SECTION VI - FACTORS INFLUENCING AND CONSTRAINING RESOURCE DEVELOPMENT AND MANAGEMENT

6.01 GENERAL LAND AND WATER CONSTRAINTS

a. The topography at Mark Twain Lake reaches a maximum elevation of about 780 feet NGVD in the southwestern portion of the project to a minimum of approximately 520 feet NGVD along the main stream of the Salt River. The North Fork, Middle Fork, Elk Fork and South Fork are the main tributaries of the Salt River within the project boundaries and have a maximum elevation of 675 feet NGVD in the western part of the project. The sides of the major valleys are dissected by short tributaries whose gradients extend from the flat uplands to the valley bottoms. The divides between these tributaries form a continuous belt of hills along either side of the major valleys. The land adjoining the project is relatively flat farmland.

Soil surveys have been prepared by the United States Department of Agriculture – Natural Resources Conservation Service (NRCS) for the counties encompassing Mark Twain Lake (Ralls and Monroe, Mo. Counties). Engineering as well as other land use interpretations for each soil unit encountered in the respective counties are included in these soil surveys.

The predominant soil units within the project area are the Armstrong-Leonard Association and the Goss-Gorin-Lindley Association. The Armstrong-Leonard Association is composed of the Armstrong and Leonard soils. The Armstrong soils are moderately to strongly sloping. They are well-drained dark gray to dark brown mottled lean and fat clays. The Leonard soils are moderately sloping, poorly drained gray lean clays. Minor soils in the Association are the well-drained, moderately steep Lindley soils and the well-drained, steep, Cherty Goss soils. These soils are on narrow ridge tops and steep side slopes. The Goss-Gorin-Lindley Association is composed of the Goss, Gorin and Lindley soils. The Goss soils are steep, well-drained, cherty clays and silts. The upper portion is typically very dark gray and brown. The subsoils are usually reddish to yellowish brown. The Gorin soils are moderately sloping and are on ridge tops above the Lindley soils. The Gorin soils are poorly drained gray to brown silty clays. The Lindley soils are steep well-drained soils on narrow ridge tops. The surface layer is dark gray to brown clay and the subsoils are yellowish brown clays. The minor soils in this association are the well-drained, nearly level Cedargap soils; the moderately well-drained, moderately sloping to strongly sloping Armstrong soils; the poorly drained, sloping Calwoods soils; and the moderately well drained, strongly sloping and moderately steep Gosport soils. The Cedargap soils are on narrow ridge tops and on side slopes

in positions higher than those of the Goss and Lindley soils. Gosport soils are in positions similar to those of the Goss soils.

The soils of the area present several problems. They are erosive particularly when the shoreline of the lake is subjected to periods of high water combined with windy conditions. Bank erosion and caving can occur. Many of the soil deposits are in an area of glacial origin, and include rocks and boulders of large to moderate size at or immediately beneath the ground surface. These conditions can complicate foundation and utility trench design and placement, thus requiring additional expense.

b. Water Constraints The lake level may rise or fall depending upon the natural factors of flood and drought. During flood control operations, the level of the lake is allowed to rise so that the adverse effect of flooding to downstream areas can be minimized.

6.02 DEMOGRAPHIC DATA

The following is a brief economic and demographic analysis of Monroe and Ralls Counties, Missouri. The combined area is located northwest of the St. Louis, Missouri - Illinois Standard Metropolitan Statistical Area (SMSA). This investigation will focus on a statistical analysis of past, present and future trends of counties mentioned above. TABLE 6-1 and FIGURE 6-I reveal a 4.2 percent decrease in population for Monroe County and an 8.0 percent increase for Ralls County from 1980 to 2000. Both counties exhibited a downward trend at the time of the 1990 Census. The study area as a whole experienced a decrease in population of about 2.0 percent for this period.

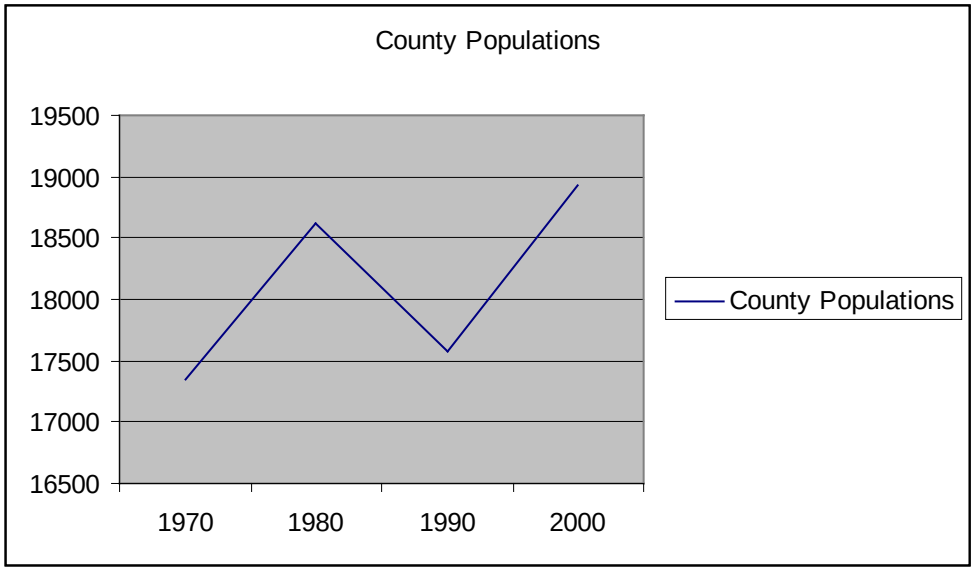
TABLE 6-1 COUNTY POPULATIONS BY DECADE

	2000[1]	1990[1]	1980[2]	1970[2]
Monroe County	9,311	9,104	9,716	9,499
Ralls County	9,626	8,476	8,911	7,846
TOTAL	18,937	17,580	18,627	17,345

[1] Missouri Census Data Center; Missouri (Counties, Places Metropolitan Areas); May 2001.

[2] U.S. Department of Commerce, Bureau of the Census; 1980 Census of Population; General and Social Economic Characteristics – Missouri; April 1980.

FIGURE 6-1 - COUNTY POPULATIONS - COMBINED POPULATION TRENDS OF RALLS AND MONROE COUNTIES

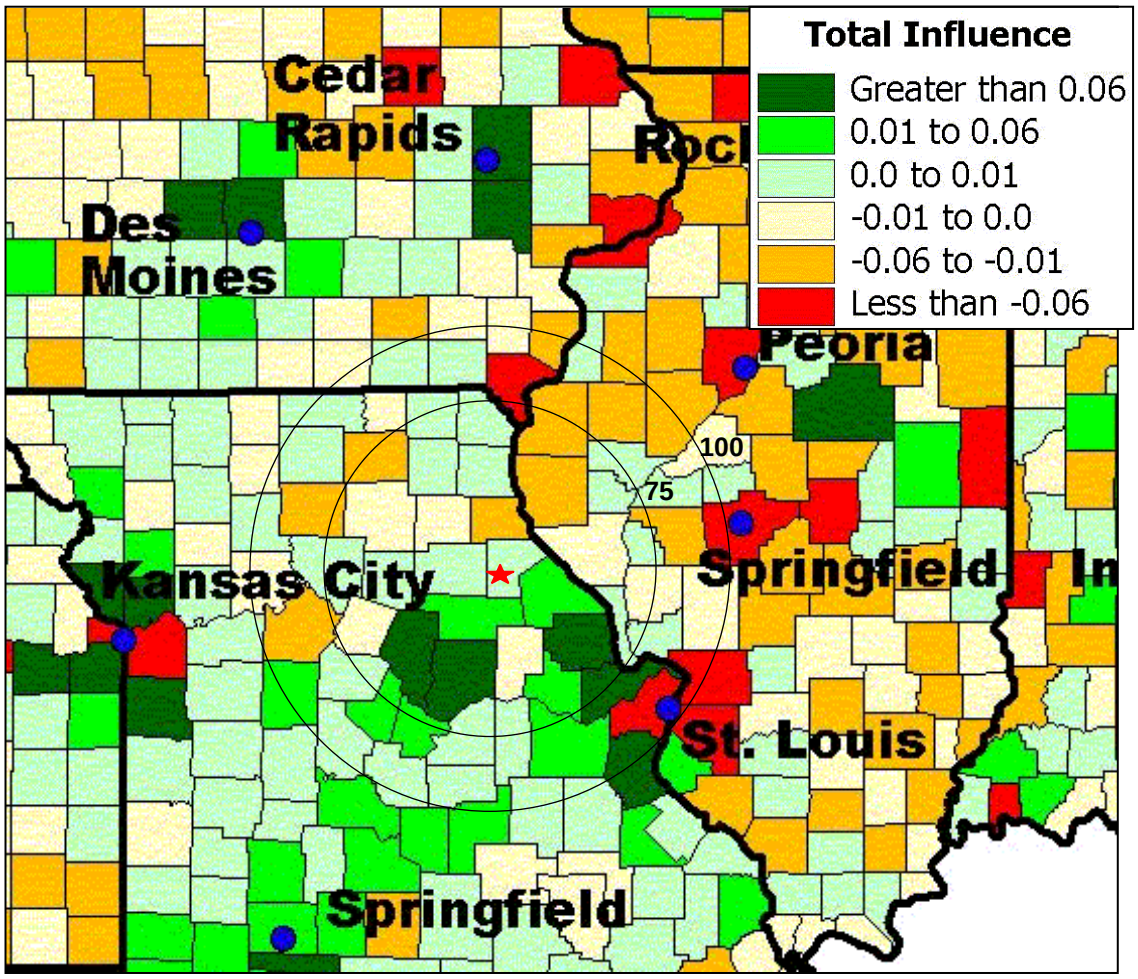


6.03 AREA OF INFLUENCE

a. General. A 100-mile radius of influence, centered on the dam site, has been adopted for purposes of this Master Plan. The area of influence shown in Figure 6-2 encompasses 37 northeast Missouri counties, 19 western Illinois counties and 8 southeastern Iowa counties. The St. Louis SMSA is located in this zone of influence and represents the majority of population and industrial concentration. The remainder of the area is substantially agriculture. Excluding St. Louis City and County, 79.7 percent of all land in 1980 was designated as farmland. This land use percentage attributed to farmland decreased to 77.2 percent in 1990.

The economic influence of counties in the Midwest Region of the U.S. between 1995 and 2001 was presented in reports developed by the Missouri Economic Research and Information Center, Missouri Department of Economic Development. A county's economic influence is a composite of changes in employment, population and income, and the percentage of a region's economy held by a county. Two very strong areas of economic influence are located in the Columbia, Missouri area and the St. Charles, Missouri area. See Figure 6-2 below for a map showing economic influence by county. Future efforts at marketing the lake may be directed to these areas.

FIGURE 6-2 Zones of Influence and Economic Influence of Counties



b. Industries. Although the manufacturing sector of the economy employs the greatest percentage of people in the area, manufacturing employment decreased 12.0 percent between 1980 and 1990. The service industry, on the other hand significantly increased employment by 14.6 percent for the same period. This trend mirrors the national trend towards increased employment opportunities in the service sector. The predominant manufacturing industries in the area of influence involve the manufacture of air and spacecraft, metal and metal products, chemicals, and refining and distributing petroleum products.

c. Transportation and Road Network[3]. FIGURE 6-3 portrays the location of Mark Twain Lake with respect to the major highways within the area. U.S.

[3] Market Potential and Feasibility Analysis for Commercial Concession Development at Mark Twain Lake, Parsons Harland Bartholomew & Associates with Fact Finders, Inc., January 2001

Highway 24 and State Highway 154 parallel the northern and southern sides of Mark Twain Lake respectively, with State Highway 107 bisecting the Lake and connecting the two highways. Route J parallels the eastern side of the Lake, and crosses over the Clarence Cannon Dam. The Corps of Engineers Operations Center and Visitor Center are located on Route J. U.S. Highway 61, a four-lane divided highway that provides the primary access from the St. Louis Metropolitan Area, is located approximately 15 miles east of the Lake. U.S. Highway 24/36 and State Highways 19 and 154 provide the primary access to Mark Twain Lake from U.S. Highway 61.

FIGURE 6-3 Regional Location Map

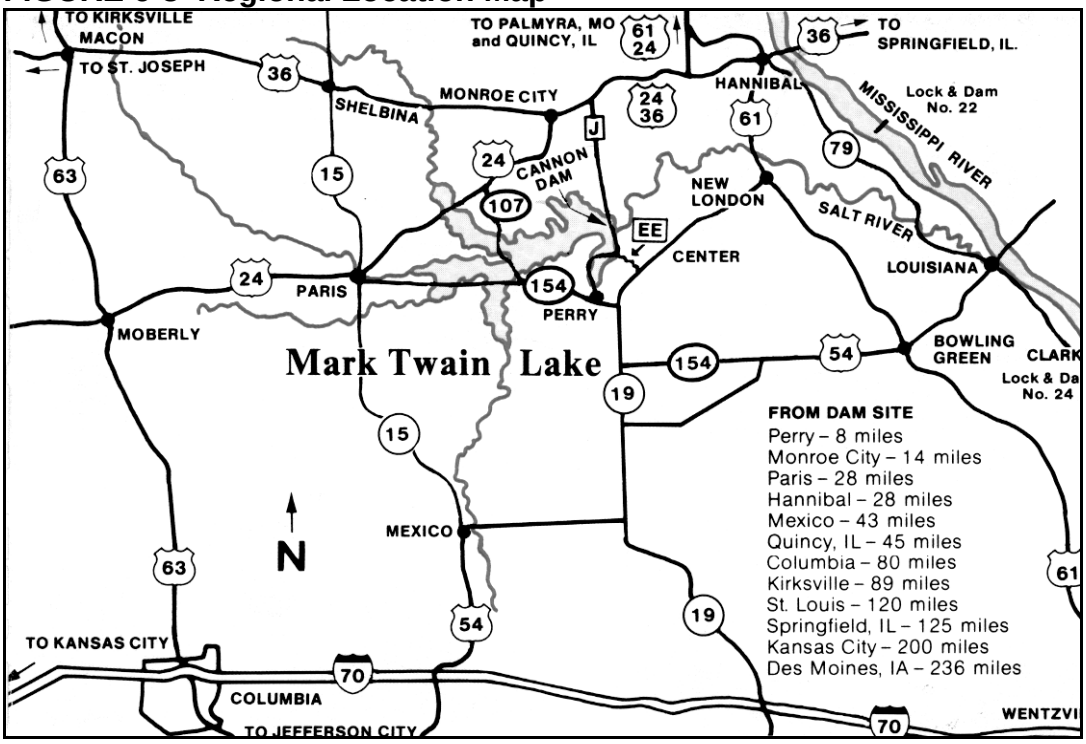


TABLE 6-2 Daily Traffic Count (ADT) Trends, 1990-1999[1]			
Highway Segment/Location	1999	1995	1990
U.S. Highway 61 @ State Highway 19	11,075	7,985	6,888
State Highway 19 @ Highway H-P	3,826	3,008	2,450
State Highway 154 @ Routes J-B	2,305	2,604	1,814
State Highway 154 @ State Highway 107	982	1,000	850
U.S. Highway 24 @ Route J	5,971	5,418	4,463
Route J @ U.S. Highway 24-36	1,182	1,370	1,076
Route J @ Route A	1,535	1,782	1,398
State Highway 107 @ U.S. Highway 24	452	258	294
State Highway 107 @ Route U	836	418	412

[1] Includes bi-directional traffic.
Source: Missouri Department of Transportation, Office of Transportation Management Systems.

TABLE 6-2 provides a summary of the daily traffic count trends on the highways in the immediate vicinity of Mark Twain Lake during the 1990-1999 period. Major traffic movement within the area is on U.S. Highway 61 on which traffic increased by 60 percent during the 1990-1999 period. Traffic on the major feeder highways from U.S. 61 to Mark Twain Lake has also increased during this period, with increases of 56 percent on State Highway 19 and 33 percent on U.S. Highway 24. However, as indicated in TABLE 6-2, daily traffic volume on the roads immediately adjacent to Mark Twain Lake has not increased substantially during this period. For example, daily traffic volume on Route J – a major center of activity on Mark Twain Lake – increased by only 10 percent during this same period. Overall daily traffic volume on State Highway 107 at Route U – the central point of Mark Twain Lake State Park – is approximately equal to one-half the daily volume on Route J, with about twice as much traffic coming from the south as from the north.

There are no short-range major highway improvement projects funded or planned for the immediate Mark Twain Lake area. State Highways 19 and 54 were on the Missouri Department of Transportation's 15-Year Plan for a 4-lane improvement, but the lack of funding has resulted in this plan being modified or postponed.

6.04 ECONOMIC CHARACTERISTICS

Manufacturing, services, retail trade and agriculture comprise the major employment sectors in Northeast Missouri. Total full-and part-time employment in the more immediate area of Monroe and Ralls counties totaled 9,481 in 1998, of which 22 percent were engaged in manufacturing; 19 percent in agriculture or farming; and 17 percent each in retail trade and services. Employment within Monroe and Ralls counties has increased 17 percent since 1990, approximately equivalent to the relative employment increase for Northeast Missouri, and exceeding the 14 percent statewide employment increase.

Employment directly associated with Mark Twain Lake and Mark Twain State Park includes employees of the U.S. Army Corps of Engineers, State Department of Natural Resources, Missouri Water Patrol, and the commercial concessionaires. The Corps of Engineers has 26 full-time employees with additional part-time summer employees, while the State Department of Natural Resources has seven full-time employees with additional part-time summer employees. The Missouri Water Patrol usually employs three/four seasonal employees for lake patrol. In addition, the Blackjack and Indian Creek marinas together have approximately 55 employees during the boating season (April–October), with a skeleton staff the remainder of the year.

6.05 ACCESSIBILITY

a. Major Highways. Major highways providing access to Mark Twain Lake are U.S. Highway 24 to the north and west, State Highway 154 to the south and State Highway 19 to the east. State Highway 107 runs north from Highway 154 bisecting the lake and ending at Highway 24. These highways provide the public with safe and adequate access to all areas of the project.

b. County Roads. Local county authorities are responsible for the maintenance of several off-project roads that provide the public with access from major highways to recreation areas. The condition of these roads varies, however, most can be considered as adequately maintained. The following roads with access descriptions are the primary routes of travel used by the visiting public.

(1) State Route J from Highway 154. This road provides access to the Ray Behrens, South Spillway, John C. “Jack” Briscoe, North Spillway, Frank Russell, and John Spalding Recreation Areas, as well as the Mark Twain Lake Project Office. Ralls County.

(2) State Route EE from Highway 19. This road leads from Highway 19 west to Route J. Ralls County.

(3) State Route BB from Route J. This road leads to Route BB boat ramp; Hunter Fisherman Access 60. Ralls County.

(4) John F. Spalding Access Road (Old State Route J) from Route J. Leads to John F. Spalding Recreation Area. Ralls County.

(5) State Route N from Highway 24. Leads to Route N Boat Ramp, Hunter Fisherman Access 11. Monroe County.

(6) State Route HH from Highway 24. Leads to Indian Creek Access Road and Shell Branch Recreation Area, Hunter Fisherman Access 15. Monroe County.

(7) Indian Creek Access Road (County) from State Route HH. Leads to Indian Creek Recreation Area. Monroe County.

(8) State Route U from Highway 107. Leads to Mark Twain State Park and Historic Area. Monroe County.

(9) Robert C. Allen Access Road (County) from Highway 154. Leads to Robert E. Allen Recreation Area. Monroe County.

6.06 RELATED RECREATIONAL AND HISTORICAL AREAS

The Mark Twain Lake Project is the primary source of outdoor recreational activities for the area. Hunnewell Lake administered by the Missouri Department of Conservation and the Route J Reservoir run by Monroe City are the two closest lakes to Mark Twain Lake and both lakes are very small. Although these have camping, picnicking and boating opportunities, they do not compete nor compare to the opportunities offered at Mark Twain Lake. The Mississippi River is approximately 30 miles from Clarence Cannon Dam and provides the public with numerous outdoor recreational opportunities on a large river environment. Hannibal, Missouri, located 28 miles northeast of Clarence Cannon Dam, is the site of Mark Twain's Boyhood Home. A shrine

commemorating the birthplace of Mark Twain is located on Mark Twain State Park lands near Florida, Missouri. These two historical areas provide visitors to the lake with supplementary points of interest.

6.07 RESERVOIR PLAN OF REGULATION

Operational concepts and plan of operation for Mark Twain Lake are explained in Paragraph 2.03.

6.08 RELOCATIONS OF ROADS, CEMETERIES, RAILROADS, AND UTILITIES

a. Highways.

By authority of a one time approval by Office of Chief of Engineers, the top of pier elevations for State Highways were set relative to an assumed flood of record estimated at 640.0 feet NGVD. Elevations for County roads were determined by the classification of the particular road and minimum elevations vary between 626.0 feet NGVD and 636.0 feet NGVD. The general policy used in the plan of relocation was to maintain the continuity of the existing road network on each side on the reservoir and to provide access to remaining properties and residences adjacent to the reservoir substantially equivalent to that which they previously had.

b. Railroads.

Operations on the Mark Twain Lake project affected the Norfolk and Western Railroad system at two locations. It was required that the track be relocated in the general vicinity of Stoutsville, Mo. One section of track was relocated to the north of the old alignment beginning at a point approximately 1,900 feet west of the North Fork Salt River crossing and extending eastward through Stoutsville, MO and northward to a point approximately 100 feet north of U.S. Route 24. Another section of track was relocated to the south of the old alignment extending 3,400 feet west and 2,400 feet east of the Otter Creek crossing. These sections of track were relocated with base of rail at minimum elevation 644.5 feet NGVD. The relocation involved the reconstruction of the bridges over the North Fork of the Salt River and Otter Creek to a low steel elevation of 638.5 + and 642.0 feet NGVD respectively. In addition to the above relocations, the end cones of the embankments at each abutment of the Burlington Northern Railroad Bridge at the North Fork River crossing were protected from pool effects by the addition of riprap on the end cone slopes.

c. Utility Lines.

(1) All major power and telephone facilities within the limits of the conservation pool have either been relocated or removed except for two large power lines. A 69 KV transmission line, owned by Northeast Missouri Electric Cooperative, crosses the project limits immediately downstream of the main dam. A second 69 KV transmission line, owned by Central Electric Power Cooperative, crosses the project just below the South Fork Recreation Area.

(2) In general, clearances are not less than those outlined in the National Electrical Safety Code for all affected by the reservoir.

(3) Two 12-inch diameter Amoco pipelines and a 6-inch diameter Monroe City natural gas pipeline cross the Salt River downstream of the Main Dam and spillway. All three pipelines were relocated to allow the channel to be widened for hydropower operation. Relocation consisted of new pipe materials and concrete weights below elevation 530.0 feet NGVD that was equivalent to existing facilities. The original pipes and weights were removed from the site.

d. Cemeteries.

Thirty-four historic, EuroAmerican cemeteries were affected by the development of the Clarence Cannon Dam and Mark Twain Lake project. Of this total, thirty-three were located within project limits while one was located immediately outside project limits. Twenty-three cemeteries required relocation, seven cemeteries were provided with protective fencing, and four cemeteries were left in their existing condition. Cemeteries that required relocation involved approximately 500 burials. All cemeteries where the ground surface was below elevation 642 feet NGVD were relocated to put them above the lake level that would result from a standard project flood. Cemeteries located within the vicinity of limited recreation development above the 642 feet NGVD elevation were left in place and fenced. Cemeteries located at or above elevation 642.0 feet NGVD, but on Government lands planned for extensive recreational development were also relocated.

6.09 EARTH BORROW AND DISPOSAL AREAS

The project has four major disposal areas within its boundaries. One of the areas is inundated by the lake. Two of the sites are immediately downstream of the dam along the exit channel. These sites are now recreation areas with roads, parking and boat launching facilities. Two other sites have been re-vegetated. One of these sites is located near a water tower just off County Road J where it crosses the lake and the other location is downstream of the exit channel. These sites can be developed, however, subsurface conditions can have extreme variations (boulders, rocks, debris, etc.) and cause additional design and construction costs. Any development such as parking lots, roads and buildings should consider the past use of the land, loads, potential settlements, and excavation techniques required (boulders, rocks, etc.). Disposal areas should be investigated thoroughly before development.

6.10 WATER QUALITY

The affect of coal strip mines, soils of high clay content, and non-point source runoff causes the watershed to have elevated levels of sulfur, iron, nutrients, and colloidal suspended solids. The reservoir has a shallow photic zone, very shallow epilimnetic zone, high algal productivity, and extremely stable stratification. This causes the lake to be eutrophic with an extreme oxygen deficiency within the hypolimnetic waters. The water temperature

control weir appears to function as designed during periods of power generation. However, evacuation of the forebay upon start-up of turbines causes water of poor quality to be released into the re-regulation pool.

Releases from the re-regulation dam had caused downstream problems in the past. Stop logs placed in one gate to act as a skimming weir were used as a temporary cure for downstream problems. A fluctuating intake that changes in conjunction with pool elevation to allow upper level water of good quality to be released downstream was installed in November 1988. This structural modification has provided adequate downstream water quality.

The lake water met state standards applying to primary and secondary contact recreation for the purposes of swimming, boating, fishing and water skiing. The lake appears to be a suitable source for drinking water, both presently and in the future, with the possible exception of taste and odor problems associated with algae. The project area has several pollution potentials, but now no major form of degradation to the lake or streams is apparent. In accordance with an agreement with the Missouri Dept. of Conservation, the pool elevation will be maintained at a constant to slowly rising level during the time of shad and bass spawns if possible, to avoid desiccating the eggs. Water quality monitoring will continue at various locations throughout the watershed to protect human health, public safety, and economic welfare of those at Corps projects, to insure downstream water quality, and to protect the district from litigation and adverse public reaction. Annual Water Quality Reports are written in accordance with ER 1110-2-8154 (Water Quality and Environmental Management for Corps Civil Works Projects) 31 May 1995 and submitted to Division.

6.11 FOREST, MINERAL, AND WATER RESOURCES

The pre-project exploitation of mineral and timber resources near the project area was not considered detrimental to public use and enjoyment of the resource base, nor does it constrain or influence resource development and management.

a. Timber Resources. Major forest types of commercial value found within the project area are oak-hickory, and bottomland hardwoods. At present the timber resources can be classified as poletimber or immature sawtimber. The existing timber quality is a direct result of past land management practices prior to purchase. There is, however, the potential to support local mills with limited intermediate cutting practices, establishing a solid timber base for future planning.

(1) The Oak-Hickory Forest Type. The white oak-black oak-northern red oak (Forest Cover Type No. 52) is the most common association on upland sites. The white oak association (Forest Cover Type No. 53) also occurs frequently. Shagbark hickory comprises a substantial stocking on most upland sites.

Dominant trees include white oak, northern red oak, and black oak. Hickory spp. and Ash spp. usually occupy the co-dominant or intermediate class. Sugar maple, elm, black cherry, red bud, flowering dogwood, and serviceberry are the predominant understory species. Understory shrub species include fragrant sumac, corralberry, greenbriar, and various forms of shade tolerant grasses

(2) The Bottomland Hardwoods Forest Type. Flood plain forests of the Salt River Basin are predominately silver maple and American elm (Forest Cover Type No. 62); however, local variations do occur in the area with such species as eastern cottonwood, sycamore, river birch, pin oak, green ash, persimmon, hackberry and black willow being common.

b. Mineral Resources. No economic deposits of metallic minerals occur within the project area; however, there are other deposits of economic or potentially economic grade resources within the reservoir area. These include fire-clay, limestone, sand and gravel, and coal.

(1) Fire-Clay. The Cheltenham Clay is the chief source of high-grade ceramic clay in the region, and is known to occur within the project area, and adjacent uplands. At present, clay is only being produced locally in the Goss area, approximately 14 miles west of the dam site. These deposits generally occur at elevations above maximum flood pool; however, it is possible that some of the clay pits may be deep enough to be impacted by prolonged periods of high pool. Sump pits in some of the excavations are below maximum flood pool, but it is believed that seepage into these pits from the reservoir will be minimal due to the short periods of high water and natural topographic boundaries between the pits and the reservoir.

(2) Limestone and Gravel. Limestone is suitable for use as flagstone. Crushed stone is common in the reservoir area and outcrops are numerous. To be commercially useful limestone should be chert free with relatively shallow overburden, accessible to transportation, and relatively free of impurities. The potentially economic limestone units within the project area are the Chouteau and the lowest portion of the Burlington Formations. There are a few limestone quarries in the area, but no known active quarry will be impacted by even extended periods of maximum pool. The quarry previously operated by the State of Missouri for resurfacing Highway J is now inundated by the reservoir.

(3) Sand and Gravel. There were, at the time the dam was under construction, several producers of sand and gravel operating in the project area. Production of sand and gravel is generally accomplished by locating a suitable bar or deposit in the riverbed, and removing the material by dragline or similar procedure. After depletion of the deposit, or location of more economically exploitable deposits elsewhere, the operation is moved. The worked sites are sometimes replenished during seasonal periods of high water, and may be reworked following sufficient re-deposition. The completion of the dam and reservoir has virtually eliminated this cycle of replenishment, to the extent that production will be limited to existing deposits downstream of the dam

without significant renewal. Because of the method of operation, all of the areas upstream of the dam have been impacted by the reservoir. Those areas inundated by the pool are no longer accessible to exploitation.

(4) Coal. There are no economic coal deposits known to exist within the reservoir area; however, there have been small coal strip mining operations on lands near the project area southeast of the reservoir. The mining has been of low sulfur coals in the discontinuous Pennsylvanian Cabannis Subgroup. Minor discontinuous coal seams exist within the reservoir area in the Tebo, Scammon, and Weir cyclothems of the Cabannis Subgroup. These deposits outcrop along some of the tributaries of the Salt River in the southern and western portions of the reservoir area west of Highway 107, along Highway 154. These deposits are found at elevations from 640 to 690 feet NGVD, generally above the maximum flood pool.

c. Groundwater. Groundwater near the reservoir is obtained from several sources. Shallow sources of groundwater include the glacial till and recent alluvium in the valleys of the Salt River and some of the tributaries. Deep sources are the Burlington and other early Mississippian limestones, and the St. Peter Sandstone (Ordovician.) The majority of producing wells on farms in the vicinity are in the Burlington Limestone. Water quality varies with the degree of mineralization. The wells producing from the alluvium generally yield water containing lower mineral content, and consequently better quality water. Many of the wells on farms in the vicinity produce water that is mineralized to the extent that farmers haul water or have cisterns for domestic use. There appear to be three groundwater levels present in the reservoir area, and not all three are necessarily present everywhere.

Well capacity, although not completely a function of well depth, is generally greater in the deeper wells. Shallow-dug wells produce varying amounts of water generally in the range of 1 to 5 gpm. Wells drilled to depths from 70 to 300 feet produce from 5 to 13 gpm, and wells deeper than 300 feet may produce anywhere from 5 to 50 gpm. No negative impact on water quality or well production is anticipated as a result of lake management policy. The impact on groundwater resources from wells and waste treatment facilities associated with recreation areas should be addressed on a site-specific basis.

6.12 RECREATION ATTENDANCE AND FACILITY REQUIREMENTS

a. Existing User Demand. Existing user demand is reflected using 2001 visitation as a basis for computations. Facility requirements are based on current visitation, design criteria, and guidelines detailed in the Institute for Water Resources' Research Report 74-RI (Estimating Recreational Facility Requirements, Volume IV). These requirements are oriented toward key facilities that include campsites, picnic units, boat launching lanes and beach area. This planning methodology estimates the number of facilities necessary to satisfy recreation use on an average weekend day during the peak month of visitation.

(1) Facility Design Day Load. This determination represents the anticipated number of users visiting the project on an average weekend day during the peak month of use. Based on 2001 visitation, the present facility day load is estimated at 26,904. (See TABLE 6-3, Actual and Projected Annual Visitation).

(2) Summary of Existing User Demand. Utilizing the facility design day load, participation rates for each activity requiring facilities, and the appropriate activity turnover rates, the principal recreation facility requirements were estimated. The existing facility user demand estimate is presented in TABLE 6-4.

(3) Summary of Existing Facility Supply. The existing supply of key park and recreation facilities is presented in TABLE 3-1 in Section III. The principal agencies developing facilities at Mark Twain Lake are the Corps of Engineers and the Missouri Department of Natural Resources. The state contributes to the supply of campsites, picnic sites, boat launching ramps, and beaches. Appendix A discusses recreation facility development (existing, proposed, future) by the Missouri Department of Natural Resources.

TABLE 6-3
ACTUAL AND PROJECTED ANNUAL VISITATION IN RECREATION USE DAYS[4] MARK TWAIN LAKE, MISSOURI

Year	Actual
1976	220,536
1977	146,023
1978	295,021
1979	229,300
1980	215,171
1981	139,741
1982	258,057
1983	424,339
1984	665,577
1985	850,700
1986	1,684,372
1987	1,863,104
1988	2,030,000
1989	1,865,980
1990	1,834,157
1991	1,849,844
1992	1,648,429
1993	1,423,489
1994	1,696,376
1995	1,685,983
1996	1,636,607
1997	1,664,087
1998	1,218,199
1999	1,794,386
2000	1,836,028
2001	1,806,966
2002	2,306,286
PROJECTED[5]	
2010	2,282,683
2015	2,485,063
2020	2,687,443

[4] See Table 2-1 for visits and visitor hour data.

[5] Computed using FORECAST equation in EXCEL for the years 1990 – 2002.

TABLE 6-4 PRINCIPAL RECREATION FACILITIES: EXISTING SUPPLY AND DEMAND SUMMARY

Facility	Corps	State**	Total	Existing Demand	Existing Excess(+) /Shortage(-)
Camp Units* (trailer or tent)	465	103	568	740	-172
Picnic Units	90	30	120	112	+8
Boat Ramp Lanes	45	9	54	52	+2
Swimming Beach (Linear feet of shoreline)	1016	300	1316	1345	-29

*Number includes sites able to accommodate trailer and/or tent camping. The hike-in tent camping area at Indian Creek, the tent only area at the Indian Creek Group Use Area, the Hunter/Fisherman Lot sites and the John C. "Jack" Briscoe Group Use Area are not included in this total.
**Number of facilities located on State Park fee title lands.

(4) Evaluation of Existing Supply and Demand

(a) Camp Units - The most critical need for new facilities is for additional camping facilities. The existing supply falls short of demand by 172 campsites as shown in TABLE 6-4. Campsite utilization percentages for Saturday nights averaged by month for the years 2000 through 2002, shown in TABLE 6-5, indicates that camping is on the rise at all three campgrounds.

Plans for additional sites in the Indian Creek Campground were proposed and approved in Supplement No. 7, Additional Recreational Facilities, Design Memorandum, No. 9, the Master Plan, 1982. However, based on current visitor use patterns and trends, the Ray Behrens Campground would be the preferred location to meet this demand.

While these additional campsites would help meet the current demand, growth in visitation is expected, based upon recent visitor use trends. According to these trends and existing demand for camping units (See Table 6-4), growth in demand for campsites and support facilities is expected.

A campsite reservation system was initiated in 1990 to alleviate some of the problems caused by the lack of campsite availability. In 1990, the reservation system was limited to 75 sites in the Indian Creek Campground. Because of the popularity of the reservation system, the program has been expanded to include various loops in all three campgrounds.

TABLE 6-5

CAMPSITE UTILIZATION PERCENTAGES				
RAY BEHRENS		2000	2001	2002
	MAY	74%	76%	63%
	JUNE	74%	86%	93%
	JULY	83%	72%	92%
	AUGUST	71%	80%	84%
	AVERAGE	**76%**	**79%**	**83%**
INDIAN CREEK		2000	2001	2002
	MAY	58%	51%	46%
	JUNE	55%	60%	62%
	JULY	66%	65%	68%
	AUGUST	53%	60%	64%
	AVERAGE	**58%**	**59%**	**60%**
FRANK RUSSELL		2000	2001	2002
	MAY	49%	44%	40%
	JUNE	35%	53%	72%
	JULY	45%	50%	60%
	AUGUST	38%	52%	54%
	AVERAGE	**42%**	**50%**	**57%**

(b) Picnic Units – Picnic units have been reduced from a total of 310 in the previous Master Plan update to 120 in this plan. The public is not using this type of facility in large numbers except at beach areas where picnicking occurs frequently. The other recreation areas only require a smaller number of tables to meet demand. TABLE 6-4 shows a very small oversupply in picnic units provided as compared to estimated demand.

(c) Boat Launch Lanes - TABLE 6-4 shows an oversupply in the number of boat launch lanes available compared to estimated demand. However, because some of the lanes are located in very remote areas, use is not evenly distributed at all of the ramps and some experience periods of overcrowding.

(d) Swimming Beach Area - TABLE 6-4 shows a small deficit in linear feet of beach available to visitors. However, a large portion of the beach frontage is concentrated in only one public beach area that already experiences overcrowding occasionally. Of the three beaches at the lake, one is only open to campers at the Indian Creek campground. Availability of swimming beach area is considered adequate for now.

b. Projected User Demand. Using projected visitation, current planning and design criteria, and the procedures and guidelines outlined in the Institute for Water Resources' Research Report 74-RI (Estimating Recreational Facility Requirements, Volume IV), the projected recreation facility requirements through the year 2020 were computed and are presented in TABLE 6-6. According to the procedures noted above, deficiencies in the number of

camping units and linear swimming beach are indicated. Only minor deficiencies are indicated for picnic units and boat ramp lanes. Further detailed evaluations will be required to substantiate the key facility demand levels identified by this planning methodology.

TABLE 6-6
SUMMARY: PROJECTED RECREATION FACILITY REQUIREMENTS

Facility	2010	2015	2020
Camp Units	829	879	930
Picnic Units	125	133	140
Boat Ramp Lanes	63	67	71
Swimming Beach (Linear feet of shoreline)	1507	1599	1691

6.13 ENVIRONMENTAL AND ECOLOGIC CONCERNS

The need for the continued protection of the project's natural areas is a key concern. Potentially incompatible uses of these areas shall be prohibited.

Project management practices will be used to maximize the support value of the project for fish and wildlife production, while at the same time maximizing recreational opportunities for hunters and fishermen. Waterfowl management objectives will be fully coordinated with other agencies and should be consistent with the North American Waterfowl Management Plan. The lake's future potential for commercial fishing activity should not be over-looked. The Corps needs to continually monitor the lake's water quality, and to alert regulatory authorities of identified sources of contamination and of the need for implementing rectifying measures to control such pollution.

Specific management practices formulated for the project's operations and maintenance will take into account the need to protect and enhance conditions for Federally-listed and state-listed endangered species provided in TABLE 6-7. Additional observations and field study are needed to determine the presence or absence of endangered species. Management practices will also take into account carrying capacities for developed recreation areas. Management and maintenance practices will include regulating visitor numbers and erosion/site deterioration repairs.

TABLE 6-7

FEDERAL AND/OR STATE THREATENED AND ENDANGERED PLANT AND ANIMAL SPECIES KNOWN TO OCCUR OR THAT MAY POTENTIALLY OCCUR WITHIN THE MARK TWAIN LAKE AREA*

Common Name	Scientific Name	State Status	Federal Status
Bald Eagle	Haliaeetus leucocephalus	Endangered	Threatened
Indiana Bat	Myotis sodalis	Endangered	Endangered
Henslow's Sparrow	Ammodramus		Species of Concern
Greater Prairie Chicken	Tympanuchus cupido	Endangered	
Gray Bat	Myotis grisescens	Endangered	Endangered
Wild Sarsaparilla	Aralia nudicaulis	Rare	
Rock Pocketbook	Arcidens confagosus	Rare	
Prairie Dandelion	Microseris cuspidate	Rare	
Ghost Shiner	Notropis buchanani	Watch List	
Hickorynut	Obovaria olivaria	Watch List	
Wartyback	Quadrula nodulata	Rare	
Ditch Grass	Ruppia maritime var rostrata	Extinct	
Meadow Willow	Salix petiolaris	Endangered	
Fat Pocketbook	Potamilus capax	Endangered	Endangered

*Based upon information provided in the Missouri Heritage Database