TRWD shortage of 82,000 acre-feet per year begins in 2020 increasing to about 500,000 acre-feet per year in 2060.

There are eight reservoirs in operation and planning documents on several more. The addition of a third transmission pipeline and booster stations will allow the additional capacity and yields from Cedar Creek Lake and Richland-Chambers Lake (115,500 acre-feet per year and 113,900 acre-feet per year, respectively) to be utilized more fully. Also, the West Fork Connection would allow water to be transferred among the existing parts of the system. Recommended water management strategies other than conservation, reuse, and the Eagle Mountain Connection, are Marvin Nichols Reservoir, Toledo Bend Reservoir, and Oklahoma water. These are multi-provider strategies. Other alternate water management strategies include Lake Wright Patman, Lakes Sam Rayburn and Steinhagen, Lake Tehuacana, and Lake Livingstone. Obtaining water from Lake Texoma is not specifically mentioned as a strategy.

e. City of Fort Worth.

The city of Fort Worth obtains water from the TRWD and distributes treated water to 29 existing customers with 3 new customer groups expected to be served in the future. The shortages of 41,000 acre-feet expected in 2020 will increase to about 305,000 acre-feet by 2060. The water management strategies recommended to meet this shortfall are conservation and reuse for steam electric power, expansion of water treatment plants and transmission lines, new treatment plants, and additional supply from the TRWD. No plans include Lake Texoma as a water management strategy.

f. Trinity River Authority (TRA).

The TRA currently provides water to users from its own water rights in Lakes Bardwell, Navarro Mills, Joe Pool, and Livingstone. The TRA also supplies water to Tarrant County entities by purchase from the TRWD. The TRA provides raw water for steam-electric power in Freestone County and reuse water to entities in Dallas and Ellis counties. The TRA has contracts with the TRWD and Ellis County users to supply water through the Ellis County Project. The TRA also owns and operates wastewater treatment plants and has plans to develop a number of direct and indirect reuse projects. Water management strategies for TRA include conservation, direct and indirect reuse projects, expansion of the Tarrant County Water Supply System, and development of the Ellis County Project. There are no plans to utilize Lake Texoma water in the future.

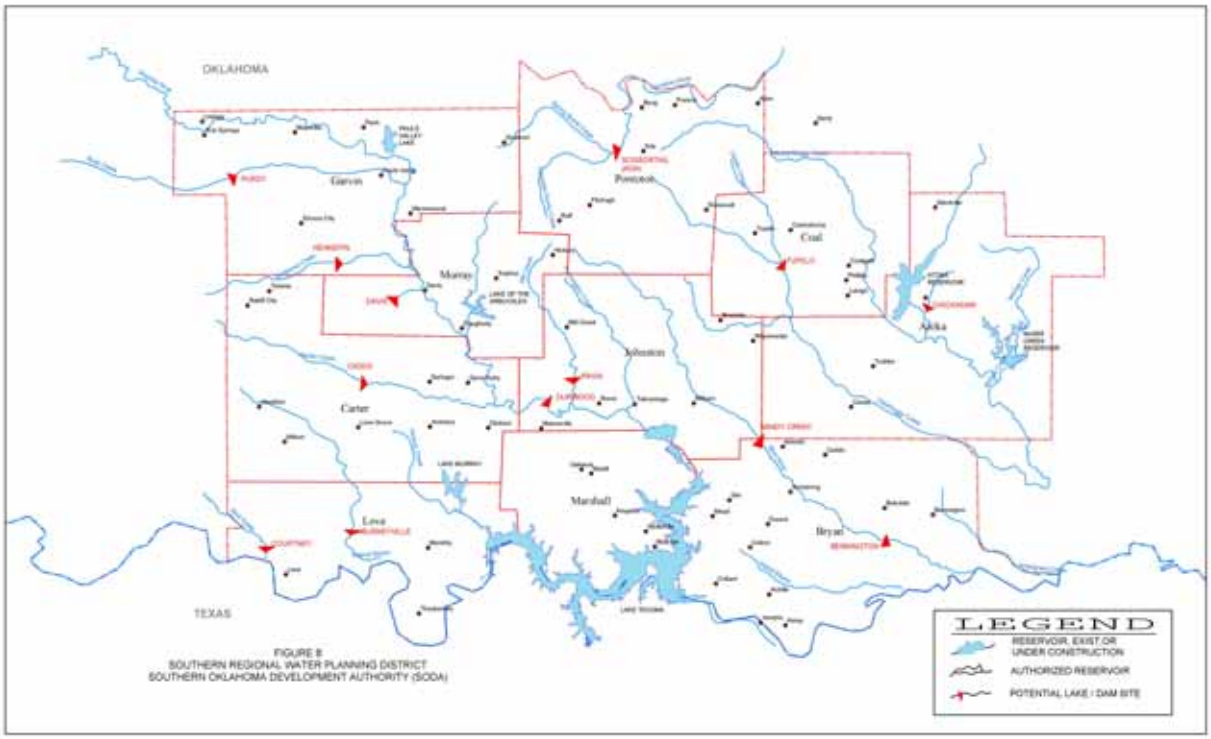
11.5.2 Oklahoma Water Demand, Water Supply, and Net Needs – Southern Regional Water Planning District

11.5.2.1 Overview.

The Oklahoma Water Resources Board (OWRB) and the U.S. Army Corps of Engineers, Tulsa District are in the process of determining future demands for water and sources of water supply for inclusion in the 2005 Oklahoma State Water Plan. Portions of that study are summarized below. This study contains an estimate of supply and demand for water from 2000 to 2060, with 2000 representing the base year and 2010 to 2060 designated as a 50-year planning horizon.

The state was reconfigured from 8 water planning regions as described in previous State water plans into 11 sub-state regional water planning districts that represented the Oklahoma Council of Government (COG) statewide planning districts or regions. The Southern Region sub-state regional water planning districts represents the region around Lake Texoma. The Southern Regional Water Planning District, represented by the Southern Oklahoma Development Authority (SODA), consists of Atoka, Bryan, Carter, Coal, Garvin, Johnston, Love, Marshall, Murray, and Pontotoc counties. Figure 2 depicts this region.

Figure 2. Southern Regional Water Planning District



11.5.2.2 Regional Description.

The Southern Regional Water Planning District (Southern Oklahoma Development Authority (SODA) covers approximately 9.8% of the state (6,724 square miles). This region lies at the eastern edge of the Southern Great Plains. The region's terrain varies from lush pastures in the river bottoms to sparsely vegetated oil fields and to the rugged foothills of the Arbuckle Mountains. Stream and surface water sources are abundant in the eastern portions of the region; however, they are relatively scarce in the western portions.

The region's climate is mild with annual mean temperatures varying from 61 °Fahrenheit (F) to 64 °F. Annual evaporation within the region ranges from 63 inches per year in the western areas to 55 inches per year in the eastern areas. Rainfall averages 30 inches per year in the western areas and approaches 39 inches per year in the eastern areas. Ardmore, Ada, and Durant are the largest cities within the region.

11.5.2.3 Water Demands.

Along with data obtained from the survey, water use data from the U.S. Geological Survey (USGS) and the OWRB were used to calibrate the IWR-MAIN model to 2000 water use. An attempt was made to calibrate the IWR-MAIN model to actual 2000 data with discrepancies indicated in the unaccounted column. In some cases, unaccounted water reflects the fact that water is being transported to or from other regions, such as Atoka, Oklahoma, and Tulsa counties.

11.5.2.4 Municipal and Industrial Water Demand.

Estimates of the quantities of water that will be used in the future require the use of appropriate econometric models to make projections of future water use that are statistically consistent for long-term water supply planning. One approach to forecast municipal and industrial (M&I) water demand is to use the IWR-MAIN software. The IWR-MAIN Water Demand Management Suite is a Windows-based PC software package that uses econometric water demand models for translating existing demographic, housing, and business statistics into estimates of existing water demands for cities, counties, or service areas. These estimates are then used to fine tune the water use equations for translating the official long-term projections of population, housing, and employment into disaggregated forecasts of water use. A survey was conducted to collect data on all known water supply purveyors in the State of Oklahoma. The questionnaire collected basic information regarding water use, pricing, conservation, source of water, and other parameters, such as unaccounted for water due to system losses. Some of these parameters are used to calibrate the IWR-MAIN model to 2000 actual water use to assist in adjusting the model to simulate actual conditions in 2000. Projected population and employment variables along with other data, such as housing units, can then be used to develop estimates of future demand for M&I users. The data also provided some information on the geographic distribution of systems particularly in dealing with systems that are in more than one planning district.

11.5.2.4.1 Demographic Parameters.

Population. One key parameter used by the IWR-MAIN model to project residential water demand is population. In 2002, the Oklahoma Department of Commerce, under contract with the OWRB, expanded their 2000-2030 projections of the resident population of Oklahoma by county. The projections were made using a cohort component projection. With this method, each component of the population, births, deaths, and migration, is projected separately based on algorithms developed by the U.S. Bureau of the Census. The base population used is April 1, 2000, the date of the U.S. Census of Population and Housing count of the United States resident population. Fertility, death, and migration rates are applied to that base population to arrive at the near year projection period. Six migration assumptions were used in developing these projections. These include:

- Very Low - negative migration for 10 years, then zero migration for the remaining years
- Low - zero migration
- Medium - 5,000 in-migration per year
- High - 10,000 in-migration per year
- Very High - 15,000 in-migration per year
- Special - 5,000 in-migration per year for 15 years and 2,000 in-migration for the remaining years

For this analysis, the medium set of assumptions, 5,000 person in-migration per year, was used. Year 2005 was interpolated between 2000 and 2010.

Employment. Commercial and industrial water use represents a very large part of current and future demand for water in the state. The IWR-MAIN model for projecting water demand for commercial, industrial, and public use categories relies on the number of persons employed in a county by each Standard Industrial Classification (SIC) category and, since 1997, the North American Industry Classification System (NAICS) code. Data used in the IWR-MAIN model utilizes the NAICS system. National water use survey data were used to provide water use coefficients for each industrial sector, by two- or three-digit code, based on the number of employees. The number of employees serves as a proxy for production activity in a given industrial sector and the associated amount of water required to support that activity. To project future industrial water demand, the model utilizes a linear relationship using employment and water use per employee by NAICS code. Specific codes are consolidated into the general categories of commercial, industrial, and public use.

Housing. Another parameter used by the IWR-MAIN model to project future residential water use is housing units. Data from the U.S. Bureau of Census and Housing were used to develop housing units for the 2000 base year. It is assumed that the person-per-household ratio will remain constant over the entire projection range. The algorithm used in the projection of residential water demand uses persons per household, population divided by number of housing units, as well as housing density. The housing density variable is a parameter used to characterize the outdoor component of water use for the summer season.

11.5.2.4.2 Forecast Manager Overview.

The forecasting algorithm of Forecast Manager is built to operate on data corresponding to study areas, water use sectors/sub-sectors, months, and forecast years. The needs and data available dictated the degree of detail required to use the model. The methodology utilized is known as the "Driver Times Rate of Use" approach. In other words, for a given study area, sector, month, and forecast year, water use can be calculated as a product of the number of users, the rate of use, and the number of days in the given month. This allows the disaggregation of a water demand forecast and permits unit water use rate, such as gallons per household, gallons per employee, etc., to be assumed or predicted via the water use model.

Four different methods can be used to generate water demand forecasts in IWR-MAIN, from the simple to the more complex depending on the availability of data and time and cost constraints. The first method is to use constant use rates, which depends on the make-up of the study area, such as the number of customers. The second method is to build a model by adjusting per unit rates of use. Unit rates of use for a user class are defined, and these rates are modified over time by specific variables. These variables may include price, income, employment, productivity, land use, or other factors. The third and fourth options are to specify or customize a model for water demand by using specific statistical information related to water use models, such as values for intercept terms, model variables, and associated coefficients and elasticities in the algorithms. This method may be either a multiplicative or linear predictive model.

The second method, building a forecasting model using explanatory variables, was utilized for most counties. This method uses selected explanatory variables, such as median household income, persons per household, housing density, marginal price of water, maximum temperature,

and precipitation, to adjust per unit usage rates. The base year per unit water use rate is calculated from the base year water use and the number of counting units for the sub-sector. This calculated rate of use is then adjusted by the relationship between sub-sector water use and those explanatory variable selected for the sub-sector, which are selected by the user and may change over time. Year to year changes in water use are explained by the change in the selected explanatory variables and the counting units. Counting units are driver variables, such as employee counts, housing units, acres, etc., associated with each sub-sector.

Residential Water Usage. Daily residential water usage for each county will be estimated by the following equation:

$$\mathbf{Q^R = N * q}$$

where N is the number of housing units and Q is the daily residential water usage given by the multiplicative model:

$$q = e^{\alpha} (Inc)^{\beta^1} (HsgDensity)^{\beta^2} (HshldSize)^{\beta^3} (MP)^{\beta^4} (MaxTemp)^{\beta^5} (Precip)^{\beta^6}$$

where: e^{α} is the model intercept in natural log form
Inc is median household income
HsgDensity is housing units per acre
HshldSize is person per household
MP is marginal price
MaxTemp is average daily maximum temperature
Precip is total precipitation

$\beta^1 - \beta^6$ are the elasticities taken from the IWR-MAIN recommended range. The midpoint of the range is used for each term. Selection of these model variables and variable elasticities provides a rational model of residential water demand that may be calibrated to average daily use in each region.

Non-residential Water Usage. Daily non-residential water usage for each sub-sector was estimated by the following equation:

$$\mathbf{Q^{NR} = N * q}$$

where N is the number of employees in a sector and q is the daily water usage for the sub-sector given by the linear model:

$$\mathbf{q = GED}$$

where q is the gallons/per employee/per day (GED) that has been developed outside the model. This method of estimation makes the assumption that the main driver of changes of water demand within a given sector is change in the number of employees rather than change in weather, pricing, or other variables.

The advantage of an average usage/per unit/per day method of estimating residential and non-residential water usage, which is based on housing units and employees, is that it accounts for usage by both public and private water suppliers.

Unaccounted Water Usage/System Losses. For each county, the amount was calculated by taking a weighted average of the estimated losses of all providers that have returned questionnaires (weighted by the relative number of accounts they serve). This county average was then scaled down based on the percentage of the population within the county that is served by a public system (available from the 1990 census data). This method is based on the assumption that private systems will have a lower loss rate (via leakage, etc.) and little or no unaccounted usage (i.e., hydrants). In addition, when major discrepancies occurred between a county's total M&I water use as reported in 2000 and the output of the IWR-MAIN model, an adjustment to total water use as generated in the model was made in the unaccounted for sector.

11.5.2.5 Thermo-Electric Power Forecasts.

The basis for projecting future water use based on nation-wide data from the Department of Energy is assumed to be a linear relationship between the amount of electricity generated and the amount of water used. This indicates that total electricity demand is projected to grow by 1.9% per year from 2001 through 2020, and 1.8% per year from 2001 to 2025. This nationwide average was applied to Oklahoma. After 2025, an increase of 1.8% per year was assumed over the base year. The Oklahoma Corporation Commission showed an increase in peak demand but not generation. If it is assumed that there is a direct correlation between peak demand and electrical generation, future water use could be calculated with this alternative method.

11.5.2.6 Agricultural Water Demand Forecasts.

Initial agricultural water demand forecasts were prepared in March 2003 by the Bureau of Reclamation (BR), Great Plains Regional Office for irrigated land and livestock. The base year is 2000 with water demand forecast by decade to 2060. Major livestock groups that were evaluated were beef and dairy cattle (cattle), sheep and lambs (sheep), hogs, and broiler and laying chickens (chickens). Others groups were not evaluated since they were not major water users. Year 2000 data were obtained from the United States Department of Agriculture (USDA) for nine major agricultural areas.

Major irrigated crop groups that were evaluated were grain corn (corn), sorghum, wheat, cotton, soybeans, peanuts, alfalfa, hay, corn silage, and vegetables. Other crop groups are minor water users. The 1997 USDA Agricultural Census provided data on county irrigated acreages. These were deemed representative for 2000. The highest reported irrigated acres from agricultural census years 1978 to 1997 were used to project irrigated acres in 2060 for most counties. Ten-year increments from 2000 to 2060 were developed by straight-line interpolation. A composite or weighted average crop irrigation requirement (CIR) for each county was developed. The CIR is that portion of total water requirements other than natural precipitation. The weighted CIR is calculated by summing the product of the individual CIR and the irrigated crop acres in each county, and then dividing this summed product by the sum of the acres. Future irrigated water

demands are determined by multiplying irrigated land values by the weighted average CIR for each county.

The percentage of acres irrigated by each method of irrigation for each county was obtained from 2000 OWRB Water Use Reports and USGS preliminary water use data for Oklahoma for 2000 (see Appendix 5). These percentages by irrigation method and applicable field application efficiencies were applied to the BR's calculations of water demand for irrigated land. For example, gross irrigation water requirement or the amount of water to be withdrawn (by diversion or pumping) and applied to the irrigation scheme was calculated as follows:

$$\frac{\text{(\% acres by irrigation method * net water demand)}}{\text{Field application efficiency}}$$

Gross irrigation water requirement thus includes net irrigation water requirement plus water losses. The above methodology was used to compute and aggregate irrigation water demands for each county and was extrapolated for each decade.

11.5.2.7 Water Resources.

11.5.2.7.1 Stream Water.

The region's major streams include the Red River and the upper Washita River, along with Mud Creek and Walnut Bayou in the western portions of the region. Stream water is not a dependable supply source within the western region due to the intermittent flow and/or water quality problems. The region's other major streams to the north and east includes Blue River, Clear Boggy Creek, Muddy Boggy Creek, and the lower Washita River. With the exception of the Red River below Lake Texoma, the eastern region's streams contain good quality water. Overall, the water is suitable for all uses.

The Red River is the major stream within the Southern Regional Water Planning District, forming the southern border. The water is highly mineralized above Lake Texoma with chlorides and dissolved solids exceeding EPA limits most of the time. The Red River Chloride Control Project is an extensive project by the Corps of Engineers to reduce the naturally occurring chloride pollution in the river and its tributaries. The project, consisting of nine smaller projects involving the use of low flow dams, brine lakes, pump stations, and pipelines, hopes to prevent 409 tons per day of chloride from reaching the river. The result would reduce chloride levels in Lake Texoma to within EPA limits ±15% of the time. Several of the projects have been completed to date; however, budgetary and environmental concerns threaten completion of the project. The water has high levels of dissolved solids and chlorides through much of Bryan and Choctaw counties. After confluence with the Blue River, Boggy Creek(s), and Kiamichi Rivers, the water is of acceptable quality for most uses.

The Washita River flows through the northern portion of the region before joining the Red River in Lake Texoma. The Washita River is also highly mineralized. The tributary streams of the Washita improve overall stream quality in the lower reaches to make it suitable for most uses.

The Blue River flows southeasterly through Pontotoc, Johnston, and Bryan counties to its confluence with the Red River. The river's drainage basin is ±80 miles long and contains 676 square miles. There are no impoundments on the river. The water is classified as hard with moderate levels of inorganic turbidity.

The Boggy Creek Basin consists of Clear Boggy Creek and Muddy Boggy Creek. The drainage basin contains 2,400 square miles of Pontotoc, Coal, Atoka, Bryan, and Choctaw counties. Atoka Lake and McGee Creek Lake are the impoundments in the river basin. The water in upper Muddy Boggy Creek is generally hard with high chloride and moderate sulfate concentrations. Downstream of Atoka the water becomes moderately hard with lower sulfate and chloride levels. High turbidity and nutrient levels exist along the entire branch. Water in Clear Boggy Creek is relatively hard with moderate turbidity, chlorides, and sulfates.

Stream Water Development. Table 7 lists the existing and proposed reservoirs within the region. There are four major impoundments within the Southern Regional Water Planning District. The largest of these impoundments is Lake Texoma on the Oklahoma-Texas border in Love and Marshall counties. This Corps of Engineers project was constructed in 1944 for flood control, water supply, recreation, navigation, and hydropower. The flood control storage of 2,613,777 acre-feet is credited with preventing over $101 million in flood related damages since becoming operational. The lake is located on the main stem of the Red River and is subject to the Red River Compact, which equally allocates water supplies to Texas and Oklahoma from the lake. Each state is allocated a dependable water supply yield of 168,000 acre-feet/year (150.0 mgd). Lake Texoma has power pool storage of 1,010,170 acre-feet and installed hydro-turbine capacity of 70,000 kW. The water is of poor quality and is not suitable for most M&I uses without treatment or blending. Water within the Washita arm of the lake is generally suitable for most uses.

The BR constructed Lake of the Arbuckles in 1967. Located on Rock Creek, a tributary of the Washita River in Murray County, the impoundment provides water supply, flood control, recreation, and fish and wildlife mitigation. The reservoir has 36,400 acre-feet of flood control storage and 62,600 acre-feet of conservation storage, which yields 24,000 acre-feet/year (±21.4 mgd). The entire available yield is allocated to the Arbuckle Master Conservancy District which provides water to the cities of Ardmore, Davis, Sulpher, Wynnwood, and Dougherty. The water is classified as good and is suitable for all uses.

Atoka Lake, located on North Boggy Creek in Atoka County, is a water supply lake owned by the city of Oklahoma City. Built in 1964, the reservoir provides 125,000 acre-feet of conservation storage yielding 65,000 acre-feet/year (±58 mgd) of good quality water. The water is transferred via pipeline to Lake Stanley Draper in the West Central Region for use by Oklahoma City. The pipeline has a capacity of 90 mgd.

Lake Murray is a State-owned lake constructed in 1937 for recreational purposes only. The lake is located on Hickory Creek in Love County. The lake has 153,250 acre-feet of conservation storage; however, none of the conservation storage is for water supply. Several permits have been issued for recreation, fish and wildlife mitigation, and irrigation uses. The lake remains one of southern Oklahoma's major tourist attractions, second only to Lake Texoma.

TABLE 7
STREAM WATER DEVELOPMENT, SOUTHERN REGION

Name of Source/County	Stream	Purpose	Flood Control Storage (acre-feet)	Water Supply Storage (acre-feet)	Water Supply Yield (acre-feet/year)
Existing					
Atoka Lake/Atoka	North Boggy Creek	ws, r	-	123,500	700 (1)
McGee Creek Lake/Atoka	McGee Creek	ws, fc, r	85,340	107,980	31,800 (2)
Arbuckle Lake/Murray	Rock Creek	ws, fc, r	36,400	62,600	24,000
Ardmore City Lake	Tributary of Caddo Creek	ws, r	-	2,300	560
Ardmore Mountain Lake	Tributary of Caddo Creek	ws, r	-	4,650	2,800
R. C. Longmire (NRCS)/ Garvin	Keel Sandy Creek	ws, fc, r	4,142	13,162	3,360
Lake Murray/Love	Tributary of Hickory Creek	r	-	153,250	-
Jean Neustadt (NRCS 13)/ Carter	Tributary of Caddo Creek	ws, fc, r	4,357	4,542	2,150
Pauls Valley Lake/ Garvin	Washington Creek	ws, r	-	8,500	4,000
Rock Creek (NRCS 18)/ Carter	Tributary of Caddo Creek	ws, r	1,634	2,573	1,220
Lake Texoma/Marshall	Red River	ws, fc, p	2,613,777	150,000	168,000 (3)
Subtotal			2,745,650	633,057	238,590
Potential					
Parker/Coal	Muddy Boggy Creek	ws, fc, r	100,300	109,940	45,900
Burneyville/Love	Walnut Bayou	ws, r, p	576,580	150,000	25,000
Caddo/Carter	Caddo Creek	ws, r, p	73,980	260,000	40,000
Courtney/Love	Mud Creek	ws, r, p	79,000	224,100	45,100
Davis/Murray	Colbert Creek	ws	4,400	10,760	2,800

TABLE 7. STREAM WATER DEVELOPMENT, SOUTHERN REGION (Continued)

Name of Source/County	Stream	Purpose	Flood Control Storage (acre-feet)	Water Supply Storage (acre-feet)	Water Supply Yield (acre-feet/year)
Gainesville/Love	Red River	ws, p, r, fw,i	47,151	35,000	8,750 (4)
Hennepin/Garvin	Wildhorse Creek	ws, p	27,000	180,000	30,000
Purdy/Garvin	Rush Creek	ws, fc, r	62,500	140,000	20,000
Bennington (Durant)/ Bryan	Blue River	ws, fc, r	359,590	287,420	179,000
Chickasaw/Atoka	Chickasaw Creek	ws, fc, r, p	158,940	36,320	17,900
Durwood/Johnston	Mill Creek	ws, r, fw	51,600	100,800	25,300
Sandy Creek/Bryan	Blue River	ws, p	88,080	16,920	10,800
Scissortail (Ada)/ Pontotoc	Sandy Creek	ws, r	-	88,200	32,000
Tupelo/Coal	Clear Boggy Creek	ws, fc, r, fw, i	177,300	280,000	93,000
Subtotal			2,051,651	2,039,190	807,550
Total			4,797,301	2,672,247	1,046,140

* ws-municipal water supply, fc-flood control, wq-water quality, p-power, r-recreation, fw-fish & wildlife, i-irrigation, n-navigation

(1) Total yield is 65,000 acre-feet/year of which 64,300 acre-feet/year is allocated to the city of Oklahoma City (West Central Region) and 700 acre-feet/year is allocated to the Southern Region. Water from McGee Creek is pumped in Atoka for transfer to Stanley Draper Lake via the Atoka Pipeline (90 mgd capacity).

(2) Total yield is 71,800 acre-feet/year of which 40,000 acre-feet/year is allocated to the city of Oklahoma City in the West Central Region.

(3) Lake Texoma is subject to the Red River Compact Agreement between the States of Oklahoma and Texas. Under the terms of the Agreement, Oklahoma has the right to use one-half of the total water supply yield or 168,000 acre-feet/year (150 mgd) each.

(4) Site is located on an interstate stream subject to the Red River Compact Agreement. Total yield is projected to be 17,500 acre-feet/year of which 8,750 acre-feet/year would be available to Oklahoma.

McGee Creek Reservoir is a BR project on McGee Creek, a tributary of Muddy Boggy Creek, in Atoka County. Completed in 1987, the project's purposes include water supply, water quality control, flood control, recreation, and fish and wildlife mitigation. The reservoir has a drainage area of 171 square miles and has 85,340 acre-feet of flood control storage. Conservation storage of 107,980 acre-feet yields 71,800 acre-feet/year (±64 mgd) of water supply. Oklahoma City in the West Central Planning Region has the allocation rights to 40,000 acre-feet/year (±35.7 mgd) of the yield. Atoka, Atoka County, and the Southern Oklahoma Development Trust have allocations totaling 20,000 acre-feet/year (±17.9 mgd).

There are several large municipal lakes within the Southern Regional Water Planning District. Ardmore City Lake is one of the oldest impoundments in Oklahoma, constructed in 1910. The impoundment is on a tributary of Caddo Creek, approximately 4 miles north of the city of Ardmore in Carter County. Its primary use is now recreation; however, it can provide 560 acre-feet/year (±0.5 mgd) of water supply from its 2,300 acre-feet of conservation storage if needed.

Ardmore Mountain Lake is an impoundment on Hickory Creek in north-central Carter County approximately 21 miles northwest of Ardmore. The lake is owned by the city of Ardmore and is primarily used for recreation and water supply. The lake has 4,650 acre-feet of conservation storage and a dependable yield of 2,800 acre-feet/year (±2.5 mgd).

Coalgate City Lake (SCS-#2) is used by the city of Coalgate for water supply, flood control, and recreation. The lake is located on Coon Creek in Coal County. The lake was built in 1965 and contains 3,437 acre-feet of conservation storage.

Pauls Valley Lake is a 750-surface-acre impoundment in Garvin County. Located on Washington Creek, the lake provides water supply and recreation for the city of Pauls Valley. The lake has 8,500 acre-feet of conservation storage, which yields 4,000 acre-feet/year (±3.6 acre-mgd) of water supply.

Lake R.C. Longmire (SCS-17M) is a Natural Resources Conservation Service (NRCS) project completed in 1990 for water supply, flood control, and recreation in Garvin County on Keel Sandy Creek. The lake is owned by the city of Pauls Valley and has 4,142 acre-feet of flood control storage and 13,162 acre-feet of conservation storage, which yields 3,360 acre-feet/year (±3 mgd).

Rock Creek Reservoir (SCS #18) is a multi-purpose project on a tributary of Caddo Creek in Carter County approximately 7 miles northwest of Ardmore. The reservoir, with 248 surface acres, has 1,634 acre-feet of flood control storage. The 2,573 acre-feet of conservation storage yields 1,220 acre-feet/year (±1.1 mgd) of water supply for the city of Ardmore.

There are numerous other NRCS projects, small municipal lakes, and private reservoirs within the Southern Regional Water Planning District. These small lakes provide municipal supplies, irrigation water, and recreational opportunities. Healdton (3,766 acre-feet storage and 413 acre-feet/year yield) in Carter County, Carter Lake (990 acre-feet) in Marshall County, and Veterans Lake (600 acre-feet) in Murray County are some of the larger impoundments in this category. The values in parenthesis indicate the approximate conservation storage of these impoundments.

Potential Development. Several sites in the Southern Regional Water Planning District have potential for development of new water supply projects. Of the sites identified in Table 9, several have been extensively studied. To date, no local sponsors exist for any of these projects.

Parker Lake is a proposed impoundment authorized by the Water Resources Development Act of 1986 for Muddy Boggy Creek in Coal County. The lake is authorized for flood control, water supply, recreation, and fish and wildlife mitigation. The lake is estimated to have a drainage area of 164 square miles and would provide 100,300 acre-feet of flood control storage and 109,940 acre-feet of conservation storage yielding 45,900 acre-feet/year (±41 mgd) of good quality water. Pre-construction engineering and design have been completed for the project. The lake construction is on hold until a local sponsor for the water supply storage is secured.

Burneyville Lake is proposed for development on Walnut Bayou in Love County. The 8,500-acre project is proposed to provide water supply and hydropower. The potential yield is estimated at 25,000 acre-feet/year (±22.3 mgd) with 150,000 acre-feet of conservation storage. An additional 576,580 acre-feet of flood control storage is possible at this site.

Caddo Lake is a proposed multi-purpose impoundment on Caddo Creek in Carter County. The lake is proposed to have 260,000 acre-feet of conservation storage yielding 40,000 acre-feet/year (±35.7 mgd). Additionally 73,980 acre-feet of flood control storage are planned.

Courtney Reservoir is a potential project on Mud Creek in western Love County. The potential yield of 45,100 acre-feet/year (±40.3 mgd) would be developed from 224,100 acre-feet of conservation storage. Flood control storage of 79,000 acre-feet is also possible.

Purdy Reservoir is a potential impoundment on Rush Creek in western Garvin County. Conservation storage of 140,000 acre-feet is proposed to yield 20,000 acre-feet/year (±17.9 mgd). The site can also provide 62,500 acre-feet of flood control storage.

Ravia Reservoir is a potential impoundment on Mill Creek in Johnston County. The reservoir is intended to provide 51,600 acre-feet of flood control storage and 100,800 acre-feet of conservation storage with a firm yield of 25,300 acre-feet/year (±22.6 mgd).

Scissortail Reservoir is a potential project on Canadian Sandy Creek, a Canadian River tributary, in Pontotoc County. Formally known as the potential Ada Reservoir, the lake would provide municipal water supply, recreation, and fish and wildlife enhancement. The site is anticipated to provide 88,200 acre-feet of conservation storage and an average annual yield of 32,000 acre-feet/year (±28.6 mgd). The BR has extensively evaluated the project as a possible water supply source for the city of Ada.

Durwood Reservoir is a potential multi-purpose site on the Washita River in Johnston County. Potential uses include water supply, flood control, hydropower, irrigation, and recreation. The reservoir is anticipated to provide 245,230 acre-feet of flood control storage and 119,730 acre-feet of conservation storage yielding 232,000 acre-feet/year (±207.1 mgd).

Tupelo, in Coal County, did not pass BR screening criteria for potential hydropower, flood control, recreation, and/or water supply projects during their last review. Bennington (Durant) Reservoir and Sandy Creek Reservoir, both in Bryan County, were recommended as long-term potential projects since they did not meet the BR selection criteria as viable projects for short-term development.

Stream Water Rights. The OWRB had issued stream water allocation permits totaling 315,286 acre-feet of water per year from lakes, rivers, and streams within the Southern Regional Water Planning District. Table 8 provides a breakdown of the stream water allocations within the region.

TABLE 8

STREAM WATER RIGHTS, SOUTHERN REGION
(acre-feet)

County	Allocations							
	Municipal	Industrial	Agricultural	Commercial	Recreation and Fish & Wildlife	Power	Other	Total
Atoka	142,161	12,000	2,055	-	535	285	-	157,036
Bryan	13,281	644	14,195	5	6,626	-	-	34,751
Carter	8,027	175	2,959	-	12,161	-	-	23,322
Coal	3,566	-	6,217	-	1	-	-	9,784
Garvin	4,453	182	8,159	10	1,452	-	-	14,256
Johnston	1,290	1,246	9,366	25	2,356	-	-	14,283
Love	-	2	2,776	667	372	-	-	3,817
Marshall	6,581	-	5,117	2	148	-	111	11,959
Murray	27,135	2,276	1,384	10	2,483	-	-	33,288
Pontotoc	8,700	17	3,907	23	143	-	-	12,790
Total	215,194	16,542	56,135	742	26,277	285	111	315,286

Note: Municipal is Public Supply. Agricultural includes Irrigation and Livestock. Mining is included in Industrial.
Source of data: Oklahoma Water Resources Board, May 2003.

11.5.2.7.2 Groundwater.

The Southern Regional Planning District overlays four principal groundwater aquifers: the Arbuckle-Simpson Group, the Oscar Formation, the Antlers Formation, and the alluvium and terrace deposits. Groundwater is the principal supply for most irrigation demands as well as the major supply for many of the smaller communities in the region.

The Arbuckle-Simpson Group is a limestone, dolomite, and sandstone formation found in portions of Carter and Murray counties. Formation thicknesses vary between 5,000 and 9,000 feet. Well depths are commonly between 100 and 2,500 feet with yields between 100 and 500 GPM. The water is a calcium magnesium bicarbonate type and is very hard. Dissolved solids are generally within acceptable limits and the water is suitable for most uses.

The Oscar Formation is an interbedded shale, sandstone, and limestone conglomerate aquifer. The formation is 300 to 400 feet thick and is found in western Stephens, southwestern Garvin and Carter, and eastern Jefferson County. Wells range from 600 to 400 GPM. The water quality is suitable for most uses.

The Antlers Sandstone is a friable sandstone, silt, clay, and shale formation with average thicknesses of 450 feet. The formation is found in Love, Marshall, Bryan, and southern Carter, Johnston, and Atoka counties. Well depths range between 200 and 800 feet with yields between 100 and 500 gpm. The water is generally of the sodium or calcium bicarbonate type with dissolved solids generally less than 1,000 mg/l. The dissolved solids can exceed 3,000 mg/l in some areas. The aquifer is largely undeveloped with an estimated 32 million acre-feet in storage.

The alluvial and terrace deposit aquifers are usually found around the two major rivers in the region, the Red River and the Washita River. Wells in this formation range from 200 gpm to 500 gpm. The formation deposits average 70 feet in thickness. The formation consists of silt and clays downgrading into fine to coarse sand. The water is hard to very hard with the water generally calcium magnesium bicarbonate type. Total Dissolved Solids values are usually less than 1,000 mg/l within the Washita River Basin and less than 2,000 mg/l within the Red River Basin. The water levels have generally declined in recent years.

Groundwater Development. Development of groundwater supplies continues within the Southern Regional Water Planning District despite the low yields and poor water quality in the aquifers. Some communities have developed the Oscar formation as their principal supply. Most irrigation within the region is done with groundwater. No costs have been calculated regarding the development of groundwater. For groundwater to be a viable and dependable source of supply, costs would have to be developed to determine it's feasibility for a particular user.

Groundwater Rights. The OWRB had issued groundwater allocation permits totaling 217,309 acre-feet of water per year from aquifers within the Southern Regional Water Planning District. Table 9 provides a breakdown of the groundwater allocations within the region.

TABLE 9

GROUNDWATER RIGHTS, SOUTHERN REGION
(acre-feet)

County	Allocations							
	Municipal	Industrial	Agricultural	Commercial	Recreation and Fish & Wildlife	Power	Other	Total
Atoka	182	-	420	2,698	20	-	-	3,320
Bryan	3,829	273	6,768	0	20	-	-	10,890
Carter	2,619	1,768	14,211	70	-	-	-	18,668
Coal	783	-	34	-	-	-	-	817
Garvin	4,922	12,471	7,716	43	33	-	5	25,190
Johnston	4,810	2,062	1,936	4	240	-	-	9,052
Love	3,338	555	21,082	100	510	-	-	25,585
Marshall	5,670	180	3,060	-	100	-	-	9,010
Murray	22,045	1,875	10,783	-	200	2,214	-	37,117
Pontotoc	53,121	6,991	14,124	794	30	2,600	-	77,660
Total	101,319	26,175	80,134	3,709	1,153	4,814	5	217,309

Note: Municipal is Public Supply. Agricultural includes Irrigation and Livestock. Mining is included in Industrial.
Source of data: Oklahoma Water Resources Board, May 2003.

11.5.2.8 Supply and Demand Analysis.

Table 10 summarizes the surface and groundwater sources of water supply within the Southern Regional Water Planning District by decade beginning in year 2000 to year 2060. The Southern Regional Water Planning District is the dividing line between the part of the state with ample water and the part with too little. The western portions of the region may have local shortages without the development of future sources. Water quality is also a problem in the western areas. Table 11 reflects the available surplus water within the region and indicates the availability of water from existing sources. The long-range projections for M&I water demand in 2060 is 67,648 acre-feet/year. Agricultural demands are estimated at 73,350 acre-feet/year by year 2060. The water is moderately turbid and is classified as soft. Table 11 shows existing and projected supply and demand for water in this region for selected decades to 2060.

11.5.2.8.1 Summary of Water Demand and Supply. In a comparison of water demands to water supply in this region, it would appear that quantities of supply are much greater than demands. This is due to the estimate of the large amount of groundwater in the aquifers in this region. However, the quantity of groundwater available does not necessarily reflect the quality of groundwater or the estimated costs of obtaining and delivering groundwater to users. Most of the groundwater is utilized for agricultural irrigation activities. Some municipalities depend on groundwater to varying degrees to meet current and future residential, commercial, industrial, and public water demands. The demand for water for power is not significant in this region. The feasibility of obtaining water supply from sources of supply, both surface and groundwater, and a water management strategy for this region would require a more detailed analysis of the cost of developing the water supply as well as the conveyance of the water to a user. A regional analysis would require the evaluation of sources of supply and demands in other regions, particularly those with less expensive sources of supply or those with large municipal and industrial demands as in large metropolitan areas.

TABLE 10
WATER SUPPLY SOURCES BY YEAR AND COUNTY, SOUTHERN REGION
(acre-feet per year)

Source: Year 2000	County										
	Atoka	**Bryan**	**Carter**	**Coal**	**Garvin**	**Johnston**	**Love**	**Marshall**	**Murray**	**Pontotoc**	**Total**
Major Reservoirs & M&I Lakes											
Atoka Lake	700	0	0	0	0	0	0	0	0	0	700
McGee Creek Lake	31,800	0	0	0	0	0	0	0	0	0	31,800
Arbuckle Lake	0	0	18,240	0	4,320	0	0	0	1,440	0	24,000
Rock Creek (SCS 18)	0	0	1,220	0	0	0	0	0	0	0	1,220
Lake Texoma	0	0	0	0	0	0	0	168,000	0	0	168,000
Other M&I Lakes & NRCS Structures*											
Blue River 1-6	0	2,400	0	245	0	0	0	0	0	949	3,594
Canadian River Subsystem 2-6-1	1,400	0	0	0	638	0	0	0	0	2,005	4,043
Muddy Boggy River 1-4	3,780	0	0	5,115	0	2,497	0	270	0	0	11,662
Red River 1-9	0	0	0	0	0	0	0	1,500	0	0	1,500
Walnut Bayou Creek 1-10	0	0	1,715	0	0	0	1,123	0	0	0	2,838
Washita River Subsystem 1-8-1	0	0	7,068	0	11,464	1,449	0	2,394	2,307	356	25,038
Washita River Subsystem 1-8-2	0	0	0	0	864	0	0	0	0	0	864
Total Impounded Surface Water Yield	37,680	2,400	28,243	5,360	17,286	3,946	1,123	172,164	3,747	3,310	275,259
Groundwater: Recoverable Water											
A&T of Canadian River	0	0	0	0	0	0	0	0	0	197,010	197,010
A&T of Red River	0	922,169	0	0	0	0	544,620	0	0	0	1,466,789
A&T of Washita River	0	0	0	0	729,638	0	0	0	178,723	0	908,361

TABLE 10. WATER SUPPLY SOURCES BY YEAR AND COUNTY, SOUTHERN REGION (Continued)

Source: Year 2000	County										
	Atoka	**Bryan**	**Carter**	**Coal**	**Garvin**	**Johnston**	**Love**	**Marshall**	**Murray**	**Pontotoc**	**Total**
Antlers	2,045,970	9,963,162	283,290	0	0	769,545	2,164,823	5,531,045	0	0	20,757,835
Arbuckle-Simpson	0	0	504,963	0	0	3,905,709	0	0	2,966,265	2,053,557	9,430,494
Gerty	0	0	0	0	66,262	0	0	0	0	156,569	222,831
Total Groundwater Recoverable	2,045,970	10,885,331	788,253	0	795,900	4,675,254	2,709,443	5,531,045	3,144,988	2,407,136	32,983,320
Total Water Supply Year 2000	2,083,650	10,887,731	816,496	5,360	813,186	4,679,200	2,710,566	5,703,209	3,148,735	2,410,446	33,258,579
Total Water Supply Year 2010	2,083,650	10,887,731	816,496	5,360	813,186	4,679,200	2,710,566	5,703,209	3,148,735	2,410,446	33,258,579
Total Water Supply Year 2020	2,083,650	10,887,731	816,496	5,360	813,186	4,679,200	2,710,566	5,703,209	3,148,735	2,410,446	33,258,579
Total Water Supply Year 2030	2,083,650	10,887,731	816,496	5,360	813,186	4,679,200	2,710,566	5,703,209	3,148,735	2,410,446	33,258,579
Total Water Supply Year 2040	2,083,650	10,887,731	816,496	5,360	813,186	4,679,200	2,710,566	5,703,209	3,148,735	2,410,446	33,258,579
Total Water Supply Year 2050	2,083,650	10,887,731	816,496	5,360	813,186	4,679,200	2,710,566	5,703,209	3,148,735	2,410,446	33,258,579
Total Water Supply Year 2060	2,083,650	10,887,731	816,496	5,360	813,186	4,679,200	2,710,566	5,703,209	3,148,735	2,410,446	33,258,579

*Includes estimated yields for structures containing more than 100 acre-feet of storage.

TABLE 11
WATER DEMAND AND SUPPLY BY YEAR, COUNTY, AND CATEGORY
SOUTHERN REGION
(acre-feet per year)

Year 2000 County	Water Demand			Total Demand	Total Supply	Balance
	M&I	Power	Agriculture			
Atoka	2,273	0	2,477	4,750	2,083,650	2,078,900
Bryan	7,440	0	14,835	22,275	10,887,731	10,865,456
Carter	9,464	0	2,857	12,321	816,496	804,175
Coal	800	0	1,402	2,202	5,360	3,158
Garvin	9,447	0	4,510	13,957	813,186	799,229
Johnston	1,727	0	3,127	4,854	4,679,200	4,674,346
Love	1,107	0	7,435	8,542	2,710,566	2,702,024
Marshall	7,828	0	2,603	10,431	5,703,209	5,692,778
Murray	2,253	0	3,300	5,553	3,148,735	3,143,182
Pontotoc	7,120	616	7,447	15,183	2,410,446	2,395,263
Total	49,459	616	49,993	100,068	33,258,579	33,248,148

Year 2010 County	Water Demand			Total Demand	Total Supply	Balance
	M&I	Power	Agriculture			
Atoka	2,557	0	2,540	5,097	2,083,650	2,078,553
Bryan	8,391	0	16,209	24,600	10,887,731	10,863,131
Carter	10,114	0	2,948	13,062	816,496	803,434
Coal	824	0	1,635	2,459	5,360	2,901
Garvin	9,929	0	5,402	15,331	813,186	797,855
Johnston	1,913	0	3,376	5,289	4,679,200	4,673,911
Love	1,350	0	7,458	8,808	2,710,566	2,701,758
Marshall	10,496	0	3,275	13,771	5,703,209	5,689,438
Murray	2,542	0	3,353	5,895	3,148,735	3,142,840
Pontotoc	7,438	733	7,691	15,862	2,410,446	2,394,584
Total	55,554	733	53,887	110,174	33,258,579	33,244,808

TABLE 11. WATER DEMAND AND SUPPLY BY YEAR, COUNTY, AND CATEGORY, SOUTHERN REGION (Continued)

Year 2020 County	Water Demand			Total Demand	Total Supply	Balance
	M&I	Power	Agriculture			
Atoka	2,799	0	2,602	5,401	2,083,650	2,078,249
Bryan	8,979	0	17,583	26,562	10,887,731	10,861,169
Carter	10,419	0	3,038	13,457	816,496	803,039
Coal	936	0	1,868	2,804	5,360	2,556
Garvin	9,654	0	6,295	15,949	813,186	797,237
Johnston	2,099	0	3,624	5,723	4,679,200	4,673,477
Love	1,548	0	7,481	9,029	2,710,566	2,701,537
Marshall	12,142	0	3,947	16,089	5,703,209	5,687,120
Murray	2,668	0	3,406	6,074	3,148,735	3,142,661
Pontotoc	7,503	850	7,935	16,288	2,410,446	2,394,158
Total	58,747	850	57,779	117,376	33,258,579	33,242,490

Year 2060 County	Water Demand			Total Demand	Total Supply	Balance
	M&I	Power	Agriculture			
Atoka	3,917	0	2,853	6,770	2,083,650	2,076,880
Bryan	11,802	0	23,079	34,881	10,887,731	10,852,850
Carter	12,123	0	3,401	15,524	816,496	800,972
Coal	1,458	0	2,800	4,258	5,360	1,102
Garvin	9,509	0	9,865	19,374	813,186	793,812
Johnson	3,004	0	4,619	7,623	4,679,200	4,671,577
Love	2,375	0	7,572	9,947	2,710,566	2,700,619
Marshall	19,811	0	6,634	26,445	5,703,209	5,676,764
Murray	3,466	0	3,618	7,084	3,148,735	3,141,651
Pontotoc	8,068	1,305	8,909	18,282	2,410,446	2,392,164
Total	75,533	1,305	73,350	150,188	33,258,579	33,232,134

11.5.3 Analysis of Water Supply Alternatives.

11.5.3.1 No Action.

Under the No Action Alternative existing condition, approximately 150,000 acre-feet of water supply storage would remain available to water users in Oklahoma and Texas. The No Action alternative represents the existing condition baseline against which to compare the effects of other alternatives.

The no action alternative would remove a large potential water source for meeting future water demand that was projected in Texas Senate Bill 1. The No Action alternative would not satisfy the expanding municipal and industrial water supply demands that are a result of population

growth in the region. Additional water requests made by the NTMWD, the GTUA, the RRAT, the Marshall County Water District, and the states of Texas and Oklahoma and the surrounding communities would not be met.

Additional water supply storage at Lake Texoma would not be made available to the GTUA as required under Public Law 85-146, thereby prompting the city of Sherman and the GTUA to obtain water contracts elsewhere and attempt to manage water demands with existing resources. This would likely result in long-term failure to meet local area municipal and industrial water supply needs. It would also require development of another alternative water source, which is not feasible.

11.5.3.2 Action Alternative.

Only one alternative was identified. That alternative is the Proposed Action. Other alternatives were eliminated from further consideration based on language in the authorizing legislation. Public Law 99-662, Section 838 (a) states that, "The project for the Denison Dam (Lake Texoma), Red River, Texas and Oklahoma, authorized by the Flood Control Act approved June 28, 1938, is modified to provide that the Secretary is authorized to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 150,000 acre-feet for municipal, industrial and agricultural water users in the State of Texas and up to an additional 150,000 acre-feet for municipal, industrial and agricultural water users in the State of Oklahoma."

In accordance with the Water Resources Development Act of 1986, 300,000 acre-feet of water currently authorized for hydropower storage would be reallocated to water supply storage. The reallocation would provide up to 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the state of Oklahoma and 150,000 additional acre-feet for municipal, industrial, and agricultural water users in the state of Texas. .

APPENDIX 11.6

DENISON DAM AND POWER HOUSE
LAKE TEXOMA, RED RIVER, OKLAHOMA AND TEXAS
WATER SUPPLY STORAGE REALLOCATION
POWER BENEFITS FOREGONE STUDY

PREPARED BY

HYDROPOWER ANALYSIS CENTER
U.S. ARMY CORPS OF ENGINEERS
DATED APRIL 2005

AND

APPENDIX A
DATED AUGUST 2005

US Army Corps of Engineers
Northwestern Division

DENISON DAM & POWERHOUSE
LAKE TEXOMA
RED RIVER
OKLAHOMA & TEXAS

WATER SUPPLY STORAGE REALLOCATION

POWER BENEFITS FOREGONE

APRIL 2006
(revision)

Prepared for

U.S. Army Corps of Engineers
Tulsa District

PREPARED BY
HYDROPOWER ANALYSIS CENTER

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LAKE TEXOMA
DENISON DAM, RED RIVER
OKLAHOMA & TEXAS

WATER SUPPLY STORAGE REALLOCATION

1.1.1.1.1 POWER BENEFITS FOREGONE

1.1.1.1.1.1.1.1 APRIL 2006

(revision)

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1.0 INTRODUCTION

1.1 Purpose and Scope

This is an update of the report dated April 2005 (revised) and is in response to public comments made to the Draft Environmental Assessment – Lake Texoma storage Reallocation Study and to reflect the latest information on Power Values available to the Hydropower Analysis Center (HAC). This was prepared by the HAC for the Tulsa District (SWT), Corps of Engineers, and presents details of the hydropower benefits and economic analysis associated with the proposed reallocation of an additional 300,000 acre-feet (AF) from Lake Texoma (Denison Dam) on the Red River. Analysis of hydropower impacts for reallocating hydropower storage to water supply storage in Lake Texoma includes the computation of the following values:

- power benefits foregone
- revenues foregone
- credit to the Federal Power Marketing Agency (Southwestern Power Administration)

Values were computed for each of these parameters for the proposed reallocation of reservoir storage to water supply.

1.2 Project Description

The Denison Dam (Lake Texoma) is located on the Red River at river mile 725.9 on the Oklahoma-Texas border in Bryan County, 5 miles northwest of Denison in Grayson County. The authorized purposes of the project are flood control, navigation, hydropower, water supply and recreation.

The project was constructed during the years 1939 to 1944. The powerhouse has two generating units – two 35 MW units for a total nameplate capacity of 70 MW (maximum capacity of 80.4 MW). These units generate an estimated average of 235 gigawatt-hours (GWh) yielding an average annual plant factor of about 38 percent. Lake Texoma has a total of 5,194,164 AF of storage, of which 1,570,216 AF (elevation 590 ft to 617 ft) is reserved for power (conservation) storage.

The Water Supply Act of 1958 established a Federal policy of cooperation in development of municipal water supplies by reallocating reservoir storage among original authorized purposes to include municipal water supply. Currently, the allocation for water supply storage in Lake Texoma is 150,000 AF made in 1983 and 1985. Existing water supply users are listed in Table 1-1. The total storage shown in Table 1-1 exceeds the 150,000 AF by approximately 8,000 AF due to a yield study done in 1992 and the new storages were distributed based on percentages in the contracts.

Table 1-1: Water Supply Storage Allocation in Lake Texoma

Entity	Storage
City of Denison	21,300 AF
Texas Power & Light	16,400 AF
Red River Authority of Texas	2,736 AF
North Texas Municipal	95,023 AF
Buncombe Creek	1 AF
Greater Texoma Utility Authority	22,600 AF

Reallocation of an additional 300,000 acre-feet of hydropower storage to water supply was authorized in Section 838 of PL 99-662. This legislation provides 150,000 acre-feet of storage for Texas and 150,000 acre-feet for Oklahoma. Of the 150,000 acre-feet of storage for Texas - 50,000 acre-feet of it is specifically set aside for the Greater Texoma Utility Authority.

1.3 Study Participants

This report was prepared by the Hydropower Analysis Center (HAC) of the Northwestern Division, North Pacific Region, Corps of Engineers in February 2005 and was updated in April 2005. In response to public comment to the Draft Environmental Assessment – Lake Texoma Storage Reallocation Study. The primary HAC point of contact and overall study manager is John Johannis, HAC Technical Manager, at telephone: (503) 808-3974. HAC engineer, Dinh Quan performed the initial power values and benefit impact analyses. Russ Davidson, HAC hydropower engineer, performed technical writing and power analyses in the initial report and the power value and benefit update in this revision. John Johannis performed the Independent Technical Review for this revision, Ms. Cynthia Kitchens was the Program Manager, Ms. Janet Hotubbee the Water Supply Specialist. Mr. Jim Sullivan was study manager and performed life-cycle economic evaluations for the overall Lake Texoma Water Supply study for Tulsa District (telephone: (918-669-7089). Ms. Mary Ann Duke of the Tulsa District performed hydrologic engineering studies using the SWD-SUPER model.

1.4 The Cost of Water Supply Storage Reallocation

The procedures for computing the cost of storage reallocation addressed in this study are outlined in Appendix E, paragraph E-57, d(2) of ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000). These procedures require that the reallocation cost of the water supply customers be the highest of the following:

- power benefits foregone
- power revenues foregone

- replacement costs of power
- updated cost of storage

Although reservoir storage reallocations could result in impacts to other project purposes, this report determines the impacts to hydropower. Therefore, power benefits foregone in this evaluation are a power related impact. The revenue foregone and replacement cost of power are also power-related. The updated cost of storage is non-power related and Tulsa District will compute the updated cost of storage based on the storage necessary to yield the requested withdrawals. In Sections 1.5 through 1.7 are descriptions of each of these power-related values.

1.5 Power Benefits Foregone

Hydropower benefits are normally based on the cost of the most likely alternative thermal source of power. When conservation storage is reallocated for water supply the lost hydropower will be replaced with the most likely alternative thermal source of power.

The power benefits foregone can be divided into two components, lost energy and lost capacity benefits. In the case of water supply withdrawals, there is usually a loss of energy benefits, which are based on the loss in generation (both at-site and downstream) as a result of water being diverted from the reservoir for water supply rather than passing through the hydropower plant. In addition, there could be a loss of capacity benefits as a result of a loss in dependable capacity at the project. Loss of dependable capacity could be a result of:

- a loss in head due to lower post-withdrawal reservoir elevations
- a reduction in the usability of the capacity due to inadequate energy to support the full capacity during low-flow periods

The details of energy benefit computations are described in Section 3, and capacity benefit computations are shown in Section 4.

1.6 Revenues Foregone

The second power-related cost is the revenues foregone. This is the value of the lost hydropower based on the power marketing agency's current energy rates. The calculations for revenues foregone are contained in Section 6.

1.7 Replacement Cost of Power

The third power-related cost is the cost of replacement power. This is a National Economic Development (NED) cost similar to power benefits foregone, and is therefore a redundant value in the case of hydropower. NED power benefits foregone are based on the cost of the most likely alternative, which in fact is the cost of replacement power. Replacement cost is included in the guidance as one of the four alternative cost methods to be evaluated because it has meaning when storage is reallocated from functions other

than hydropower. For example, if the objective is to reallocate flood control storage to water supply, the replacement cost of flood control storage would have to be considered, because this storage would have an entirely different value than the flood control benefits foregone. However, for a hydropower/conservation storage reallocation, the replacement cost of hydropower is identical to the power benefits foregone.

Note the following reference, Appendix E, paragraph d(2)(c)(3), *Planning Guidance Notebook* (22 April 2000), also discusses a replacement cost based on financial or actual market prices, but this is an entirely different value than the replacement cost discussed in the paragraph above. The market-based replacement cost is to be used to compute a annual credit to the power marketing agency. If the water supply reallocation results in less hydropower being available to the marketing agency for delivery to its customers, the marketing agency will receive a credit to offset additional costs that they might incur and to reduce their repayment obligation. The calculation of this annual credit is described in Section 7.

2.0 POWER BENEFITS FORGONE

2.1 General

The details of energy and capacity benefit computation are described in Section 3 and Section 4, respectively. This section describes some of the terminology, methodology, and basic assumptions required for computing power benefits foregone.

2.2 Power Unit Values

The power benefits foregone are computed by applying power unit values to the loss in average annual generation and dependable capacity at Lake Texoma (Denison Dam). The capacity unit value, applied to the dependable capacity loss, represents the unit cost of constructing an increment of thermal capacity to replace the lost hydropower capacity. The energy unit value, the unit cost of producing replacement energy in the area power system, is applied to the loss in average annual generation.

These values were derived using NED economic criteria, in accordance with the U.S. Water Resources Council's Economics and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, previously referenced as ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000).

2.3 Interest Rate

The interest rate used in computing power benefits foregone due to water supply storage reallocation is the current (Fiscal Year 2006) Federal interest rate of 5-1/8 percent.

2.4 Period of Analysis

The economic period of analysis for this study is 50 years. The “Period of Analysis” as defined in *Planning Guidance Notebook*, Section 2-4j, for a multiple-purpose reservoir project, is not to exceed 100 years. In section E-63 i(1)(a)(1), “Benefits Foregone”, defines the period of analysis for storage reallocations as the greater of (a) the remaining economic life of the project, or (b) 50 years. Benefits foregone for this analysis are computed assuming the water supply contract will be implemented in 2007. The power on-line date, total economic life, and remaining economic life for the project are shown in Table 2-1.

Table 2-1: Pertinent Study Data Hydropower and Economic Parameters

Power Generation	
Installed capacity (MW)	70
Economic Parameters	
Power on-line (POL) date	1944
Total Project life (yrs)	100
Remaining life (yrs)	40
Interest Rate	5.125%
Period of Analysis	50

2.5 Price Level

The capacity and energy unit values used 2005 dollar values in FY 2006. The capacity values were computed using the projected indexes and fuel costs for 1 January 2006. The energy values were derived from Platts Power Outlook Research Service data available as of February 2006.

2.6 Most Likely Thermal Generation Alternative

For determination of capacity benefits, the type of thermal alternative electric generating plants considered were coal-fired steam (base loads displacement), gas-fired combined cycle (intermediate loads displacement), and gas-fired combustion turbine (peak loads displacement). As described in Section 4.7.1, the most likely thermal generation alternatives to the Lake Texoma (Denison Dam) generation are natural gas-fired combined cycle and natural gas-fired combustion turbines, determined by using a screening curve methodology. Thermal generation replacement alternatives are used in power system modeling to replace the Lake Texoma (Denison Dam) hydropower capacity.

2.7 Revised Simulations with SWD-SUPER Streamflow Routing Model

The SWD-SUPER streamflow routing model was used to simulate the operation of Lake Texoma (Denison Dam) reservoir on a daily time-step according to existing guidelines for reservoir and system operation. The simulations used in the analysis were based on a period of record of 63 years, from 1938 through 2000, and models three alternative storage reallocations of 150,000, 300,000 and 450,000 acre-feet (AF). See Section 3.2 for an explanation of alternatives considered in this analysis.

In the April 2004 report prepared by the HAC, the original load schedule obtained from the Southwestern Power Administration (SWPA), occasionally emptied Lake Texoma's conservation storage under the SUPER simulated condition of a water supply allocation

alternative of 450,000 AF. The exhaustion of conservation storage in this alternative simulation was due to over commitment of the available storage. The generating units in the Denison Dam powerhouse do not operate when the pool drops below Elevation 602 because generator efficiency rapidly decreases below this pool elevation. Therefore, to realistically model how the pool would operate under the Alternative 450,000 AF, SWPA modified the load schedule to reduce the storage commitment to avoid exhausting the available conservation storage for an extended period of time.

2.8 Generator Rewind Study

A generator rewind study was preformed by HAC for the Denison powerhouse units in July 2003. The rewound units were not included in the SUPER simulations due to the uncertainty of when the generator rewind project would actually be implemented.

3.0 ENERGY BENEFITS FOREGONE

3.1 General

Energy benefits foregone have traditionally been computed as the product of the energy loss (in megawatt-hours) and an energy unit value ($/MWh). The energy unit value is based on the cost of energy from alternative generating resources that would replace the lost energy from the hydropower plant due to operational and/or structural changes.

Beyond 20 years, the energy value is held constant due to uncertainty. The 50 annual energy values are brought to a present value using present-worth methods and amortized to an annualized value. The product of the annualized energy value and energy losses due to water withdrawals represents the annual energy benefits foregone for that alternative.

3.2 Water Supply Withdrawal Alternatives Considered

To date there are various water supply contracts in force as listed in Table 1-1. The full use of existing water supply contracts are accounted for in the base case alternative. Tulsa District requested the Hydropower Analysis Center to evaluate the following alternatives:

- Base Case Alternative. Current operations with full use of existing water supply allocation of 150,000 AF.

- 300,000 AF Alternative. Base case alternative with an additional 150,000 AF reallocated from hydropower (conservation) storage for water supply.

- 450,000 AF Alternative. Base case alternative with an additional 300,000 AF reallocated from hydropower (conservation) storage for water supply.

Congress provides discretionary authority to the Commander, US Army, Corps of Engineers to approve storage reallocation requests if the reallocation of storage in a Federal reservoir does not have a severe effect on other project authorized purposes. Additionally, the Commander, USACE, has Congressional authority to reallocate storage to water supply from other purposes in amounts up to 15 percent of total storage capacity allocated to all authorized project purposes or 50,000 acre-feet, whichever is less. In the case of Lake Texoma, 15 percent of the total storage capacity is 779,100 acre-feet. Therefore, the Commander, USACE can reallocate up to 50,000 acre-feet of storage in the reservoir. Existing reallocated storage amounts in the reservoir already exceeds the discretionary limit (see Table 1.1). Therefore, any additional storage reallocation in Lake Texoma would require Congressional authority.

3.3 Study Assumptions

The evaluation of energy benefits foregone due to water supply withdrawals from Lake Texoma was performed based on the following assumptions.

- Water supply withdrawals are considered "consumptive use," implying that none of the withdrawal amount taken from Lake Texoma (Denison Dam) reservoir will be returned to either the reservoir or the stream reach below the reservoir.

- The seasonal water supply withdrawal rates from Lake Texoma (Denison Dam) are made at a uniform rate through out the year.

The impact on hydropower benefits from reallocating storage for water supply will only be evaluated for storage reallocations in the conservation or hydropower pool. The Tulsa District eliminated evaluation of storage reallocations in the flood control pool based on language in the authorizing legislation. Public Law 99-662, Section 838 (a) states that, "The project for the Denison Dam (Lake Texoma), Red River, Texas and Oklahoma, authorized by the Flood Control Act approved June 28, 1938, is modified to provide that the Secretary is authorized to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 150,000 acre-feet for municipal, industrial and agricultural water users in the State of Texas and up to an additional 150,000 acre-feet for municipal, industrial and agricultural water users in the State of Oklahoma."

3.4 Computation of Energy Losses

Energy losses associated with the reallocation of storage alternatives at Lake Texoma (Denison Dam) were computed by the Tulsa District using the stream flows from the historical period of record (1938–2000) in the SWD-SUPER streamflow routing model. Lake Texoma (Denison Dam) average annual energy losses were computed between the base case and 300,000 AF alternative and the base case and 450,000 AF alternative and are shown in Table 3-1.

Table 3-1: Annual Energy Loss Due to Reallocation

Year	Existing (MWh)	300K Withdrawal (MWh)	Loss (MWh)	450K Withdrawal (MWh)	Loss (MWh)
1938	287,639	278,839	-8,800	268,290	-19,349
1939	67,938	53,792	-14,146	41,823	-26,115
1940	112,434	96,292	-16,142	79,076	-33,358
1941	467,160	458,024	-9,136	449,533	-17,627
1942	354,380	342,748	-11,632	330,486	-23,894
1943	224,046	212,346	-11,700	203,282	-20,764
1944	125,872	117,902	-7,970	106,463	-19,409
1945	344,665	328,694	-15,971	313,696	-30,969
1946	268,478	256,054	-12,424	243,865	-24,613
1947	245,095	239,962	-5,133	230,747	-14,348
1948	182,353	165,694	-16,659	151,967	-30,386
1949	168,439	157,574	-10,865	153,563	-14,876
1950	352,142	339,374	-12,768	324,252	-27,890
1951	189,865	180,035	-9,830	171,576	-18,289
1952	103,360	86,114	-17,246	62,294	-41,066
1953	87,270	69,469	-17,801	57,855	-29,415
1954	161,475	152,084	-9,391	141,144	-20,331
1955	191,021	179,629	-11,392	171,627	-19,394
1956	73,716	58,695	-15,021	48,741	-24,975
1957	278,949	268,383	-10,566	255,966	-22,983
1958	186,555	177,539	-9,016	166,370	-20,185
1959	183,731	167,541	-16,190	153,112	-30,619
1960	252,519	239,903	-12,616	227,860	-24,659
1961	230,537	215,717	-14,820	201,081	-29,456
1962	229,679	216,547	-13,132	204,869	-24,810
1963	99,823	85,655	-14,168	71,157	-28,666
1964	66,133	53,796	-12,337	43,824	-22,309
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
1995	412,693	403,221	-9,472	392,603	-20,090
1996	263,096	249,621	-13,475	236,512	-26,584
1997	383,762	373,017	-10,745	362,118	-21,644
1998	295,197	288,347	-6,850	279,884	-15,313
1999	169,668	156,956	-12,712	145,907	-23,761
2000	189,077	171,495	-17,582	154,810	-34,267
Average	232,084	220,089	-11,995	208,292	-23,792

The average annual generation loss for each alternative is summarized in Table 3-2.

Table 3-2: Average Annual Energy (1938 – 2000)

LAKE TEXOMA	Average Annual Energy	Average Annual Energy Loss
Base Case (MWh)	232,084	---
300,000 AF Alternative (MWh)	220,089	11,995
450,000 AF Alternative (MWh)	208,292	23,792

3.5 Input Revision to the SUPER model

The SUPER model simulation of the 450,000 AF reallocation alternative using the original generation load schedule from SWPA caused the conservation pool to be completely evacuated for a short time in the period of simulation. The conservation pool was over committed. This did not occur for the 150,000 AF reallocation or the 300,000 AF simulations. The efficiency of the generators decreases when the pool drops below Elevation 602. Therefore, generation is not normally scheduled when the pool drops below this elevation. To realistically model how the pool would be operated under the three alternatives, the generation loads were modified by SWPA. In the resulting model output, the conservation pool does not fully evacuate during any period.

3.6 General Basis for Computing Energy Benefits

The energy benefits for a hydropower project are based on the area power system cost of producing the same amount of replacement energy as the proposed hydropower project.

Hydropower generation from the Denison powerhouse is distributed to two preference customers of SWPA, the Rayburn Country and Tex-La Electric Co-operatives. The reliability and security of electricity transmission in Texas is ensured by the Electric Reliability Council of Texas (ERCOT) system. The ERCOT, one of 10 regional reliability councils in the North American Electric Reliability Council (NERC) organization, borders the Southwest Power Pool (SPP) to the south.

The Denison project is operated primarily as a peaking project. Its power generation generally fluctuates daily to meet a relatively constant load pattern. Power generation at Denison powerhouse contributes about 235 gigawatt-hours (GWh) annually to SWPA. The Denison powerhouse operates independently from SWPA's power system and is not considered a firm resource to meet their system power obligations. The energy generated at Denison is delivered directly to the Rayburn Country and Tex-La Electric Cooperatives.

3.7 General

The energy value used to determine the value of energy impacts for reallocating storage to water supply from Lake Texoma is based on information developed by Platts Power Outlook Research Service; a wholesale North American power market forecast service. Platts is a Division of the McGraw-Hill Companies, Inc. Platts' data sets are proprietary and are used under subscription by the Corps of Engineers' Hydropower Analysis Center.

Platts uses AuroraXMP, an electric energy market model owned and licensed by EPIS, Incorporated to forecast market clearing prices for electric power. Platts estimates both On-Peak and Off-Peak energy values on a monthly basis for a 20 year forecast period from 2006 through 2025.

The hourly market-clearing price is based upon a fixed set of resources dispatched in least-cost order to meet demand while subject to emissions limits. The hourly price is set equal to the variable cost of the marginal resource needed to meet the last unit of demand. A long-term resource optimization feature within the AURORA model allows generating resources to be added or retired based on economic profitability. Market-clearing price and the resource portfolio are interdependent. Market-clearing price affects the revenues any particular resource can earn and consequently will affect which resources are added or retired. AURORA sets the market-clearing price using assumptions on demand levels (load) and supply costs. The demand forecast implicitly includes the effect of price elasticity over time. The supply side is defined by the cost and operating characteristics of individual electric generating plants, including resource capacity, heat rate, and fuel price. AURORA recognizes the effect that transmission capacity and prices have on the system's ability to move generation output between areas.

Platts market clearing price includes both an energy and capacity component. For determination of the lost energy value, only the energy component was used in this analysis. Capacity value determination and capacity loss computation are described in Section 4.

In providing input data to AURORA, Platts utilizes numerous other models and data sources including the following:

- Electricity Demand model
- Coal Market model
- Gas Market model
- NEWGen database of new generating capacity
- SO2 and NOx emissions allowance price forecasting model

3.8 Procedure

Platts develops power price forecasts for all the North American Electric Reliability Council (NERC) regions. As discussed in Section 3.6, hydropower generation from the Denison powerhouse is distributed to two preference customers of SWPA, the Rayburn

Country and Tex-La Electric Co-operatives. which are within the ERCOT region of NERC.

The power values used in this report are based on the Baseline Price Forecast in the February 2006 release by the Platts Power Outlook Research Service and represent conditions at that time (this is the latest data currently available). The Baseline forecast assumes average hydrologic conditions occur for each year of the simulation. To determine the estimated market value of energy forgone, the average annual generation decrease in MWh was multiplied by a levelized average annual energy value. To derive this levelized annual value, the forecasted monthly values derived from data provided by Platts for the ERCOT market region were used.

Platts provides a 20 year forecast of projected market energy values on both a monthly and annual basis for the period 2006 through 2026. These forecasted values are provided in both Nominal (inflation included) and Constant 2005 dollars for annual values, while monthly values are provided in Nominal Dollars only. To account for the monthly variation in generation that occurs at hydropower plants, it is desirable to use the monthly energy values to derive the annual levelized value so that the levelized annual value reflects the monthly generation distribution. To utilize the monthly values, each of the monthly values was converted to Constant 2005 Dollars (inflation removed) based on the annual inflation rates used by Platts. In addition, Platts provides energy values for both "On-Peak" and "Off-Peak" periods. For ERCOT, Platts uses the definition of "On-Peak" hours as 16 hours per day, 5 days per week (Monday through Friday) with remaining hours and some holidays considered "Off-Peak".

Denison is a storage project with 5,194,164 AF of storage, of which 1,570,216 AF (elevation 590 ft to 617 ft) is reserved for power (conservation) storage. It is used for the daily shaping of power releases. The project has an annual plant factor of about 30 percent which means that when flows are high enough the project is operated in a base-load mode. However, when flows are low, the project is used primarily for peaking. The pondage is used to shape the flow to permit operating at full capacity during the high demand hours and shutting the plant down during the remaining hours. Under this "mixed" mode of operation which varies seasonally the energy value was weighted for "On" and "Off" peak generation as well as monthly variations in this analysis.

To estimate a single levelized energy value, the same long term generation used to determine energy loss was used to estimate the average monthly and daily energy distribution to be applied to the power values to reflect their variation over time-of-day and time-of-year. The monthly distributions are shown in Figure 3-1. The hourly weighting in Figure 3-2 shows "On-Peak" in each month and is based on the ERCOT standard definition of 16-hour "On-Peak" periods on each work-day of the week. The daily generation for the entire period of record simulated was evaluated. For those days that fell within the defined "On-Peak" period, the number of hours the plant could generate at peak plant capacity was determined. Up to 16 hours of this generation was assumed to be "On-Peak". If the daily generation for these days exceeded 16 hours, the remainder was assumed to be "Off-Peak", as well as all generation that occurred on

Saturdays and Sundays. A combined weighting factor using monthly distribution and the monthly on-peak and off-peak split is then applied to develop the single levelized annual energy. In Figure 3-3 the Platts monthly "On-Peak' and "Off-Peak" power values are plotted along with combined monthly energy value that was derived by applying the "On-Peak" and "Off-Peak" weighting value.

Figure 3-1: Annual Energy Distribution

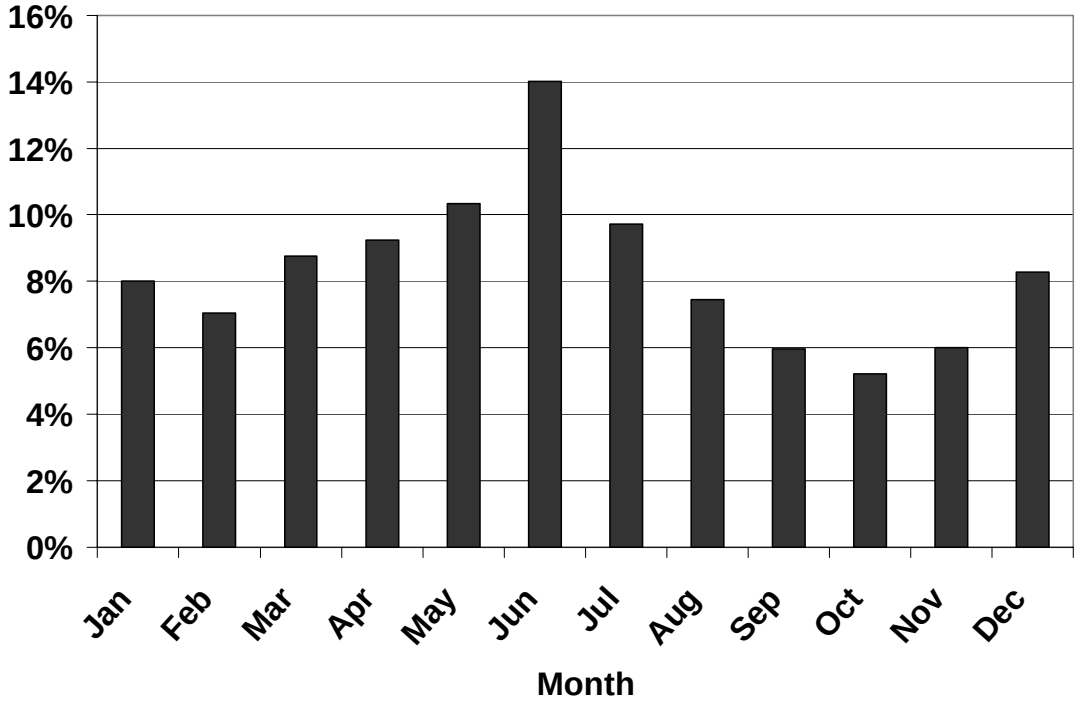


Figure 3-2: Monthly On/Off Peak Distribution

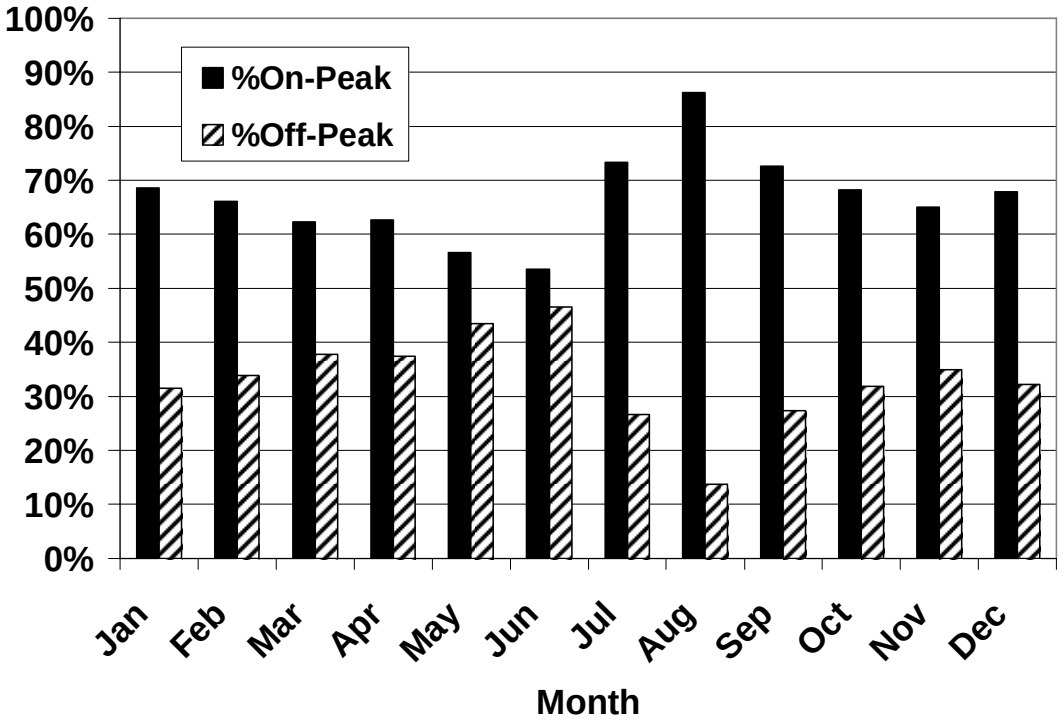
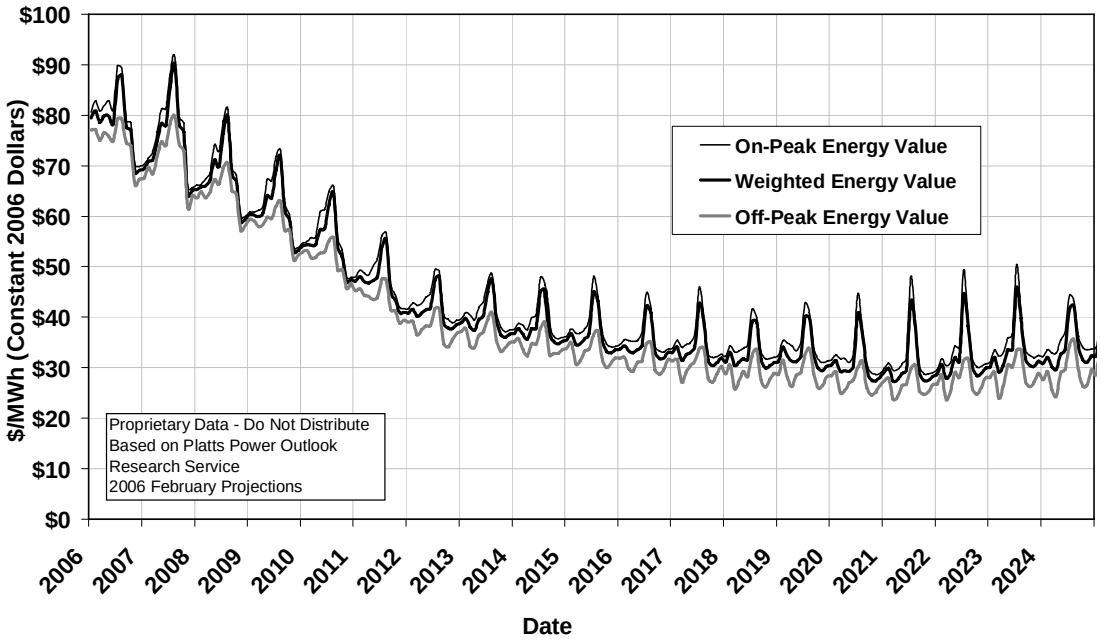


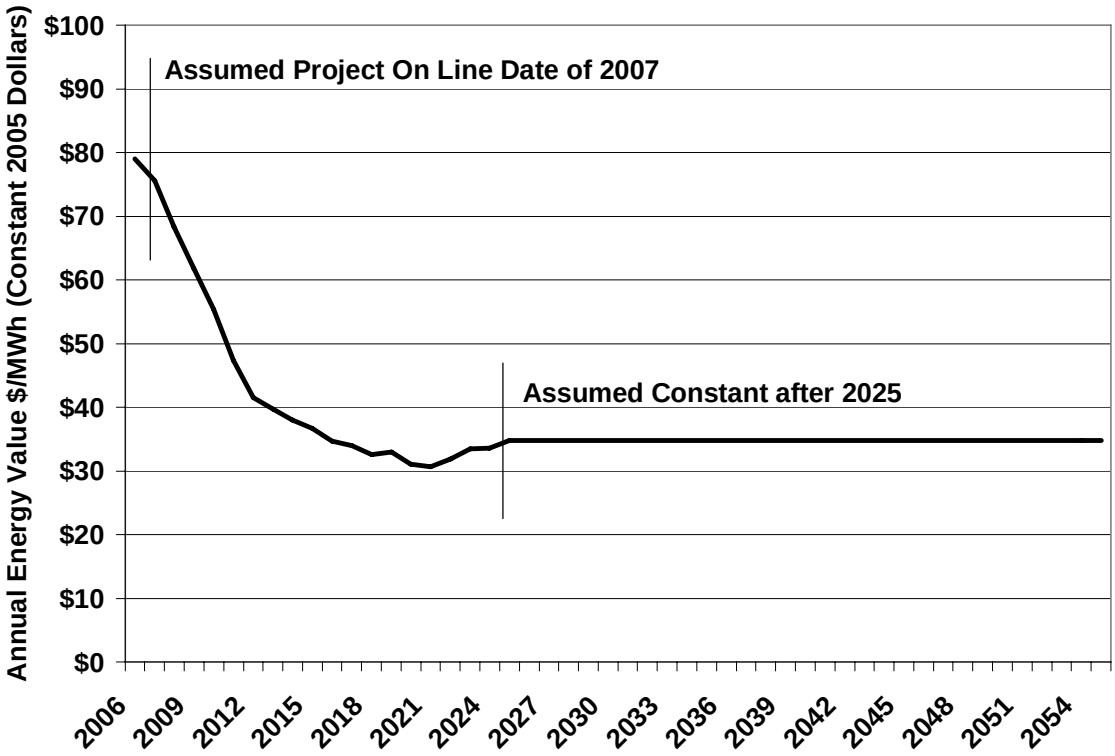
Figure 3-3: Monthly Energy Values



To develop a levelized annual power value for the 50 year project period, after the weighted monthly energy values are determined for each month in the 20 year forecast period, these monthly figures are converted to annual values by multiplying each month

by the percent of generation that occurs in that month and these products are summed to produce an annual value. The resulting annual values are shown in Figure 3-4. Annual values for the years after 2025 (last year of Platts forecast) are assumed equal to 2025 (constant after 2025).

Figure 3-4: Annual Energy Values



Each annual value is present-worthed to the year 2006 using the Federal interest rate of 5.125%. The present worth of each year through 2056 is totaled, and this total present worth is converted to an annual equivalent or "Levelized" value for an assumed project life of 50 years and the Federal interest rate. Therefore, this single levelized value accounts for the variation of energy value over the time-of-day and time-of-year. This is shown in Table 3-4. Please note in this table, the shaded values show the years assumed constant after the 20 year forecast period of energy values.

Annual Energy Value for Texoma Powerhouse = $41.62/MWh

Table 3-4: Levelized Annual energy Value at 5.125%

FY 2006 Interest Rate	**5.125%**
Project Online Date	**2007**
End of Economic Life	**2056**
Period of Analysis (Years)	**50**

Year Number	Calendar Year	Present Worth Factor	Annual Energy Value $/MWh	Present Worth Energy Value $/MWh
	2006	---	78.99	---
1	**2007**	0.9512	75.63	71.94
2	2008	0.9049	68.31	61.81
3	2009	0.8608	61.82	53.21
4	2010	0.8188	55.42	45.37
5	2011	0.7789	47.35	36.88
6	2012	0.7409	41.52	30.76
7	2013	0.7048	39.75	28.02
8	2014	0.6704	38.05	25.51
9	2015	0.6377	36.67	23.39
10	2016	0.6067	34.74	21.08
11	2017	0.5771	34.04	19.65
12	2018	0.5489	32.60	17.90
13	2019	0.5222	32.96	17.21
14	2020	0.4967	31.07	15.43
15	2021	0.4725	30.65	14.48
16	2022	0.4495	31.89	14.33
17	2023	0.4276	33.49	14.32
18	2024	0.4067	33.60	13.66
19	2025	0.3869	34.82	13.47
20	2026	0.3680	34.82	12.81
21	2027	0.3501	34.82	12.19
22	2028	0.3330	34.82	11.60
23	2029	0.3168	34.82	11.03
24	2030	0.3013	34.82	10.49
25	2031	0.2866	34.82	9.98
26	2032	0.2727	34.82	9.49
27	2033	0.2594	34.82	9.03
28	2034	0.2467	34.82	8.59
29	2035	0.2347	34.82	8.17
30	2036	0.2233	34.82	7.77
31	2037	0.2124	34.82	7.39
32	2038	0.2020	34.82	7.03
33	2039	0.1922	34.82	6.69
34	2040	0.1828	34.82	6.37
35	2041	0.1739	34.82	6.05
36	2042	0.1654	34.82	5.76
37	2043	0.1574	34.82	5.48
38	2044	0.1497	34.82	5.21
39	2045	0.1424	34.82	4.96
40	2046	0.1354	34.82	4.72
41	2047	0.1288	34.82	4.49
42	2048	0.1226	34.82	4.27
43	2049	0.1166	34.82	4.06
44	2050	0.1109	34.82	3.86
45	2051	0.1055	34.82	3.67
46	2052	0.1004	34.82	3.49
47	2053	0.0955	34.82	3.32
48	2054	0.0908	34.82	3.16
49	2055	0.0864	34.82	3.01
50	2056	0.0822	34.82	2.86
Present Worth Energy Value Total				745.45
LEVELIZED ENERGY VALUE ($/MWh)				**41.62**

4.0 CAPACITY BENEFITS FOREGONE

4.1 General

Capacity benefits foregone are defined as the product of the loss in dependable capacity and a capacity unit value, which represent the capital cost of constructing replacement thermal capacity.

4.2 Dependable Capacity

A hydropower project's dependable capacity is a measure of the amount of capacity that the project can reliably contribute towards meeting system peak power demands. If a hydropower project always maintains approximately the same head, and there is always an adequate supply of stream flow so that there is enough generation for the full capacity to be usable in the system load, the full installed capacity can be considered dependable. In some cases even the overload capacity is dependable.

However, at storage projects, normal reservoir drawdown can result in a loss of capacity due to a loss in head. At other times, stream flows in low flow periods may result in insufficient generation to support the available capacity in the load. Dependable capacity is a measure of the amount of capacity that can be provided with some degree of reliability during peak demand periods.

4.3 Dependable Capacity Evaluation Method

Dependable capacity can be computed in several ways. The method that is most appropriate for evaluating a hydropower plant's dependable capacity in a predominantly thermal-based power system is the average availability method, as described in Section 6-7g of EM 1110-2-1701, Hydropower, dated 31 December 1985. The occasional unavailability of a portion of hydro project's generating capacity due to hydrologic variations should be treated in the same manner as the occasional unavailability of all or part of a thermal plant's generating capacity due to forced outages.

This assumption is not appropriate in power systems where hydropower is a majority resource, because adverse hydrology can affect all of the hydropower projects in a system simultaneously, with a resulting long-term reduction in capacity at all projects. In such systems, hydropower dependable capacity must be based on the capacity available under adverse hydrologic conditions or critical period.

This is not the case in a large, diverse power system, where hydropower represents only a small portion of the region's generating resources. When defining a hydropower project contribution to meeting peak loads in this type of system, random hydrologic variations can be considered equivalent to random thermal generating plant forced outages. ERCOT is primarily a thermal-based power system with only a small amount of hydropower.

Therefore, average availability method is the most appropriate method for measuring dependable capacity for this analysis.

4.4 Dependable Capacity vs. Marketable Capacity

The average availability method differs from the method used by Southwestern Power Administration (SWPA) in defining the amount of firm hydropower capacity that it can market. SWPA uses a method based on adverse water, because hydropower is its only generating resource. SWPA can only guarantee delivery of hydropower capacity that it can support during adverse water conditions, because it has no thermal generating plants to back up its hydropower resources. SWPA sometimes purchases thermal power generation on the open market during periods of low stream flows, but cannot afford to do this very often and still meet its repayment obligations to the Federal treasury.

However, even though SWPA uses a method based on a year of adverse hydrologic conditions to determine the marketable capacity of the Lake Texoma (Denison Dam) project, that does not mean the method is appropriate for measuring the loss in NED capacity benefits at this project. The objective of NED benefits is to measure the gain or loss of benefits to the nation as a whole, not to a single entity (such as SWPA) or to a small group of entities (SWPA's customers).

4.5 Computation of Dependable Capacity

Under the average availability method the Lake Texoma (Denison Dam) may occasionally lose capacity due to loss of head or due to inadequate energy to support the available capacity. Similarly, there are periods when the full peaking capacity is both available and usable. The average availability method attempts to measure the average capacity available during the peak demand periods of the year.

4.5.1 Hydrologic Period of Analysis

In order to evaluate the average dependable capacity for a project, a long-term record of project operation must be used. Actual project operating records can be used, but the period of operation may not be long enough to give a statistically reliable value. Furthermore, operating changes may have occurred over the life of the project, which would make actual data somewhat inconsistent.

A reliable alternative method is the use of a period-of-record computer simulation of system operation. As described in Section 2.7, the Tulsa District provided a daily simulation of the Red River projects over the period 1938 to 2000 (63 years). This simulation, which was performed using the SWD-SUPER streamflow routing model, served as the basis of this study's dependable capacity computations.

4.5.2 Criteria for Computing Dependable Capacity

The SWPA criterion for sustained capacity at Lake Texoma (Denison Dam) has been approximated by examining the project's contribution to meeting total system capacity requirements in the water year 1964—the year SWPA uses to measure system marketable capacity. Dependable capacity is normally based on the amount of capacity that can be supported in the peak demand period of June through August in the ERCOT region according to SWPA. Table 4-1 list the dependable capacity parameters used in computing dependable capacity at Lake Texoma (Denison Dam).

Table 4-1: Lake Texoma Dependable Capacity Parameters

Critical period:	June-August 1964
Marketed capacity	70 MW
Machine capability	80 MW
Number of hrs/day on peak:	7 hours

The average weekly energy output at Lake Texoma (Denison Dam) during June-August 1964 was obtained from the SWD-SUPER streamflow routing model simulation for the Base Case Alternative. The number of hours that the project is required to support was then determined by dividing the average weekly energy by the amount of capacity that SWPA markets from the Lake Texoma (Denison Dam) project.

Thus, based on water available during the 1964 peak demand period of June-August, the number of hours of weekly peaking that the Lake Texoma (Denison Dam) powerhouse can support under the base condition with no new withdrawals for water supply is as follows:

(1) average June-August 1964 simulated weekly energy: 2,261 MWh
(2) SWPA marketable capacity: 70.0 MW
(3) 1964 machine capability: 78.7 MW
(4) HAC hours on peak per week [(1)/(2)] 32.3 hours

4.5.3 Computation Procedure for Supportable Capacity

Using 32.3 hours per week for sustainable capacity, as computed above and which approximates the SWPA criterion of 7 hours per weekday, the average weekly energy for the peak demand period was computed for each year and divided by 32.3 hours in order to determine how much capacity could be supported during the peak demand months of each year.

For each year, a comparison was made between the "potential" supportable capacity and the project machine capability for that year. In all cases, the capacity that could actually

be supported was limited to that portion of the potential supportable capacity that did not exceed project machine capability.

The following example summarizes the computations that were performed to determine average supportable (usable) capacity during the peak demand months of June-August 1964.

Computed from project data for operation without diversion for water supply:

- Average weekly energy during June – August 1964 without diversion is 2,261 MWh

- Average weekly machine capability during June – August 1964 is 78.7 MW (In most years with normal pool levels the machine capability in the months of June-August was 80 MW)

- Potential supportable capacity during June – August 1964 is 2,261 MWh / 32.3 hours or 70 MW

- Actual supportable capacity during June – August is the minimum of machine capability or potential support capacity or MIN (78.7 MW, 70.0 MW) = 70 MW

4.6 Dependable Capacity Losses

Compared to the existing condition, Table 4-2 and 4-3 show the dependable capacity computations for the 300,000 AF and 450,000 AF reallocation alternatives, respectively. Columns 1-5 of Tables 4-2 and 4-3, "Calculations - Before Withdrawals", show how the above procedure was followed to compute each project's dependable capacity without water supply withdrawals. Columns 6-10, "Calculation - After Withdrawals", shows the project's dependable capacity with water supply withdrawals. Notes at the bottom of the tables show how the values in each column were computed. The dependable capacity lost computed in Tables 4-2 and 4-3 are summarized in Table 5-1.

Table 4-2: Dependable Capacity Calculation - 300,000 AF

	Calculations Before Withdrawals					Calculations After Withdrawals				
	1	2	3	4	5	6	7	8	9	10
Year	Required Hours On Peak	Average Weekly Energy Jun-Aug (MWh)	Potential Support Capacity (MW)	Machine Capability (MW)	Actual Support Capacity (MW)	Average Weekly Energy Jun-Aug (MWh)	Potential Support Capacity (MW)	Machine Capability (MW)	Actual Support Capacity (MW)	Lost Capacity (MW)
1964	32.30	2261	70.00	78.7	70.0	1,850	57.27	78.6	57.3	12.730
1938	32.30	6,017	186.3	80.0	80.0	5,952	184.3	80.0	80.0	0.00
1939	32.30	2,262	70.0	80.0	70.0	1,850	57.3	80.0	57.3	12.74
1940	32.30	4,576	141.7	80.0	80.0	4,098	126.9	80.0	80.0	0.00
1941	32.30	9,890	306.2	80.0	80.0	9,730	301.3	80.0	80.0	0.00
1942	32.30	7,057	218.5	80.0	80.0	6,835	211.6	80.0	80.0	0.00
1943	32.30	5,419	167.8	80.0	80.0	5,345	165.5	80.0	80.0	0.00
1944	32.30	3,894	120.6	80.0	80.0	3,771	116.8	80.0	80.0	0.00
1945	32.30	8,191	253.6	80.0	80.0	8,127	251.6	80.0	80.0	0.00
1946	32.30	4,942	153.0	80.0	80.0	4,753	147.2	80.0	80.0	0.00
1947	32.30	6,538	202.4	80.0	80.0	6,474	200.4	80.0	80.0	0.00
1948	32.30	5,740	177.7	80.0	80.0	5,629	174.3	80.0	80.0	0.00
1949	32.30	5,908	182.9	80.0	80.0	5,850	181.1	80.0	80.0	0.00
1950	32.30	10,219	316.4	80.0	80.0	9,963	308.5	80.0	80.0	0.00
1951	32.30	7,239	224.1	80.0	80.0	7,134	220.9	80.0	80.0	0.00
1952	32.30	3,164	97.9	80.0	80.0	3,035	94.0	80.0	80.0	0.00
1953	32.30	2,234	69.2	80.0	69.2	1,824	56.5	79.9	56.5	12.72
1954	32.30	5,070	157.0	80.0	80.0	4,880	151.1	80.0	80.0	0.00
1955	32.30	6,352	196.7	80.0	80.0	6,225	192.7	80.0	80.0	0.00
1956	32.30	2,262	70.0	80.0	70.0	1,849	57.3	80.0	57.3	12.77
1957	32.30	9,843	304.8	80.0	80.0	9,748	301.8	80.0	80.0	0.00
1958	32.30	3,509	108.7	80.0	80.0	3,256	100.8	80.0	80.0	0.00
1959	32.30	5,065	156.8	80.0	80.0	4,513	139.7	80.0	80.0	0.00
1960	32.30	4,548	140.8	80.0	80.0	4,329	134.0	80.0	80.0	0.00
1961	32.30	4,999	154.8	80.0	80.0	4,753	147.2	80.0	80.0	0.00
1962	32.30	7,311	226.4	80.0	80.0	7,122	220.5	80.0	80.0	0.00
1963	32.30	2,280	70.6	80.0	70.6	1,863	57.7	80.0	57.7	12.91
1964	32.30	2,261	70.0	78.7	70.0	1,850	57.3	78.6	57.3	12.73
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
1990	32.30	7,545	233.6	80.0	80.0	7,592	235.1	80.0	80.0	0.00
1991	32.30	7,279	225.4	80.0	80.0	7,034	217.8	80.0	80.0	0.00
1992	32.30	9,484	293.6	80.0	80.0	9,395	290.9	80.0	80.0	0.00
1993	32.30	7,289	225.7	80.0	80.0	7,107	220.1	80.0	80.0	0.00
1994	32.30	5,974	185.0	80.0	80.0	5,821	180.2	80.0	80.0	0.00
1995	32.30	11,909	368.7	80.0	80.0	11,814	365.8	80.0	80.0	0.00
1996	32.30	2,950	91.3	80.0	80.0	2,622	81.2	80.0	80.0	0.00
1997	32.30	7,852	243.1	80.0	80.0	7,621	235.9	80.0	80.0	0.00
1998	32.30	2,504	77.5	80.0	77.5	2,206	68.3	80.0	68.3	9.23
1999	32.30	5,708	176.7	80.0	80.0	5,584	172.9	80.0	80.0	0.00
2000	32.30	3,273	101.3	80.0	80.0	3,072	95.1	80.0	80.0	0.00
Average Actual Supportable Capacities (MW) :					**78.24**				**75.93**	**2.310**

Explanation of Calculations:
Col (1): Required hours on peak from Table 4-1. **Col (2)**: Ave weekly energy before water supply withdrawals is based on the output from theKerr-Philpott model for Jul-Aug. **Col (3):** Col (2)/Col(1).
Col (4) & Col (8): Machine Capability specify in table xxx. **Col (5):** Lesser of Col (3) and Col (4).
Col (6): Ave weekly energy after water supply withdrawals is based on the data in Col (2) minus the energy losses computed using thepower equation. **Col (7):** Col (6)/Col (1).
Col (9): The lesser of Col (7) and Col (8). **Col (10):** Col (5) - Col (9)

Table 4-3: Dependable Capacity Calculation - 450,000 AF

	Calculations Before Withdrawals					Calculations After Withdrawals				
	1	2	3	4	5	6	7	8	9	10
Year	Required Hours On Peak	Average Weekly Energy Jun-Aug (MWh)	Potential Support Capacity (MW)	Machine Capability (MW)	Actual Support Capacity (MW)	Average Weekly Energy Jun-Aug (MWh)	Potential Support Capacity (MW)	Machine Capability (MW)	Actual Support Capacity (MW)	Lost Capacity (MW)
1964	32.30	2,261	70.0	78.7	70.0	1348	41.7	78.3	41.7	28.263
1938	32.30	6,017	186.3	80.0	80.0	5,896	182.6	80.0	80.0	0.00
1939	32.30	2,262	70.0	80.0	70.0	1,349	41.8	79.9	41.8	28.28
1940	32.30	4,576	141.7	80.0	80.0	3,406	105.5	80.0	80.0	0.00
1941	32.30	9,890	306.2	80.0	80.0	9,596	297.1	80.0	80.0	0.00
1942	32.30	7,057	218.5	80.0	80.0	6,583	203.8	80.0	80.0	0.00
1943	32.30	5,419	167.8	80.0	80.0	5,284	163.6	80.0	80.0	0.00
1944	32.30	3,894	120.6	80.0	80.0	3,600	111.5	80.0	80.0	0.00
1945	32.30	8,191	253.6	80.0	80.0	8,027	248.5	80.0	80.0	0.00
1946	32.30	4,942	153.0	80.0	80.0	4,617	142.9	80.0	80.0	0.00
1947	32.30	6,538	202.4	80.0	80.0	6,386	197.7	80.0	80.0	0.00
1948	32.30	5,740	177.7	80.0	80.0	5,527	171.1	80.0	80.0	0.00
1949	32.30	5,908	182.9	80.0	80.0	5,794	179.4	80.0	80.0	0.00
1950	32.30	10,219	316.4	80.0	80.0	9,765	302.3	80.0	80.0	0.00
1951	32.30	7,239	224.1	80.0	80.0	7,068	218.8	80.0	80.0	0.00
1952	32.30	3,164	97.9	80.0	80.0	2,175	67.4	80.0	67.4	12.65
1953	32.30	2,234	69.2	80.0	69.2	1,331	41.2	79.8	41.2	27.96
1954	32.30	5,070	157.0	80.0	80.0	4,579	141.8	80.0	80.0	0.00
1955	32.30	6,352	196.7	80.0	80.0	6,018	186.3	80.0	80.0	0.00
1956	32.30	2,262	70.0	80.0	70.0	1,348	41.8	79.9	41.8	28.28
1957	32.30	9,843	304.8	80.0	80.0	9,724	301.1	80.0	80.0	0.00
1958	32.30	3,509	108.7	80.0	80.0	3,000	92.9	80.0	80.0	0.00
1959	32.30	5,065	156.8	80.0	80.0	4,178	129.4	80.0	80.0	0.00
1960	32.30	4,548	140.8	80.0	80.0	4,087	126.6	80.0	80.0	0.00
1961	32.30	4,999	154.8	80.0	80.0	4,505	139.5	80.0	80.0	0.00
1962	32.30	7,311	226.4	80.0	80.0	7,002	216.8	80.0	80.0	0.00
1963	32.30	2,280	70.6	80.0	70.6	1,359	42.1	80.0	42.1	28.52
1964	32.30	2,261	70.0	78.7	70.0	1,348	41.7	78.3	41.7	28.26
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
1990	32.30	7,545	233.6	80.0	80.0	7,343	227.4	80.0	80.0	0.00
1991	32.30	7,279	225.4	80.0	80.0	6,903	213.7	80.0	80.0	0.00
1992	32.30	9,484	293.6	80.0	80.0	9,305	288.1	80.0	80.0	0.00
1993	32.30	7,289	225.7	80.0	80.0	6,923	214.3	80.0	80.0	0.00
1994	32.30	5,974	185.0	80.0	80.0	5,721	177.1	80.0	80.0	0.00
1995	32.30	11,909	368.7	80.0	80.0	11,707	362.5	80.0	80.0	0.00
1996	32.30	2,950	91.3	80.0	80.0	2,271	70.3	80.0	70.3	9.70
1997	32.30	7,852	243.1	80.0	80.0	7,382	228.6	80.0	80.0	0.00
1998	32.30	2,504	77.5	80.0	77.5	1,808	56.0	80.0	56.0	21.53
1999	32.30	5,708	176.7	80.0	80.0	5,437	168.3	80.0	80.0	0.00
2000	32.30	3,273	101.3	80.0	80.0	2,605	80.7	80.0	80.0	0.00
Average Actual Supportable Capacities (MW) :					**78.24**				**72.77**	**5.472**

Explanation of Calculations:
Col (1): Required hours on peak from Table 4-1. **Col (2)**: Ave weekly energy before water supply withdrawals is based on the output from theKerr-Philpott model for Jul-Aug. **Col (3):** Col (2)/Col(1).
Col (4) & Col (8): Machine Capability specify in table xxx. **Col (5):** Lesser of Col (3) and Col (4).
Col (6): Ave weekly energy after water supply withdrawals is based on the data in Col (2) minus the energy losses computed using thepower equation. **Col (7):** Col (6)/Col (1).
Col (9): The lesser of Col (7) and Col (8). **Col (10):** Col (5) - Col (9)

4.7 Capacity Values

Hydropower benefits are based on the cost of the most likely thermal generation alternative that would carry the same increment of load as the proposed hydropower project or modification. Capacity benefits are intended to measure the investment cost of thermal generating plant capacity that would be needed to replace the lost capacity due to the water withdrawals from the reservoir. Capacity benefits are computed as the product of the dependable capacity loss and a capacity unit value, which is based on the unit cost of constructing the most likely thermal generating alternative.

4.7.1 Most Likely Thermal Generating Alternative

A screening curve analysis was conducted to determine the mix of thermal resources that would be the most likely, least-cost generation plant alternative to the Lake Texoma (Denison Dam) project. The type of alternative plants considered were coal-fired steam (base loads displacement), gas-fired combined cycle (intermediate loads displacement-load following), and gas-fired combustion turbine (peak loads displacement). The screening curve analysis for Lake Texoma (Denison Dam) is described in Section 4.7.3.

4.7.2 Capacity and Energy Values Used in Screening Curve Analysis

Capacity unit values for coal-fired steam, gas-fired combined cycle and combustion turbine plants were computed using procedures developed by the Federal Energy Regulatory Commission (FERC). Capacity values were computed for the Texas region based on a 5-1/8 percent interest rate and price levels projected to 1 January 2006 (FY 2006). Computed capacity values are shown in Table 4-4. The adjusted capacity values incorporate adjustments to account for differences in reliability and operating flexibility between hydropower and thermal generating power plants. See EM 1110-2-1701, Hydropower, Chapter 9-5c for further discussion on the capacity value FERC adjustments.

Unit capacity values for coal-fired steam, gas-fired combined cycle and gas-fired combustion turbine plants were computed using procedures developed by the Federal Energy Regulatory Commission (FERC). Capacity values were computed for Texas.

The adjusted FERC capacity value (CVFERC) incorporates the unadjusted capacity value (CV), an adjustment for the ratio of availability (HMA/TMA) and the flexibility adjustment (1+F).

$$CV_{FERC} = (CV)\left(\frac{HMA}{TMA}\right)(1+F) \qquad \textbf{(Eq. C-1)}$$

where: CV = unit cost of the most likely thermal alternative, in $/kW-year (also sometimes called the unadjusted unit capacity value)
HMA = mechanical/electrical availability of the hydro-generating unit (computed as 1 - FOR, where FOR = unit forced-outage rate)
TMA = mechanical/electrical availability of the thermal Alternative
F = operational flexibility adjustment factor

The ratio of availability accounts for the relative mechanical/electrical reliability of hydropower compared to the thermal alternative, while the flexibility adjustment accounts for the added operational flexibility of hydropower compared to the thermal alternative.

The adjusted and unadjusted unit capacity values, based on a Federal interest rate of 5.125 percent and 2005 price levels, are shown in Table 4-4. A summary of the input data used in computing the adjusted capacity values is included in Attachment A. Also included in Attachment A are copies of the FERC model output where adjusted capacity and energy values were calculated for Texas.

Table 4-4: Capacity Unit Values

Thermal Alternative Plant Type	Adjusted Capacity Value $/kW-Year	FERC Adjustments			Unadjusted Capacity Value $/kW-Year
		HMA	TMA	F	
Coal-Fired Steam	236.15	0.98	0.85	0.050	195.07
Combined Cycle	119.22	0.98	0.90	0.025	106.82
Combustion Turbine	62.19	0.98	0.90	0.025	55.72

Energy unit values for coal-fired steam, gas-fired combined cycle and gas-fired combustion turbine plants were developed using information obtained from the publication EIA Electric Power Monthly (DOE/EIA-0226) and other sources. The information obtained included fuel costs, heat rates and variable O&M costs. The resulting values, based on 2005 price levels, are shown in Table 4-5. Since current Corps of Engineers policy does not allow the use of real fuel cost escalation, these values were assumed to apply over the entire period of analysis.

Table 4-5: Energy Unit Values

Thermal Alternative Plant Type	Energy Value $/MWH
Coal-Fired Steam	20.61
Combined Cycle	42.03
Combustion Turbine	66.03

4.7.3 Screening Curve Analysis

Adjusted capacity values shown in Table 4-4 were used to develop a screening curve for Texas for each of the thermal generating alternatives. Adjusted values account for the more frequent outages experienced by thermal generating plants. A screening curve is a plot of total plant cost (fixed plus variable) versus annual plant factor. Energy unit values in Table 4-5 represent the plant's variable cost.

A screening curve analysis consists of the following steps:

- Construct a total plant cost (in $/kW-year) versus annual plant factor (in percent) diagram (screening curve) which includes a curve for each type of thermal generating plant available for addition to the system; this screening curve will show which type of plant is least costly in each plant factor range.

- Construct an hourly load-duration curve, based on loads for a typical operating year, for the increment of load being analyzed.

- From the screening curve, determine the "breakpoints" (the plant factors at which the least costly plant type changes).

- Find the points on the load-duration curve where the percent of time load is numerically identical to the plant factor breakpoints defined in the preceding step; these intersection points define the portion of the load that would be carried by each plant type.

The plot for each thermal generating alternative was developed by computing the annual plant cost for various plant factors ranging from zero to 100 percent. The annual costs were computed using the following equation:[1]

1 The product 0.0876 * PF is the factor used to convert EV from $/MWh to $/kW-year so that CV and EV have the same units.

$$AC = CV + (EV * 0.0876 * PF) \qquad \text{(EQ 3)}$$

where:
AC = thermal generating plant total cost ($/kW-year)
CV = thermal generating plant capacity value ($/kW-year)
EV = thermal generating plant energy value ($/MWh)
PF = annual plant factor (percent)

The resulting Screening Curve is shown in Figure 4-1. Figure 4-2 shows an hourly duration for 1998, which was considered by the Tulsa District to be a typical operating year for the Denison powerhouse.

Figure 4-1: Thermal Screening Curve

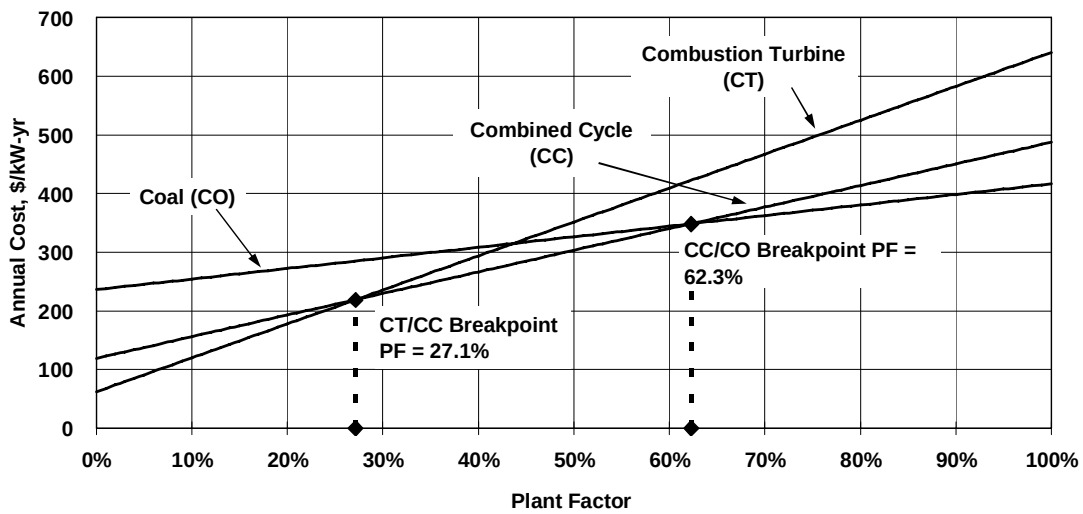
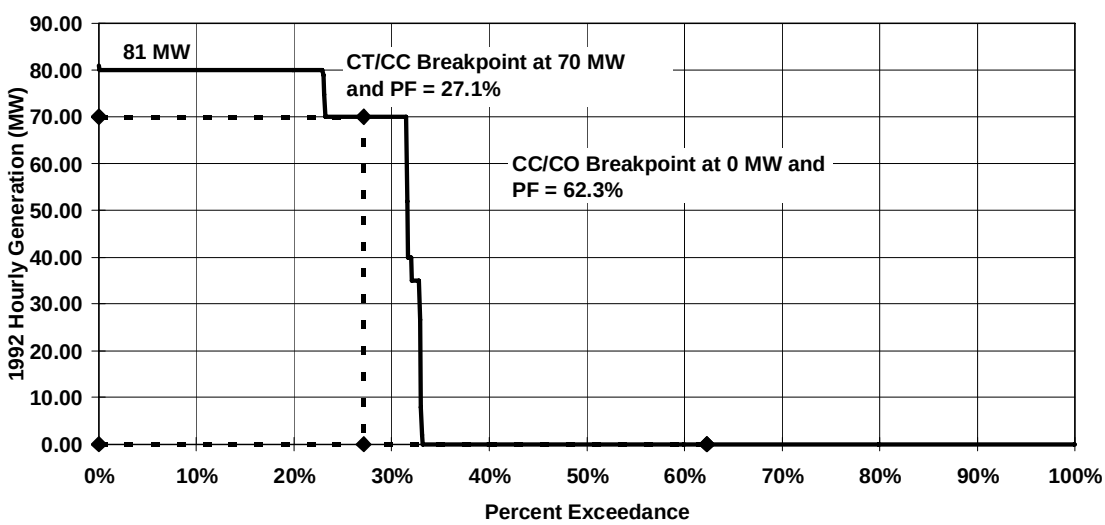


Figure 4-2: Total hourly Generation Duration Curve for 1998



4.7.4 Least-Cost Thermal Mix

From Figure 4-1 a breakpoint plant factor of 27.1% is obtained between the combustion turbine and combined-cycle plant. This plant factor was matched to the percent exceedence on the 1998 hourly generation-duration curve in Figure 4-2. The Tulsa District considers 1998 to be a representative year of operation in terms of both power generation and river flows. A generation value of 70 MW was obtained for the breakpoint. This generation value was then used to divide the generation-duration curve into two components: a 11 MW (81 MW – 70 MW) combustion-turbine (upper) component, a 70 MW combined-cycle component. Thus, the most likely, least-cost thermal alternative to the Lake Texoma hydropower plant would be 11 MW of gas-fired combustion turbine, 70 MW of gas-fired combined cycle power plant, because the project is operated at a relatively low plant factor. This is the most likely least cost generation alternative to the Lake Texoma (Denison Dam) hydro-generation.

4.7.5 Composite Capacity Unit Value

The composite unit capacity value was derived by applying the capacity components of the least-cost thermal alternative as weighting factors to the corresponding adjusted capacity values from Table 4-4. The calculation of the composite unit capacity value is shown below.

CC Cap. Value=$119.22/kW-yr*[70 MW / (70MW+11 MW)]= $103.03/kW-yr (Weighted)

CT Cap. Value=$62.19/kW-yr [11MW / (70MW+11 MW)]= $8.45/kW-yr (Weighted)

Summarizing:

Composite Unit Cap.Value=$103.03/kW-yr+$8.45/kW-yr=$111.48/kW-yr

Based on the Screening Curve analysis results, the FERC adjusted capacity value for gas-fired combustion turbine thermal generating plant for Lake Texoma (Denison Dam) project is $111.48/kW-yr. This capacity unit value will be used to compute capacity benefits foregone for each allocation alternative.

Composite Unit Capacity Value = $111.48/kW-yr

5.0 TOTAL BENEFITS FOREGONE

5.1 General

One of the objectives of this study was to identify power benefits foregone due to the proposed storage allocation of 300,000 AF and 450,000 AF in the Lake Texoma (Denison Dam) reservoir (hydropower/conservation) pool. Annual energy losses were computed and then multiplied by the energy unit value to arrive at annual energy benefits foregone. Annual capacity losses were computed and then multiplied by the composite capacity unit value to arrive at annual capacity benefits foregone. Capacity benefits foregone were then added to energy benefits foregone to arrive at total hydropower benefits foregone due to water supply withdrawals.

5.2 Summary of Power Benefits Foregone

Table 5-1 summarizes total hydropower benefits foregone due to allocating 300,000 AF and 450,000 AF of hydropower (conservation) storage to water supply in Lake Texoma (Denison Dam) reservoir. The data in Table 5-1 is derived from information developed in prior sections of this report. Table 3-1 provides the lost energy due to diversion for water supply from the hydropower (conservation) zone in Lake Texoma (Denison Dam) reservoir and Table 3-3 provides the unit value of the energy lost. Capacity losses shown in Tables 4-2 and 4-3 are for diversion from the hydropower (conservation) zone. The unit value for generation capacity is found in Section 4.7.5.

Table 5-1: Annual Hydropower Benefits Foregone Due to Reallocation in Lake Texoma

Reallocation Alternative ==>	Benefit Impacts 300,000 AF	Benefit Impacts 450,000 AF
Average Annual Energy Loss (MWh)	11,995	23,792
Energy Value ($/MWh)	$41.62	$41.62
Annual Energy Value Loss	**$499,284**	**$990,326**
Aveage Annual Capacity Loss (kW)	2,310	5,472
Unadjusted Capacity Value ($/kW)	$111.48	$111.48
Annual Capacity Value Loss	**$257,514**	**$610,007**
Total Annual Benefits Foregone	**$756,798**	**$1,600,333**

Though we present energy and capacity benefits separately, for the foregone benefits, a "melded" value can be determined by dividing the total benefits (energy and capacity) foregone by the energy loss. These "melded" values (in constant 2005 dollars) are; $63.09/MWh for the 300,000 AF Alternative and $67.26/MWh for the 450,000 AF Alternative. These "melded" values are more commonly used in the power industry but to be consistent with the guidance and policy these energy and capacity values are shown and used separately.

6.0 REVENUES FOREGONE

6.1 General

Revenues foregone are based on the current contract rates of the Southwestern Power Administration (SWPA), the power marketing administration for Lake Texoma (Denison Dam) project power generation. The rates in effect were obtained from SWPA comments dated 20 December 2005 and are used in this analysis were as follows:

Energy charge:	8.20 mills/kWh
Capacity charge:	$36.36/kW-year

To compute revenues foregone, the energy charge is applied to the average annual energy losses calculated in Section 3. The capacity charge is applied to the loss in dependable capacity in 1964, SWPA's most critical operating year, calculated in Section 4. The results are summarized in Tables 6-1.

6.2 Energy Revenue Foregone

SWPA's average annual energy revenue foregone would be the product of the average annual energy loss under each allocation alternative (Table 2-2) and SWPA's energy charge shown above in Section 6.1. Energy revenue foregone is shown in Table 6.1.

6.3 Capacity Revenue Foregone

SWPA's annual capacity revenue foregone would be the product of the loss of marketable capacity during the peak demand period of 1964 (Tables 4-2 and 4-3) and the capacity charge. Capacity revenue foregone is shown in Table 6-1.

6.4 Loss in Marketable Capacity

Under SWPA's current marketing procedures, the amount of marketable capacity at Denison Dam (Lake Texoma) is based on the capacity that can be supported during the 1964 peak demand period. As shown in Table 4-2 and 4-3 for 1964, the loss in marketable capacity for the 300,000 AF and 450,000 AF allocations alternatives is 12,730 kW and 28,263 kW, respectively.

6.5 Marketable Capacity vs. Dependable Capacity

The 1964 critical water year was designated by SWPA and the marketable capacity loss computation for that year is shown on the first line of data in Tables 4-2 and 4-3. Also, shown in these tables is the dependable capacity loss. The difference between the two parameters measures different quantities. The dependable capacity is an NED value, which is intended to measure the economic impact on the region as a whole, while the marketable capacity is a financial parameter that applies only to a single entity, SWPA. Dependable capacity is computed based on the critical period average of historical period

years, while marketable capacity is computed based on adverse water conditions and peak power demand during a single year.

6.6 Total Revenues Foregone

The computation of total revenues foregone for the allocation alternatives from Lake Texoma (Denison Dam) is shown in Table 6-1.

Table 6-1: Hydropower Revenues Foregone Due to Reallocation from the Conservation Pool Storage in Lake Texoma

Reallocation Alternative ==>	Benefit Impacts 300,000 AF	Benefit Impacts 450,000 AF
Annual Energy Losses (MWh)	11,995	23,792
Energy charge ($/MWh)	$8.20	$8.20
Annual Energy Revenue Loss	**$98,358**	**$195,092**
Capacity Losses (kW)	12,730	28,263
Capacity charge ($/kW)	$36.36	$36.36
Annual Capacity Revenues Loss	**$462,866**	**$1,027,658**
Total Annual Revenue Foregone	**$561,224**	**$1,222,750**

7.0 CREDIT TO POWER MARKETING AGENCY

7.1 General

Project costs originally allocated to hydropower are being repaid through power revenues which are based on rates designed by the Federal power marketing agency (SWPA) to recover allocated costs plus interest within 50 years of the date of commercial power operation. If a portion of the storage is reallocated from hydropower to water supply, SWPA's repayment obligation must be reduced in proportion to the lost energy and marketable capacity.

Planning Guidance Notebook, Appendix E-57d(3) of ER 1105-2-100 (22 April 2000) states that;

> "If hydropower revenues are being reduced as a result of the reallocation, the power marketing agency will be credited for the amount of revenues to the Treasury foregone as a result of the reallocation assuming uniform annual repayment."

Paragraph d(2)(b) states that;

> "Revenues foregone to hydropower are the reduction in revenues accruing to the Treasury as a result of the reduction in hydropower outputs based on the Baseline rates charged by the power marketing agency. Revenues foregone from other project purposes are the reduction in revenues accruing to the Treasury based on any Baseline repayment agreements."

For purposes of estimating what this cost will be, the energy and marketable capacity values and energy and capacity charges from Section 6 will be used. No annual escalation rate will be applied to the energy and capacity charges to cover SWPA's estimated real increase in rates in the future, in accordance with paragraph 4-32d(2)(b) of ER 1105-2-100 cited above.

ER 1105-2-100 also allows the marketing agency credit for any additional costs above the lost revenue to recover costs of purchased power to meet the obligations of the current power sales contract(s) relating to the marketing of power from the hydro project(s) where storage is being reallocated. The continuation of Appendix E-57d(3), provides the following guidance:

> "In instances where Baseline contracts between the power marketing agency and their customer would result in a cost to the Federal Government to acquire replacement power to fulfill the obligations of contracts, an additional credit to the power marketing agency can be made for such costs incurred during the remaining period of the contracts."

In both cases the credit in each year will be based on the revenue actually lost or the replacement costs actually incurred (and documented) by the power marketing agency. However, for purposes of providing an estimate of this credit, the cost of replacement power will be based on the same power values and energy and average capacity losses as were used in the benefits foregone calculations.

7.2 Remaining Period of Contract

The length of time remaining under the current power sales contracts had to be identified to determine how many years the SWPA credit would be based on cost of replacement power. Contract information provided by SWPA indicated that current contracts for all power marketed from the Lake Texoma (Denison Dam) project will expire in 2015. For this reason, the cost of replacement power will be the basis for the SWPA credit until the present contracts expire in 2015. Following this year, the SWPA credit will be based on revenue foregone for the remaining economic life of the project.

7.3 Computation of Credit to Power Marketing Agency

Tables 7-1 and 7-2 show the computation of SWPA capacity and energy credits. Lost energy and dependable capacity and the power values were taken from Table 5-1. The lost marketable capacity and current SWPA unit energy and capacity charges were taken from Tables 6-1. Following are explanations of the columns in Tables 7-1 and 7-2;

- Column 1 - end of the Lake Texoma (Denison Dam)'s economic life is the year 2055
- Column 2 - capacity benefit is from Table 5-1.
- Column 3 - capacity revenue is from Table 6-1.
- Column 4 - power from this project is marketed under a contract that will expire in 2015. Capacity credits are based upon capacity benefits until 2015, and capacity revenues foregone from 2015 to the end of project economic life.
- Column 5 - energy benefit is from Table 5-1.
- Column 6 - energy revenue is from Table 6-1.
- Column 7 - energy credits are calculated as described in Column (4).
- Column 8 - amortization factor at 5-3/8 percent interest
- Column 9 - column 4 x column 8
- Column 10 - column 7 x column 8
- Column 11 - column 9 + column 10

Following is the calculation of the expected average annual SWPA credit for the alternative storage reallocations in Lake Texoma (Denison Dam) analyzed in this report.

Table 7-1: SWPA Annual Capacity and Energy Credit 300,000 AF Reallocation from Lake Texoma Conservation Zone

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Year	Capacity Benefit ($)	Capacity Revenue ($)	Annual Capacity Credit ($)	Energy Benefit ($)	Energy Revenue ($)	Annual Energy Credit ($)	Present-Worth Factor	Present-Worthed Capacity Credit ($)	Present-Worthed Energy Credit ($)	Total Power Credit ($)
2007	$257,514	----	$257,514	$499,284	----	$499,284	0.9512	$244,960	$474,943	$719,903
2008	$257,514	----	$257,514	$499,284	----	$499,284	0.9049	$233,018	$451,789	$684,807
2009	$257,514	----	$257,514	$499,284	----	$499,284	0.8608	$221,658	$429,764	$651,421
2010	$257,514	----	$257,514	$499,284	----	$499,284	0.8188	$210,852	$408,812	$619,664
2011	$257,514	----	$257,514	$499,284	----	$499,284	0.7789	$200,572	$388,882	$589,454
2012	$257,514	----	$257,514	$499,284	----	$499,284	0.7409	$190,794	$369,923	$560,717
2013	$257,514	----	$257,514	$499,284	----	$499,284	0.7048	$181,493	$351,889	$533,381
2014	$257,514	----	$257,514	$499,284	----	$499,284	0.6704	$172,645	$334,734	$507,378
2015	$257,514	----	$257,514	$499,284	----	$499,284	0.6377	$164,228	$318,415	$482,643
2016	$257,514	----	$257,514	$499,284	----	$499,284	0.6067	$156,221	$302,892	$459,113
2017	----	$462,866	$462,866	----	$98,358	$98,358	0.5771	$267,109	$56,760	$323,870
2018	----	$462,866	$462,866	----	$98,358	$98,358	0.5489	$254,087	$53,993	$308,080
2019	----	$462,866	$462,866	----	$98,358	$98,358	0.5222	$241,700	$51,361	$293,061
2020	----	$462,866	$462,866	----	$98,358	$98,358	0.4967	$229,917	$48,857	$278,774
2021	----	$462,866	$462,866	----	$98,358	$98,358	0.4725	$218,708	$46,475	$265,183
2022	----	$462,866	$462,866	----	$98,358	$98,358	0.4495	$208,046	$44,209	$252,255
2023	----	$462,866	$462,866	----	$98,358	$98,358	0.4276	$197,903	$42,054	$239,957
2024	----	$462,866	$462,866	----	$98,358	$98,358	0.4067	$188,255	$40,004	$228,259
2025	----	$462,866	$462,866	----	$98,358	$98,358	0.3869	$179,078	$38,054	$217,131
2026	----	$462,866	$462,866	----	$98,358	$98,358	0.3680	$170,347	$36,198	$206,546
2027	----	$462,866	$462,866	----	$98,358	$98,358	0.3501	$162,043	$34,434	$196,476
2028	----	$462,866	$462,866	----	$98,358	$98,358	0.3330	$154,143	$32,755	$186,898
2029	----	$462,866	$462,866	----	$98,358	$98,358	0.3168	$146,628	$31,158	$177,786
2030	----	$462,866	$462,866	----	$98,358	$98,358	0.3013	$139,480	$29,639	$169,119
2031	----	$462,866	$462,866	----	$98,358	$98,358	0.2866	$132,680	$28,194	$160,874
2032	----	$462,866	$462,866	----	$98,358	$98,358	0.2727	$126,212	$26,820	$153,031
2033	----	$462,866	$462,866	----	$98,358	$98,358	0.2594	$120,059	$25,512	$145,571
2034	----	$462,866	$462,866	----	$98,358	$98,358	0.2467	$114,206	$24,268	$138,474
2035	----	$462,866	$462,866	----	$98,358	$98,358	0.2347	$108,638	$23,085	$131,723
2036	----	$462,866	$462,866	----	$98,358	$98,358	0.2233	$103,342	$21,960	$125,301
2037	----	$462,866	$462,866	----	$98,358	$98,358	0.2124	$98,304	$20,889	$119,193
2038	----	$462,866	$462,866	----	$98,358	$98,358	0.2020	$93,511	$19,871	$113,382
2039	----	$462,866	$462,866	----	$98,358	$98,358	0.1922	$88,952	$18,902	$107,854
2040	----	$462,866	$462,866	----	$98,358	$98,358	0.1828	$84,616	$17,981	$102,596
2041	----	$462,866	$462,866	----	$98,358	$98,358	0.1739	$80,491	$17,104	$97,595
2042	----	$462,866	$462,866	----	$98,358	$98,358	0.1654	$76,567	$16,270	$92,837
2043	----	$462,866	$462,866	----	$98,358	$98,358	0.1574	$72,834	$15,477	$88,311
2044	----	$462,866	$462,866	----	$98,358	$98,358	0.1497	$69,283	$14,722	$84,006
2045	----	$462,866	$462,866	----	$98,358	$98,358	0.1424	$65,905	$14,005	$79,910
2046	----	$462,866	$462,866	----	$98,358	$98,358	0.1354	$62,692	$13,322	$76,014
2047	----	$462,866	$462,866	----	$98,358	$98,358	0.1288	$59,636	$12,673	$72,309
2048	----	$462,866	$462,866	----	$98,358	$98,358	0.1226	$56,729	$12,055	$68,783
2049	----	$462,866	$462,866	----	$98,358	$98,358	0.1166	$53,963	$11,467	$65,430
2050	----	$462,866	$462,866	----	$98,358	$98,358	0.1109	$51,332	$10,908	$62,240
2051	----	$462,866	$462,866	----	$98,358	$98,358	0.1055	$48,830	$10,376	$59,206
2052	----	$462,866	$462,866	----	$98,358	$98,358	0.1004	$46,449	$9,870	$56,320
2053	----	$462,866	$462,866	----	$98,358	$98,358	0.0955	$44,185	$9,389	$53,574
2054	----	$462,866	$462,866	----	$98,358	$98,358	0.0908	$42,031	$8,931	$50,962
2055	----	$462,866	$462,866	----	$98,358	$98,358	0.0864	$39,982	$8,496	$48,478
2056	----	$462,866	$462,866	----	$98,358	$98,358	0.0822	$38,032	$8,082	$46,114
								$6,713,342	$4,838,624	$11,551,966
				Years of Analysis				50	50	50
				Annualization Factor				0.05584	0.05584	0.05584
				Annualized Capacity Credit				**$374,860**	**$270,179**	**$645,039**

Table 7-2: SWPA Annual Capacity and Energy Credit 450,000 AF Reallocation from Lake Texoma Conservation Zone

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Year	Capacity Benefit ($)	Capacity Revenue ($)	Annual Capacity Credit ($)	Energy Benefit ($)	Energy Revenue ($)	Annual Energy Credit ($)	Present-Worth Factor	Present-Worthed Capacity Credit ($)	Present-Worthed Energy Credit ($)	Total Power Credit ($)
2007	$610,007	----	$610,007	$990,326	----	$990,326	0.9512	$580,268	$942,046	$1,522,314
2008	$610,007	----	$610,007	$990,326	----	$990,326	0.9049	$551,979	$896,120	$1,448,099
2009	$610,007	----	$610,007	$990,326	----	$990,326	0.8608	$525,070	$852,433	$1,377,502
2010	$610,007	----	$610,007	$990,326	----	$990,326	0.8188	$499,472	$810,875	$1,310,347
2011	$610,007	----	$610,007	$990,326	----	$990,326	0.7789	$475,122	$771,344	$1,246,466
2012	$610,007	----	$610,007	$990,326	----	$990,326	0.7409	$451,959	$733,740	$1,185,699
2013	$610,007	----	$610,007	$990,326	----	$990,326	0.7048	$429,925	$697,969	$1,127,894
2014	$610,007	----	$610,007	$990,326	----	$990,326	0.6704	$408,966	$663,942	$1,072,908
2015	$610,007	----	$610,007	$990,326	----	$990,326	0.6377	$389,028	$631,574	$1,020,602
2016	$610,007	----	$610,007	$990,326	----	$990,326	0.6067	$370,062	$600,784	$970,846
2017	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.5771	$593,038	$112,583	$705,621
2018	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.5489	$564,127	$107,095	$671,221
2019	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.5222	$536,624	$101,874	$638,498
2020	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.4967	$510,463	$96,907	$607,370
2021	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.4725	$485,577	$92,183	$577,760
2022	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.4495	$461,905	$87,689	$549,593
2023	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.4276	$439,386	$83,414	$522,800
2024	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.4067	$417,966	$79,347	$497,313
2025	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.3869	$397,589	$75,479	$473,068
2026	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.3680	$378,206	$71,799	$450,005
2027	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.3501	$359,768	$68,299	$428,067
2028	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.3330	$342,229	$64,969	$407,198
2029	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.3168	$325,545	$61,802	$387,346
2030	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.3013	$309,674	$58,789	$368,463
2031	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2866	$294,577	$55,923	$350,500
2032	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2727	$280,216	$53,197	$333,412
2033	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2594	$266,555	$50,603	$317,158
2034	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2467	$253,560	$48,136	$301,696
2035	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2347	$241,198	$45,789	$286,988
2036	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2233	$229,440	$43,557	$272,997
2037	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2124	$218,254	$41,434	$259,688
2038	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.2020	$207,614	$39,414	$247,028
2039	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1922	$197,492	$37,492	$234,985
2040	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1828	$187,864	$35,664	$223,529
2041	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1739	$178,706	$33,926	$212,631
2042	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1654	$169,993	$32,272	$202,265
2043	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1574	$161,706	$30,698	$192,405
2044	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1497	$153,823	$29,202	$183,025
2045	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1424	$146,324	$27,778	$174,102
2046	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1354	$139,190	$26,424	$165,614
2047	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1288	$132,404	$25,136	$157,540
2048	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1226	$125,949	$23,910	$149,860
2049	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1166	$119,809	$22,745	$142,554
2050	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1109	$113,968	$21,636	$135,604
2051	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1055	$108,412	$20,581	$128,993
2052	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.1004	$103,127	$19,578	$122,705
2053	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.0955	$98,099	$18,623	$116,723
2054	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.0908	$93,317	$17,715	$111,032
2055	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.0864	$88,768	$16,852	$105,619
2056	----	$1,027,658	$1,027,658	----	$195,092	$195,092	0.0822	$84,440	$16,030	$100,470
								$15,198,751	$9,597,370	$24,796,121
				Years of Analysis				50	50	50
				Annualization Factor				0.05584	0.05584	0.05584
				Annualized Capacity Credit				**$848,669**	**$535,899**	**$1,384,567**

7.4 Summary of Credits

Table 7-3 is a summary of credit due the power marketing administration for the 300,000 AF Alternative and 450,000 AF Alternative reallocations in Lake Texoma (Denison Dam).

Table 7-3: Annual Credit Due Power Marketing Agency Due to Reallocation from the Conservation Pool Storage in Lake Texoma (Denison Dam)

Reallocation Alternative ==>	Benefit Impacts 300,000 AF	Benefit Impacts 450,000 AF
Energy Credit	$270,179	$535,899
Capacity Credit	$374,860	$848,669
Annual Credit to PMA	**$645,039**	**$1,384,567**

8.0 SUMMARY OF RESULTS

Power benefits foregone, which are equivalent to replacement costs of power, and power revenues foregone, were considered over a 50-year evaluation period in order to determine the cost of the storage reallocation being requested. The non-power related updated cost of storage was not evaluated in this report, but will be determined by the Tulsa District. The reallocation cost to the water supply customers will be the highest cost for each of these different components.

8.1 Power Benefits Foregone

Summarizing the data developed in Sections 2 through 5, power benefits foregone for the 300,000 AF Alternative and 450,000 AF Alternative reallocations in Lake Texoma (Denison Dam) are as follows (from Table 5-1):

Table 8-1: Annual Power Benefits Foregone

Reallocation Alternative ==>	Benefit Impacts 300,000 AF	Benefit Impacts 450,000 AF
Annual Energy Benefit Foregone	$499,284	$990,326
Capacity Benefit Foregone	$257,514	$610,007
Annual Benefit Foregone	**$756,798**	**$1,600,333**

8.2 Replacement Cost

As noted in Section 1.7, the replacement cost of power as used in determining the cost of the reallocation to the water supply customer is identical in each case to the hydropower benefits foregone presented in Section 5.2.

8.3 Revenues Foregone

Summarizing the data developed in Sections 6 and in Table 6-1, the power revenues foregone for 300,000 AF Alternative and 450,000 AF Alternative reallocations in Lake Texoma (Denison Dam) are as follows.

Table 8-2: Annual Revenue Foregone

Reallocation Alternative ==>	Benefit Impacts 300,000 AF	Benefit Impacts 450,000 AF
Annual Energy Revenue Foregone	$98,358	$195,092
Capacity Revenue Foregone	$462,866	$1,027,658
Annual Revenue Foregone	**$561,224**	**$1,222,750**

8.4 SWPA Credit

Summarizing the data developed in Section 7, the 300,000 AF Alternative and 450,000 AF Alternative estimated SWPA credits for the project are as follows (from Table 7-3).

Table 8-3: Annual SWPA Credit

Reallocation Alternative ==>	Benefit Impacts 300,000 AF	Benefit Impacts 450,000 AF
Energy Credit	$270,179	$535,899
Capacity Credit	$374,860	$848,669
Annual Credit to PMA	**$645,039**	**$1,384,567**

ATTACHMENT A

FERC Power Values

				Date Run
COAL-FIRED STEAM POWER VALUE				04/21/06
PROJECT NAME:		Lake Texoma WS Study (April 2006)		
LOCATION:		Texas		
FINANCING:		FEDERAL @	5.125%	
Capacity Value		$236.15	per kW-yr	
Energy Value		$20.61	per MWh	
PROGRAM INPUT DATA			State Index Number	44
			State Location	TX
Cost Level Date	1/1/2006		H-W Index Reg No	4
Single unit capacity	600		ROW ($/acre)	2507
Capacity factor	0.65		Clearing % of ROW	0.60
Trans Voltage	345		Rec Sub Land Cost	23579
Transformer MVA	200		Plant Invest	1551
No of Trans	6		FC Mov-Ave Time Frame	60
No of Trans Pos	2		Fuel Cost	129.6
Single or Three Phase	1		Heat Rate	10730
Length Line 1	50		Variable O&M	6.70
Length Line 2	0		Fixed O&M	66.78
Line 1: Total Circuits	3		O&M update	3.07
No of Single Circ	1		Plant update	2.85
No of Double Circ	1		Transmission update	2.51
Line 2: Total Circuits	0		Depreciation Plant (%)	1.47
No of Single Circ	0		Deprec Sub (%)	1.47
No of Double Circ	0		Deprec Trans Tower (%)	0.46
			Deprec Trans Pole (%)	1.47
Cost of Money (%)	5.125			
Plant Life	30		Fed Inc Tax (%)	0.000
Substation Life	30		Fed Misc Tax (%)	0.000
Trans (towers) Life	50		State & Local Tax (%)	0.000
Trans (poles) life	30			
			Hydro Flex Adjust	0.050
Plant insurance (%)	0.25		Alt Mechanical Avail	0.850
Trans Insurance (%)	0.10		Hydro Mech Avail	0.980
Sub insurance (%)	0.25		Mech Avail Adjust	0.153

				Date Run
COMBINED CYCLE POWER VALUE				04/21/06
PROJECT NAME:		Lake Texoma WS Study (April 2006)		
LOCATION:		Texas		
FINANCING:		FEDERAL @	5.125%	
Capacity Value		$119.22	per kW-yr	
Energy Value		$42.03	per MWh	
PROGRAM INPUT DATA			State Index Number	44
			State Abbr. (exact)	TX
Cost Level Date	1/1/2006		H-W Index Reg No	4
Single unit capacity	150		ROW ($/acre)	2507
Capacity factor	0.20		Clearing % of ROW	0.60
Trans Voltage	230		Rec Sub Land Cost	23579
Transformer MVA	200		Plant Invest	751
No of Trans	1		FC Mov-Ave Time Frame	60
No of Trans Positions	1		Fuel Cost	511.1
Single or Three Phase	3		Heat Rate	8030
Length Line 1	0		Variable O&M	0.99
Length Line 2	0		Fixed O&M	49.57
Line 1: Total Circuits	2		O&M update	3.07
No of Single Circ	2		Plant update	2.85
No of Double Circ	0		Transmission update	2.51
Line 2: Total Circuits	0		Depreciation Plant (%)	1.47
No of Single Circ	0		Deprec Sub (%)	1.47
No of Double Circ	0		Deprec Trans Tower (%)	0.46
			Deprec Trans Pole (%)	1.47
Cost of Money (%)	5.125			
Plant Life	30		Fed Inc Tax (%)	0.000
Substation Life	30		Fed Misc Tax (%)	0.000
Trans (towers) Life	50		State & Local Tax (%)	0.000
Trans (poles) life	30			
			Hydro Flex Adjust	0.025
Plant insurance (%)	0.25		Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10		Hydro Mech Avail	0.980
Sub insurance (%)	0.25		Mech Avail Adjust	0.089

				Date Run
COMBUSTION TURBINE POWER VALUE				04/21/06
PROJECT NAME:		Lake Texoma WS Study (April 2006)		
LOCATION:		Texas		
FINANCING:		FEDERAL @	5.125%	
Capacity Value		$62.19	per kW-yr	
Energy Value		$66.03	per MWh	
PROGRAM INPUT DATA			State Index Number	44
			State Location	TX
Cost Level Date	1/1/2006		H-W Index Reg No	4
Single unit capacity	100		ROW ($/acre)	2319
Capacity Factor	0.10		Clearing % of ROW	0.60
Transmission Voltage	230		Rec Sub Land Cost	21869
Transformer MVA	125		Plant Invest	465
No of Trans	2		FC Mov-Ave Time Frame	60
No of Trans Pos	2		Fuel Cost	511.1
Single or Three Phase	3		Heat Rate	12870
Length Line 1	0		Variable O&M	0.25
Length Line 2	0		Fixed O&M	16.26
Line 1: Total Circuits	2		O&M update	3.07
No of Single Circ	2		Plant update	2.74
No of Double Circ	0		Transmission update	2.51
Line 2: Total Circuits	0		Depreciation Plant (%)	1.47
No of Single Circ	0		Deprec Sub (%)	1.47
No of Double Circ	0		Deprec Trans Tower (%)	0.46
			Deprec Trans Pole (%)	1.47
Cost of Money (%)	5.125			
Plant Life	30		Fed Inc Tax (%)	0.000
Substation Life	30		Fed Misc Tax (%)	0.000
Trans (towers) Life	50		State & Local Tax (%)	0.000
Trans (poles) life	30			
			Hydro Flex Adjust	0.025
Plant insurance (%)	0.25		Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10		Hydro Mechanical Avail	0.980
Sub insurance (%)	0.25		Mech Avail Adjust	0.089

US Army Corps of Engineers ®
Northwestern Division

Appendix A

Alternative Power Benefits Foregone Analysis for the Lake Texoma Water Supply/Storage Reallocation Study

FINAL DRAFT

August 2005

Prepared for

U.S. Army Corps of Engineers
Tulsa District
Tulsa, Oklahoma

PREPARED BY
HYDROPOWER ANALYSIS CENTER

BACKGROUND

Traditionally, the Corps of Engineers Hydropower Analysis Center (HAC) evaluated impacts to Federal hydropower economic benefits the National Economic Development (NED) approach. The traditional HAC procedure for computing power values is based on a system approach, which values Federal hydropower generation based on the system replacement cost of lost hydropower production. The general concept of NED economics is that since investments to construct, maintain and operate Federal hydropower generating facilities are made with Federal capital, the resulting benefits from that investment should benefit the entire nation. Federal guidance for hydropower NED economic evaluations are outlined in ER 1110-2-100 and EM 1110-2-1705.

When evaluating impacts to hydropower due to the reallocation of conservation storage to other purposes other than hydropower, the Southwestern Power Administration (SWPA) believes that a more regional approach should be utilized. SWPA argues that Federal hydropower generation is consumed regionally and the loss of that generation would create a regional impact, not a national impact. Moreover, SWPA argues that when the Federal Power Marketing Administration (PMA) has to replace lost hydropower generation, the PMA has to compete on the wholesale power market for replacement power.

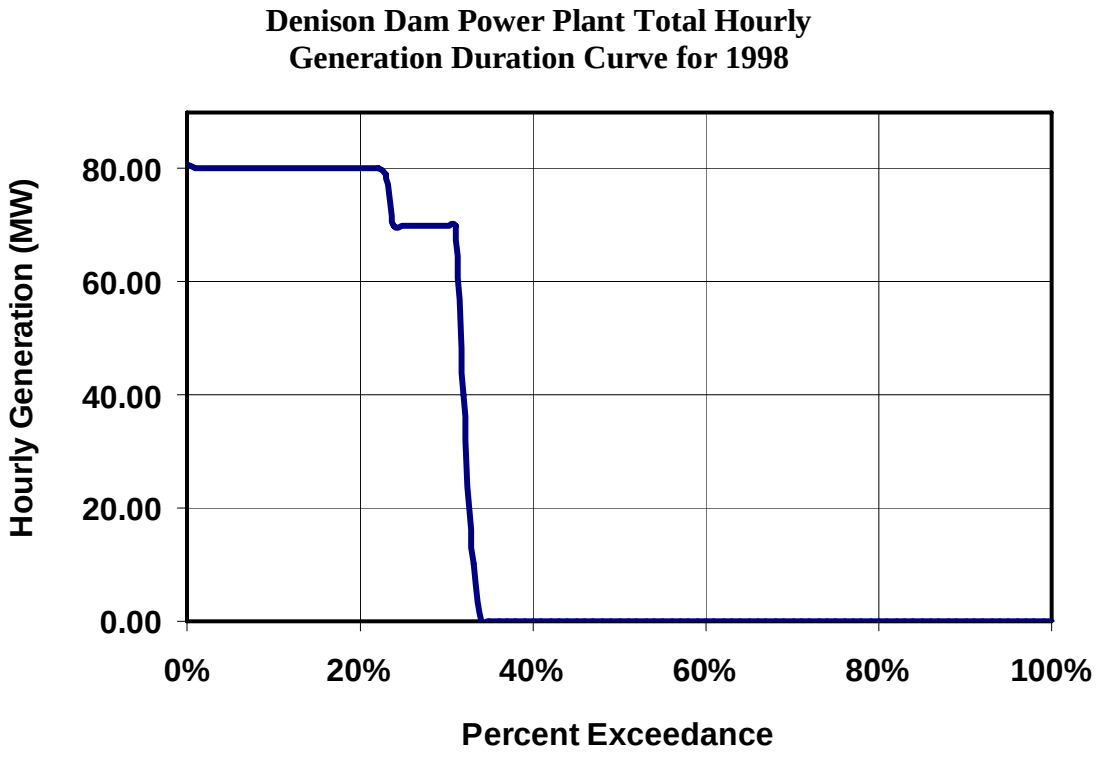
SWPA and HAC have had numerous discussions concerning the appropriate methodologies for evaluating impacts to energy and capacity benefits when hydropower storage is reallocated to other uses. This appendix presents an alternative approach to quantifying power benefits foregone due to water supply storage reallocations and will evaluate the Lake Texoma Water Supply/Storage Reallocation study based on comments received from SWPA. This computation of power benefits foregone does not follow current Corps of Engineers policy and guidelines but is presented here for comparison purposes only. The calculations within this appendix are based on HAC's interpretation of SWPA's comments and may not duplicate the exact procedures and values used by SWPA. For future water supply analyses, the HAC will continue to collaborate with SWPA to develop an analysis methodology that is agreeable to both agencies.

ALTERNATIVE EVALUATION OF ENERGY BENEFITS IMPACTS

The HAC evaluation of power benefits foregone is normally based on the cost of the most likely thermal generation alternative to the Federal hydropower facility. When Federal hydropower generation is a relatively small portion of a much larger diverse power system, Corps guidance states that an average approach can be used to quantify power benefits foregone because the lost hydropower generation can usually be replaced with a mix of thermal-generation.

The following computations for hydropower benefits foregone are presented as an alternative to the standard approach used by HAC in response to SWPA comments on HAC methodology for developing hydropower benefits foregone due to reallocating reservoir storage for water supply diversion.

Denison Dam Power Plant Operation. The hydropower plant at Denison Dam is operated primarily as a peaking plant with a plant factor of about 30 percent. Below is an hourly generation duration curve for a typical generation year (1998) at the Denison Dam power plant.



At a 30 percent plant factor, the Denison Dam hydropower plant operates in the electrical power system with characteristics similar to both Combustion Turbine (CT) and Combined Cycle (CC) generating plants. SWPA believes that the energy loss at Dennison is likely to be replaced by a single thermal alternative, in this case Combustion Turbines. While HAC recognizes that this may be the case in certain months, for a plant such as Dennison, it is likely over a long term period that the energy would be replaced by a combination of thermal resources. For demonstration purposes, HAC has developed two alternative energy value combinations to try to represent a potential range of values. The first bases energy values on energy production costs of a CT only. The second uses a combination of CT and CC generating plants.

Energy Loss Computation. The SWPA and HAC average annual energy loss computation is similar and therefore, remains unchanged from the computation used in the main report. It represents the average annual energy lost based on the historical water years evaluated. The average annual energy for each alternative storage reallocation evaluated in the main report is as follows:

Storage Reallocation Alternatives	Existing	300,000 AF	450,000 AF
Average Annual Energy	232,084	220,089	208,292
Lost Avg. Annual Energy	---	-11,995	-23,792

Energy Value Determination. The traditional HAC procedure for computing energy values is based on an NED system production cost approach, which values Federal hydropower generation based on the system replacement cost of lost hydropower production. SWPA believes that this approach undervalues the real cost of Federal hydropower replacement in the regional electrical system. SWPA thinks that the real value of lost Federal hydropower generation should reflect the real market value of the power generated.

To address SWPA's concern, HAC considered alternative approaches to computing the energy value of Federal hydropower generation. The alternative energy value computations used for this appendix are based on estimating the energy production cost for possible thermal replacement generation based on the average of the most recent 24 month fuel cost (assumed to be natural gas, the latest available data as of July 2005 was for actual fuel prices through March 2005) as reported by the Energy Information Agency (EIA) Monthly Prices for Texas. Generally HAC uses a longer period average (60 months) for fuel prices, but recognizing SWPA's concern about current high fuel costs, a shorter period was assumed. This shorter period is not consistent with the methodology normally used by HAC. These fuel costs were used in HAC's FERC Power Values Spreadsheet Model and an average energy value was computed for each thermal replacement alternative considered for the Denison Dam hydropower plant. The output of the FERC Power Values Spreadsheet Model is attached at the end of this appendix for both Combustion Turbine and Combined Cycle generating plants.

For the first alternative method, the Combustion Turbine unit energy value was used for all energy lost. For the second alternative method, the thermal plant replacement generation for the Denison Dam hydropower plant was determined using a "screening curve analysis" based on energy values from the FERC Power Values Spreadsheet Model. The output of the FERC Power Values Spreadsheet Model is attached to this appendix for a combustion turbine and combined-cycle thermal plants. In the main report the thermal generating resource mix was determined to be 10 MW of CT generation and 71 MW of CC generation for the average annual generation.

The energy values for each of the thermal alternatives are summarized below.

Generating Plant Type	**Energy Value**
Combustion Turbine Plant	$72.54 / MWh
Combined Cycle Plant	$46.09 / MWh

For the first alternative method, the Combustion Turbine value of $72.54 / MWh was used for all energy lost.

For the second alternative method, using the unit values and the ratio of replacement generation, an aggregated average annual energy value was determined as follows:

Energy Value = $72.54*(10/ (10+71)) +$46.09*(71/ (10+71)) = $49.36 / MWh

Energy Benefits Foregone. The energy benefits foregone due to each of the reallocation alternatives evaluated is the product of the average annual energy loss and the energy value. The results are summarized below.

Storage Reallocation Alternatives	300,000 AF	450,000 AF
First Alternative (CT's only)		
Annual Energy Benefits Foregone	$870,117	$1,725,872
Second Alternative (CC's & CT's)		
Annual Energy Benefits Foregone	$592,073	$1,174,373

ALTERNATIVE EVALUATION OF CAPACITY BENEFITS FOREGONE

Both SWPA and HAC agree that capacity benefits lost should be based on the firm load carrying capability during the power plant's critical period. The critical period is considered the most adverse power demand and hydrologic period in which the power plant operates. For the Denison Dam hydropower plant, the annual critical period is considered to be the months of June, July and August of each year. The firm load carrying capability of the power plant during this annual critical period is considered the plant's dependable capacity. The dependable capacity of the hydropower plant is used to compute capacity benefits.

SWPA and HAC disagree on how dependable capacity is computed for the Denison Dam hydropower plant. HAC believes that the Denison Dam hydropower plant's dependable capacity should be based on an annual average of the critical period dependable capacity over a representative historical period. HAC believes that this approach is reasonable because the Denison Dam hydropower plant is a very small portion of the total electrical system. If its capacity is lost to the system, it can be replaced by thermal-generation alternatives. SWPA takes a more conservative approach to computing dependable capacity. SWPA believes that the Denison Dam hydropower plant dependable capacity should be based on the most adverse, single year, June-July-August period in the historical record. This adverse period occurs in 1964. HAC used the SWPA approach to computing dependable capacity and quantifying capacity benefits impacts for this alternative hydropower benefit analysis.

Capacity Loss Computation. The basis for computing the dependable capacity for Denison Dam hydropower plant was to examine the lowest water availability in the reservoir during the year when the demand for peaking power is the highest. This critical period was determined to be the 13 weeks of June through August in 1964. At Denison

Dam hydropower plant the capability of the hydro-turbine/generator unit, during the season of the year considered to be the critical period, at the minimum conservation pool elevation is 70 MW. SWPA informed HAC that 7 hours of peaking power was required each weekday (about 35 hours per week) was its criterion for the sustain peaking capability. Computations using the SWD-SUPER, a reservoir routing model, indicated that about 2,261 MWh per week of on-peak power was available during the critical period in 1964. This is about 32.21 hours of weekly on-peak power (this model output correlates well with the SWPA criterion).

Therefore, during the critical period of 1964, the loss of supportable capacity for the water supply reservoir storage reallocation alternatives considered was computed and displayed in the main report as follows;

Storage Reallocation Alternatives	Existing	300,000 AF	450,000 AF
Supportable Capacity	70.000 MW	57.270 MW	41.737 MW
Lost Supp. Capacity	---	12.730 MW	28.263 MW

Capacity Value Determination. The FERC Spreadsheet Model was used to compute the unit cost for a combustion-turbine and combined-cycle generating plant. The input variables used in the model are the following:

Base date for the price computation: 1 July 2005
The current 2005 fiscal year Federal Interest Rate: 5 3/8%
Handy-Whitman power plant construction cost index updated through 1 January 2005
ENR Skilled Labor cost index updated through 1 January 2005
EIA Preliminary Monthly Gas Prices for Texas updated through March 2005 (24-month average gas price)

For each of the Denison power plant thermal replacement alternatives, the capacity value computed using the FERC Spreadsheet Model is as follows:

Combustion Turbine	$62.16 / kW-yr
Combined-Cycle	$117.40 / kW-yr

In it's evaluation in the main report; HAC assumed that capacity would be replaced by a mix of thermal resources in the same ratio as energy calculation above. Using these values and the ratio of replacement generation, an aggregated average annual capacity value was determined as follows:

Capacity Value = $62.16*(10/ (10+71)) +$117.40*(71/ (10+71)) = $110.58/ kW-yr

This was the capacity value used in the main report. SWPA has indicated that it believes the most likely type of replacement capacity during the critical period would be Combustion Turbines. It is not uncommon when using capacity expansion models in

conjunction with production cost models to base capacity on critically dry years and energy on the long term average. Although the second alternative method uses a combination of thermal resources for energy replacement, it is assumed that much of the replacement energy would come from existing generating resources over the long term and in non-critical months, but that for capacity purposes in critical periods, Combustion Turbines would be needed to maintain power system reliability. Therefore, although the energy value may be based on a likely mix of thermal generation over the year, the capacity value is assumed to be for Combustion Turbines during the critical period only and the following value was used for both alternative calculations:

Capacity Value = $62.16 / kW-yr

Capacity Benefits Foregone. The capacity benefits foregone at the Denison power plant due to each of the alternative storage reallocations is the product of the supportable capacity loss and the capacity value. The results are as follows:

Storage Reallocation Alternatives	300,000 AF	450,000 AF
Annual Capacity Benefits Foregone	$791,297	$1,756,828

SUMMARY OF POWER BENEFITS FOREGONE

Based on the alternative analysis approaches that were developed based on SWPA's perspective for quantifying power impacts, the total power benefits foregone due to the Lake Texoma Water Supply/Storage Reallocation alternatives would be in the following range:

Storage Reallocation Alternatives	300,000 AF	450,000 AF
First Alternative (Energy from CT's only)		
Energy Benefits Foregone	$ 870,117	$1,725,872
Capacity Benefits Foregone	$ 791,297	$1,756,828
Annual Power Benefits Foregone	$1,661,414	$3,482,700
Second Alternative (Energy from CC's & CT's)		
Energy Benefits Foregone	$ 592,073	$1,174,373
Capacity Benefits Foregone	$ 791,297	$1,756,828
Annual Power Benefits Foregone	$1,383,370	$2,931,201

The table on the following page compares the main report results with the alternate methods used in this appendix for identifying the value of hydropower benefits lost due to reallocating reservoir storage to water supply. This appendix is intended to be a basis for further discussion of methods for valuing Federal hydropower for water supply projects, but does not represent a recommended change in the values used in the main report for the Lake Texoma Water Supply/Storage Reallocation.

Comparison of Alternate Methods for Valuing Foregone Power at Dennison

Storage Reallocation Alternatives	300,000 AF					450,000 AF				
Analysis Methods	HAC Analysis Methods			Alternative Methods based on SWPA Comments		HAC Analysis Methods			Alternative Methods based on SWPA Comments	
				CT Energy Only	CC & CT Energy				CT Energy Only	CC & CT Energy
	Benefits	Revenue	PMA Credit	Value	Value	Benefits	Revenue	PMA Credit	Value	Value
Annual Energy Losses (MWh)	11,995	11,995		11,995	11,995	23,792	23,792		23,792	23,792
Energy value ($/MWh)	$31.81	$8.25		$72.54	$49.36	$31.81	$8.25		$72.54	$49.36
Annual energy foregone	**$381,555**	**$98,957**	**$232,418**	**$870,117**	**$592,073**	**$756,816**	**$196,282**	**$461,791**	**$1,725,872**	**$1,174,373**
Capacity Losses (kW)	2,310	12,730		12,730	12,730	5,472	28,263		28,263	28,263
Capacity value ($/kW)	$110.58	$23.52		$62.16	$62.16	$110.58	$23.52		$62.16	$62.16
Annual capacity foregone	**$255,397**	**$299,412**	**$278,625**	**$791,297**	**$791,297**	**$605,150**	**$664,755**	**$639,275**	**$1,756,828**	**$1,756,828**
Total Annual Benefits Foregone	**$636,952**	**$398,369**	**$511,043**	**$1,661,414**	**$1,383,370**	**$1,361,966**	**$861,037**	**$1,101,065**	**$3,482,700**	**$2,931,201**
Annual Benefits Foregone $/MWh (melded Energy + Capacity)	**$53.10**	**$33.21**	**$42.61**	**$138.51**	**$115.33**	**$57.25**	**$36.19**	**$46.28**	**$146.38**	**$123.20**

				Date Run
COMBUSTION TURBINE POWER VALUE				08/22/05
PROJECT NAME:		Lake Texoma Water Supply		
	LOCATION:	Texas		
	FINANCING:	FEDERAL @	5.375%	
Capacity Value		$62.16	per kW-yr	
Energy Value		$72.54	per MWh	
PROGRAM INPUT DATA			State Index Number	44
			State Location	TX
Cost Level Date	7/1/2005		H-W Index Reg No	4
Single unit capacity	100		ROW ($/acre)	2319
Capacity Factor	0.10		Clearing % of ROW	0.60
Transmission Voltage	230		Rec Sub Land Cost	21869
Transformer MVA	125		Plant Invest	457
No of Trans	2		FC Mov-Ave Time Frame	24
No of Trans Pos	2		Fuel Cost	561.7
Single or Three Phase	3		Heat Rate	12870
Length Line 1	0		Variable O&M	0.25
Length Line 2	0		Fixed O&M	15.84
Line 1: Total Circuits	2		O&M update	2.99
No of Single Circ	2		Plant update	2.78
No of Double Circ	0		Transmission update	2.42
Line 2: Total Circuits	0		Depreciation Plant (%)	1.41
No of Single Circ	0		Deprec Sub (%)	1.41
No of Double Circ	0		Deprec Trans Tower (%)	0.42
			Deprec Trans Pole (%)	1.41
Cost of Money (%)	5.375			
Plant Life	30		Fed Inc Tax (%)	0.000
Substation Life	30		Fed Misc Tax (%)	0.000
Trans (towers) Life	50		State & Local Tax (%)	0.000
Trans (poles) life	30			
			Hydro Flex Adjust	0.025
Plant insurance (%)	0.25		Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10		Hydro Mechanical Avail	0.980
Sub insurance (%)	0.25		Mech Avail Adjust	0.089
			ALT PLANT CAP FAC	5.00
			HYDRO CAP FAC	5.00
			VAL DISPLACED ENERGY	0.00
			EV ADJUST	72.54
			VARIABLE O&M	0.25
			ESC ENERGY VAL	72.54
			ESCALATION FACTOR	1.00

				Date Run
COMBINED CYCLE POWER VALUE				08/22/05
PROJECT NAME:		Lake Texoma Water Supply		
	LOCATION:	Texas		
FINANCING:		FEDERAL @	5.375%	
Capacity Value		$117.40	per kW-yr	
Energy Value		$46.09	per MWh	
PROGRAM INPUT DATA			State Index Number	44
			State Abbr. (exact)	TX
Cost Level Date	7/1/2005		H-W Index Reg No	4
Single unit capacity	150		ROW ($/acre)	2494
Capacity factor	0.20		Clearing % of ROW	0.60
Trans Voltage	230		Rec Sub Land Cost	23460
Transformer MVA	200		Plant Invest	738
No of Trans	1		FC Mov-Ave Time Frame	24
No of Trans Positions	1		Fuel Cost	561.7
Single or Three Phase	3		Heat Rate	8030
Length Line 1	0		Variable O&M	0.99
Length Line 2	0		Fixed O&M	48.28
Line 1: Total Circuits	0		O&M update	2.99
No of Single Circ	0		Plant update	2.78
No of Double Circ	0		Transmission update	2.42
Line 2: Total Circuits	0		Depreciation Plant (%)	1.41
No of Single Circ	0		Deprec Sub (%)	1.41
No of Double Circ	0		Deprec Trans Tower (%)	0.42
			Deprec Trans Pole (%)	1.41
Cost of Money (%)	5.375			
Plant Life	30		Fed Inc Tax (%)	0.000
Substation Life	30		Fed Misc Tax (%)	0.000
Trans (towers) Life	50		State & Local Tax (%)	0.000
Trans (poles) life	30			
			Hydro Flex Adjust	0.025
Plant insurance (%)	0.25		Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10		Hydro Mech Avail	0.980
Sub insurance (%)	0.25		Mech Avail Adjust	0.089
			ALT CAP FAC	5.00
			HYDRO CAP FAC	5.00
			VAL DISPLACED ENERGY	0.00
			EV ADJUST	46.09
			VARIABLE O&M	0.99
			ESC ENERGY VALUE	46.09
			ESCALATION FACTOR	1.00

APPENDIX 11.7

SOUTHWESTERN POWER ADMINITRATION (SWPA) LETTERS

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Southwestern Power Administration
Water Storage Reallocation
Hydropower Impacts
Executive Summary

The purpose of the paper is to document the Southwestern Power Administration's (Southwestern) concerns with the procedures used by the US Army Corps of Engineers (Corps) in determining and compensating the hydropower purpose for impacts resulting from water storage reallocations at Corps projects.

1. Capacity Loss Calculations. The Corps uses average year capacity losses instead of the critical year capacity losses used by Southwestern to market the capacity. While the Corps' method may be applicable in determining the feasibility of new hydropower, Southwestern does not believe it is applicable to existing hydropower that is already meeting market energy and capacity needs. As such, a loss of Southwestern's marketable capacity is a loss in the National electrical energy market.

2. Energy Loss Calculations. Both agencies generally use the same procedure to calculate energy losses. Southwestern is concerned that the "water storage yield" amount used in the simulations as withdrawal for the water represents the minimum amount that can be withdrawn. Southwestern encourages development of a method that represents a maximum, or at least an average, withdrawal rate.

3. Capacity Cost Calculations. Southwestern generally agrees with the Corps use of the Federal Energy Regulatory Commission's (FERC) procedure to develop the cost of alternative sources of generation. Southwestern believes the alternative generation source should be selected based on the replacement of capacity as used in the power sales contract and not based on the project's average annual generation.

4. Energy Cost Calculations. Because Southwestern occasionally purchases energy in the market, it is familiar with the energy costs. Southwestern cannot typically purchase replacement energy at the unit costs assumed in the Corps' study. The energy market has changed significantly in the past several years and the procedures used to estimate the price of energy must therefore also change. Southwestern suggests the use of properly selected FERC calculated energy values as appropriate in determining the energy replacement costs. Care should also be taken in the studies in handling on-peak and off-peak energy.

5. Compensation Issues. The Corps agrees to provide compensation for benefits foregone through the life of the current power sales contracts. Southwestern believes that its 1980 Final Power Allocations assures the Federal customers continuation of their contracted capacity and energy. It would therefore follow that the hydropower purpose should be credited for the benefits foregone through the life of the project (much as the water supply users are guaranteed the water storage through the life of the project). Southwestern also believes that a procedure to provide the hydropower purpose the financial credit should be developed and included in the Corps' water storage reallocation reports.

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Southwestern Power Administration
Water Storage Reallocations
Hydropower Impacts

Purpose: To provide Southwestern Power Administration's (Southwestern) general observations and concerns with the US Army Corps of Engineers (Corps) methods of determining the hydropower purpose impacts resulting from water storage reallocations at Corps projects along with any associated compensation.

Background: The Corps occasionally reallocates water storage from one purpose to another at their multipurpose lake projects (most often, but not always, for municipal and industrial water supply usage). Whenever a reallocation occurs at a project that includes hydropower as a project purpose, there is typically a negative impact to the hydropower purpose. During the study phase, the Corps requests their Hydropower Analysis Center (HAC) to determine the impact of the proposed water storage reallocation to the hydropower purpose. Determination of the hydropower impacts by HAC is generally composed of four parts: 1) amount of capacity lost, 2) amount of energy lost, 3) value of capacity lost, and 4) value of energy lost. As a result of reviewing numerous such studies, Southwestern has several areas of concern with the methodologies being used to determine those amounts and values. Additionally, Southwestern also has concern with how the Corps compensates the hydropower purpose once those impacts are determined. The following is a discussion of the current methods and proposed changes.

Capacity Loss: The determination of the amount of dependable capacity lost as the result of a water storage reallocation at a Corps project is of critical importance to Southwestern. Reliable capacity with associated energy is the major resource Southwestern has to market in order to repay the nation's hydropower investment in the project. In benefit calculations, the ".. .dependable capacity of a project is used to represent the amount of thermal capacity that would be displaced by the hydro plant. More specifically, it is intended to identify how much thermal capacity would be required to carry the same amount of system peak load as would be carried by the hydro plant..." [Section 6-7b(l) of the Corps' EM 1110-2-1701, Hydropower, dated 31 December 1985], HAC and Southwestern differ in the method used to compute the dependable capacity loss in the case of storage reallocations.

a) HAC's Method: In Southwestern's marketing area, HAC typically uses the average availability method as described in Section 6-7g of the Corps' EM 1110-2-1701. HAC's justification for such usage is that hydropower in Southwestern's area represents only a small portion of the region's generating resources and as such, random hydrologic variations can be considered equivalent to random thermal generating plant forced outages.

In general, the average availability method computes the dependable capacity for a critical load demand period for each year of a given period-of-record based on energy produced and peaking demand hours (never allowing it to be more than machine capability). The dependable capacity for each year is then averaged over the period-of-record to determine the project's dependable capacity. To determine the impacts of a reallocation, the average dependable capacity is determined for both a base case and an alternative case modified to represent the proposed reallocation. The difference in the two cases is the capacity loss due to the proposed reallocation.

More specifically, in the average availability method, a period-of-record simulation is made for the base and modified conditions. The annual peak demand period is determined in consultation with Southwestern (typically June through August in Southwestern's area) and the project's average weekly energy output is computed for that peak demand period for each year of the simulation. Southwestern provides HAC with the critical flow year as used in its studies. In order to calculate the number of peaking hours required from the project each week, the average weekly energy for the peak demand period of the critical year of the base case is divided by the amount of capacity that Southwestern markets from the project. The average weekly energy for the peak demand period for each year of the entire period-of-record is then divided by the number of hours required by week as computed above to determine the potential supportable capacity. That value for each year is compared with machine capability (reduced for loss of head based on headwater and tailwater conditions) and the lower value chosen for the actual supportable capacity. The actual supportable capacity computed for each year of the period-of-record is averaged and used as the dependable capacity of the project. Using the required number of hours per week from the base case, the actual supportable capacity is computed for the alternative's modified conditions. The alternative average capacity is subtracted from the base average capacity to determine the loss of dependable capacity that is used in the study to determine revenues and benefits lost due to the proposed reallocation.

b) Southwestern’s Method: Southwestern's method used to determine the lost capacity reflects how the capacity is marketed and used in the region. The capacity available from the Corps' hydropower projects is the only capacity available to Southwestern to meet the obligations of Federal long-term power sales contracts in its area. The revenues collected from those power sales contracts are used to repay the Federal investment in the projects, with interest. Southwestern has entered into those power sales contracts after determining the amount of capacity available for marketing based on the ability of the hydropower projects to reliably provide capacity and firm energy throughout the worst drought of record. The Federal customers receiving the electricity request long-term power sales contracts in order to provide them sufficient time to make arrangements for replacement generation sources if the hydropower is no longer available. Based on Section 5 of the Flood Control Act of 1944, as amended, and on discussions with the Office of Management and Budget, Southwestern believes that it only has the authority to market the capacity dependably available at the projects. If the capacity is not available because of a drought period, Southwestern cannot purchase replacement capacity, even if it was available, and therefore, Southwestern cannot market that capacity through the Federal power sales contracts. (Special allowance is made for forced outages that are expected to return to service). If Southwestern cannot market the capacity on a long-term basis, then it is not available to the region as a generating resource and must be replaced in the long-term with the construction of thermal plant capacity. Therefore, benefits from the hydropower capacity that was marketed and now lost are no longer a benefit to the Nation.

Southwestern, from time to time, purchases energy on the shoulders of the peak during drought conditions to conserve water in storage to preserve the marketed project capacity. Southwestern must maintain the ability to meet the peak capacity demands solely with its hydropower resources. In system projects, an attempt is made to maintain a balance of the projects' storage to equitably address the needs of all the water users.

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As mentioned, Southwestern determines the capacity loss of a water storage reallocation based on a critical drought period (instead of average conditions). A period-of-record simulation is made for both the base case (existing conditions) and an alternative case (modified to represent the proposed water storage reallocation yield). The peaking loads used in the alternative case are reduced by the amount of the reallocated water storage yield in order to maintain the minimum pool elevation achieved in the base case in the high load month of August during the critical drought period. From the two runs, the energy produced during the critical drought period (from the time the water surface receded into the power storage until the minimum August pool is reached) is computed. The critical drought period will often exceed one year. The number of peaking hours needed for the critical drought period is based on Southwestern's power sales contracts (1,200 hours per year) and a critical loading pattern based on the requirements of those contracts. The lost capacity is then computed by taking the amount of energy lost during the critical drought period between the base and alternative cases and dividing it by the number of peaking hours needed during the drought period.

c) Comparison: Southwestern's method uses procedures (energy loss divided by peaking hours required) similar to those used by HAC in determining the capacity lost. Southwestern uses a longer critical period (similar to the critical period used in a water yield analysis) than HAC (uses two to four months during the peak demand period). Most importantly, Southwestern is compelled, for reasons stated above, to use the critical drought capacity instead of the average available capacity. In addition, the critical drought conditions have a greater impact than random hydrologic variations and in Southwestern's area, critical drought conditions occur in several of the major river basins concurrently. Southwestern believes that the HAC method can be properly used in planning studies to determine whether new hydropower projects should be constructed. However, once a project is constructed and marketed into the electrical system, it has been established as a generating resource meeting specific electrical loads. Without the ability to provide capacity throughout the critical drought period, Southwestern cannot make the capacity available for long-term marketing. If that generating resource were no longer available for long-term marketing, it would have to be replaced by equivalent thermal plant capacity at the associated cost. Therefore, the capacity lost to the electrical system would be the amount of capacity lost during the critical drought period.

d) Flood control reallocation: When the proposed water storage reallocation is taken from the flood control storage, the impacts on the hydropower purpose will vary. If the reallocation provides for hydropower yield protection operation (HYPO) for the hydropower purpose, similar to the dependable yield mitigation storage for the water supply purpose, the hydropower storage capabilities remain whole, and there is no impact on the marketable capacity. If HYPO is not provided to protect the yield of the storage for hydropower, then the impact of the yield reduction of the hydropower storage must be determined and the associated capacity loss determined.

Energy Loss: Both HAC and Southwestern use the same method to compute the amount of energy lost from a proposed water storage reallocation. A period-of-record simulation is made for both the base case (existing conditions) and an alternative case (modified to represent the proposed water storage reallocation yield). The average annual energy produced is computed in both simulations. The average annual energy produced by the alternative case is subtracted from

the base case value and the result is the average annual energy loss associated with the proposed water storage reallocation.

Southwestern's concern in the process is typically limited to efforts to assure that the proposed reallocation is properly modeled in the simulation runs. Southwestern believes that use of the water storage yield as the normal withdrawal in the simulation underestimates the amount of water that can normally be withdrawn from the storage. The yield represents the amount of water that can be withdrawn in the critical drought period. During the rest of the period-of-record, withdrawals exceeding the yield can be made from the water storage. Since there are normally no restrictions in the Corps' water storage contracts to limit the withdrawal amount and in order to properly model the impacts, the maximum withdrawal rate for each period must be assumed. When the potential withdrawal (average withdrawal instead of critical drought withdrawal) is properly modeled in the simulation, the energy losses associated with the reallocation would increase. With that exception, Southwestern generally agrees with the energy loss values computed by HAC. However, in a few studies, a distinction should be made to differentiate between the loss and gain of on-peak and off-peak energy in order for proper cost values to be assigned to each. Southwestern is willing to work with the Corps in developing a process to better model the potential average water withdrawal available from proposed storage reallocations.

Capacity Cost: Once the amount of capacity loss is established, the cost or value of the capacity lost must be determined. Both capacity revenues and benefits foregone are computed by HAC. The revenues are straightforward and are based on the capacity loss multiplied by the current rates Southwestern is charging for the capacity in the power sales contracts. The capacity cost used by HAC to calculate benefits foregone represents the unit cost of constructing an increment of the most likely thermal generating alternative to replace the lost hydropower capacity. HAC computes the capacity unit values for coal-fired steam, gas-fired combined cycle, and combustion turbine plants using procedures developed by the Federal Energy Regulatory Commission (FERC). The capacity values are computed for the applicable region based on the current interest rate with the construction costs adjusted to the current price level. Southwestern agrees with the use of the FERC model in determination of the capacity values. However, it appears that the construction costs, although brought to the current price level, are based on older data and should be updated based on new construction cost information.

HAC uses the FERC thermal alternative cost information to develop a thermal screening curve of annual costs versus the operating plant factors. A project hourly generation duration curve is also developed from a typical generation year. From those two curves, HAC selects a least-cost thermal mix that represents the least-cost thermal alternative for generation of the typical annual generation from the project. Weighting factors are calculated to represent that mix and applied to the previously calculated FERC unit capacity values for each thermal alternative. A composite unit capacity value is calculated and multiplied by the previously calculated capacity loss to determine the capacity benefit loss from the proposed reallocation.

Southwestern believes that, while the HAC approach provides a reasonable thermal mix for the modified project's average annual generation, it does not represent the most likely thermal alternative for the capacity and energy that is being lost because of the reallocation. Southwestern believes that the thermal generating alternative selected to replace the lost

hydropower capacity should be based on replacement of capacity as used in the power sales contracts to meet the firm peaking energy requirements. The hydropower storage at a project provides the dependability that makes the capacity marketable. It is used to meet the 1,200 hours per year of energy guaranteed in the power sales contracts (not the average annual generation). The loss of the use of a portion of that storage reduces the amount of marketable capacity at the project available to meet the 1,200 hours. The thermal generating alternative used to replace the product Southwestern markets from those projects would be used to provide 1,200 hours per year, or a plant factor of 13.7 percent. Therefore, Southwestern believes that the most likely thermal generating alternative for most of the water storage reallocations proposed in its area should be a gas-fired combustion turbine.

Energy Cost: After the amount of energy loss is estimated, the cost or value of the lost energy must be determined. Both energy revenues and benefits foregone are computed by HAC. The energy portion of the revenue foregone is computed by multiplying the energy loss by Southwestern*s current energy rate. Both on-peak and off-peak rates are available in Southwestern's current rate structure.

a) On-peak energy: Because the hydropower storage at a project is used to produce peaking energy, the impact in Southwestern's area of reducing the hydropower storage is the loss of peaking energy. HAC and Southwestern differ in the method used to compute the value of the energy loss in the case of storage reallocations.

1) HAC's Method: HAC uses the computer model PROSYM, which is developed and maintained by Henwood Energy Services, to develop the area power system cost of producing an equivalent amount of thermal replacement energy to offset that hydropower energy lost due to the reallocation. It appears that the model tries to absorb the lost energy into the existing resources, assuming that there is sufficient energy in reserve to meet the loss, and to replace the loss with the existing thermal generating alternative that has the lowest production cost.

2) Southwestern’s Method: While Southwestern believes that the model and procedure used by HAC had merit in previous planning studies in determining the feasibility of constructing new hydropower facilities, it believes the value used by HAC in the studies for the replacement cost of the peaking energy loss is not valid. In the existing open, de-regulated energy market, the replacement of the lost hydropower energy will be made through either the purchase of peaking energy at market-based rates or through the construction of a new thermal generating plant. The price of energy in the new market-driven industry is no longer based on production costs, but rather on supply and demand. Southwestern has responsibility for the purchase of peaking energy from time to time to preserve water storage in the reservoirs. Therefore, it has practical experience in the energy market. The unit cost of peaking energy purchased by Southwestern is considerably more than the energy unit cost used by HAC in the studies. The unit cost of energy used by HAC in the studies is not reasonable or representative of the actual energy market. Until a market cost forecast

model is developed, Southwestern believes that the peaking energy replacement costs can adequately be represented by use of the FERC energy values computed for the gas-fired combustion turbine.

b) Off-peak energy: In studies where the proposed water storage reallocation is from the flood control pool and HYPO is provided to protect the hydropower yield, the capability of the hydropower storage is not impacted. Energy loss in that case should be considered off-peak energy and its cost or value should reflect the lower costs. Additionally, in a recent study, the reallocation energy loss was offset by energy generated through new, larger station service units that generated when the main units were not used. In the study, all the energy was treated as having the same value. Since the main units are typically run to produce energy when needed to meet the firm peaking energy requirements of the power sales contracts, the energy from the new station service units should be considered as off-peak energy (not used to meet the peaking energy requirements). In the energy market, such off-peak energy has a much lower value. Southwestern recommends that when similar conditions are evaluated, the off-peak energy should be valued at the FERC energy value for the coal-fired steam as the most likely thermal alternative to replace the off-peak energy in the benefits calculations.

Compensation: Southwestern has concerns with two issues involving compensation to the hydropower purpose for any proposed water storage reallocation. The first issue involves the amount of compensation and the second involves the procedure for compensation.

a) Amount: Appendix E of the Corps' ER 1105-2-100, Planning Guidance Notebook, dated 22 Apr 2000, allows for hydropower to receive a financial credit of revenues foregone when hydropower is adversely impacted by water storage reallocations. Additionally, where existing Federal power delivery contracts require market purchases of power as a result of storage reallocations and withdrawal, the additional credit for funds expended for purchases is provided. In essence, the latter provision gives the hydropower purpose a financial credit for the replacement costs or benefits foregone for the duration of the power sales contracts.

Under the same Appendix E, the permanent right to storage is discussed for water supply users that continue to make payments pursuant to their agreement with the government. Southwestern believes that the Federal power customers have a similar guarantee of continued benefits under Southwestern's Final Power Allocations published in the Federal Register on March 24, 1980. It states, "SWPA will not withdraw any capacity now under contract to a preference customer in order to sell the capacity to another preference customer. As contracts expire, SWPA will offer to enter into peaking contracts for the sale of a like amount of capacity with 1200 kWh/kW/yr of associated energy." It further states that "Capacity that becomes available with the expiration of a preference customer contract is to be used for continued service to that preference customer and is, therefore, not available for allocation to others." The 1980 Final Power Allocations provides the permanent right to the capacity and associated energy to the existing preference customers provided that the "power allottee will accept the amounts allocated with its attendant terms" and "transmission facilities will be available to move this power to load centers." As such, Southwestern believes that, while compensation for the loss of hydropower capacity and energy associated with the reallocation of water storage should continue to be based on the replacement costs or benefits foregone for the term of the contract, the contract should be considered permanent, or without end.

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b) Procedure: In order to assure that the proposed hydropower compensation is accomplished, Southwestern believes that the water storage reallocation reports should have clearly delineated procedures that outline the process for providing a financial credit to the hydropower purpose. It is imperative that the hydropower purpose actually receives the credit on the financial books in order that Southwestern's electrical rates can reflect the proposed compensation. Southwestern is willing to work with the Corps in the development of a standard financial credit procedure for hydropower compensation.

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Denison - Lake Texoma
Hydropower Impacts from Water Storage Reallocation

Revenues Foregone	*300,000 acre-feet Alternative*		*450,000 acre-feet Alternative*	
	Corps	**SWPA**	**Corps**	**SWPA**
Annual Energy Losses (MWh)	11,995	11,995	23,792	23,792
Additional water usage adjustment (MWh)	---	15,069	---	30,131
Total Annual Energy Losses (MWh)	**11,995**	**27,064**	**23,792**	**53,923**
Energy value ($/MWh)	8.25	8.20	8.25	8.20
Annual energy revenue foregone	**$98,959**	**$221,926**	**$196,284**	**$442,165**
Capacity Losses (kW)	12,730	11,483	28,263	23,685
Capacity value ($/kW)	23.52	36.36	23.52	36.36
Annual capacity revenue foregone	**$299,410**	**$417,522**	**$664,746**	**$861,187**
Total Annual Revenues Foregone	$398,368	$639,448	$861,030	$1,303,352

Benefits Foregone	*300,000 acre-feet Alternative*		*450,000 acre-feet Alternative*	
	Corps	**SWPA**	**Corps**	**SWPA**
Annual Energy Losses (MWh)	11,995	11,995	23,792	23,792
Additional water usage adjustment (MWh)	---	15,069	---	30,131
Total Annual Energy Losses (MWh)	**11,995**	**27,064**	**23,792**	**53,923**
Energy value ($/MWh)	31.81	59.73	31.81	59.73
Annual energy benefit foregone	**$381,561**	**$1,616,543**	**$756,824**	**$3,220,796**
Capacity Losses (kW)	2,310	11,483	5,472	23,685
Capacity value ($/kW)	111.80	63.00	111.80	63.00
Annual capacity benefit foregone	**$258,258**	**$723,29**	**$611,770**	**$1,492,155**
Total Annual Benefits Foregone	**$639,819**	**$2,339,972**	**$1,368,593**	**$4,712,951**