# CHAPTER 2 - MISSOURI RIVER BASIN

The Missouri Basin is vast and diverse. This chapter describes its diverse nature under five headings: physical characteristics, biological and esthetic characteristics, socioeconomic characteristics, water resources characteristics, and legal and institutional characteristics. The description provides a perspective for understanding the direction of and need for implementing the regional plan for the Missouri River Basin.

The basin description is followed by an overview of the basinwide and statewide components of the plan. The basinwide components, which are presented in tabular form following the plan overview, are recommended programs of significance to all or a large part of the Missouri River Basin. A series of recommended statewide water resources programs follows the basinwide programs section. The final section of this chapter presents conclusions and additional recommendations of basinwide application.

It is important to note that the plan for each subbasin includes both the material presented in the respective subbasin chapter and also the relevant basinwide and statewide recommendations in this chapter.

## DESCRIPTION OF THE MISSOURI RIVER BASIN

### PHYSICAL CHARACTERISTICS

The Missouri River Basin encompasses one-sixth of the contiguous area of the United States. It is bounded by the Rocky Mountains on the west, by Canada on the north, by the Souris-Red River basins on the northeast, by the upper Mississippi River basin on the east, and by the Arkansas-White-Red River basins on the south. Figure 2-1 shows that the basin includes all of the State of Nebraska; most of Montana, South Dakota, and Wyoming; about half of Kansas, Missouri and North Dakota;

Figure 2-1 – Missouri River Basin, Physical Setting

smaller parts of Colorado, Iowa, and Minnesota; and parts of southern Alberta and Saskatchewan in Canada. The Missouri River is formed by the junction of the Jefferson, Gallatin, and Madison Rivers in southwestern Montana and flows generally southeastward 2,315 miles to its junction with the Mississippi River 15 miles above St. Louis, Missouri. The Missouri River and its tributaries drain 328.5 million acres within the United States and about 6.2 million acres within Canada. The Canadian drainage area is not considered in this report.

Three major physiographic divisions within the basin, as shown in figure 2-1, are the Interior Highlands, the Interior Plains, and the Rocky Mountain System. The western boundary of the basin is formed by the Rocky Mountain System, an area of exceptionally rugged topography. Many of its peaks surpass 14,000 feet (mean sea level) in elevation. This 35.2-million-acre mountainous area is marked by many high valleys, but the peaks and mountain spurs are predominant.

Extending eastward from the Rocky Mountain System are the Interior Plains, including some 230.4 million acres classified as the Great Plains province and 56.3 million acres called the Central Lowlands province. The Great Plains province is in the west-central part of the basin and has, in general, a flat to gently rolling topography. Average west-to-east slopes are about 10 feet to the mile from an average elevation of 5,500 feet along the western boundary of the Great Plains at the foot of the Rocky Mountains to the 1,500-foot contour that approximates the eastern boundary of the province.

There are two other types of landforms within the Great Plains. Isolated dome-type uplifts have formed rugged, almost mountainous areas such as the Black Hills of western South Dakota and northeastern Wyoming. The other type of landform consists of moderately sloping sand dunes stabilized by grasses with many shallow basins, ponds, and swamps. Principal among these is the Sand Hills area of north-central Nebraska.

The other province within the Interior Plains, the Central Lowlands, extends eastward from the Great Plains to the upper Mississippi River divide. The land is generally level except where stream development has created a hilly topography.

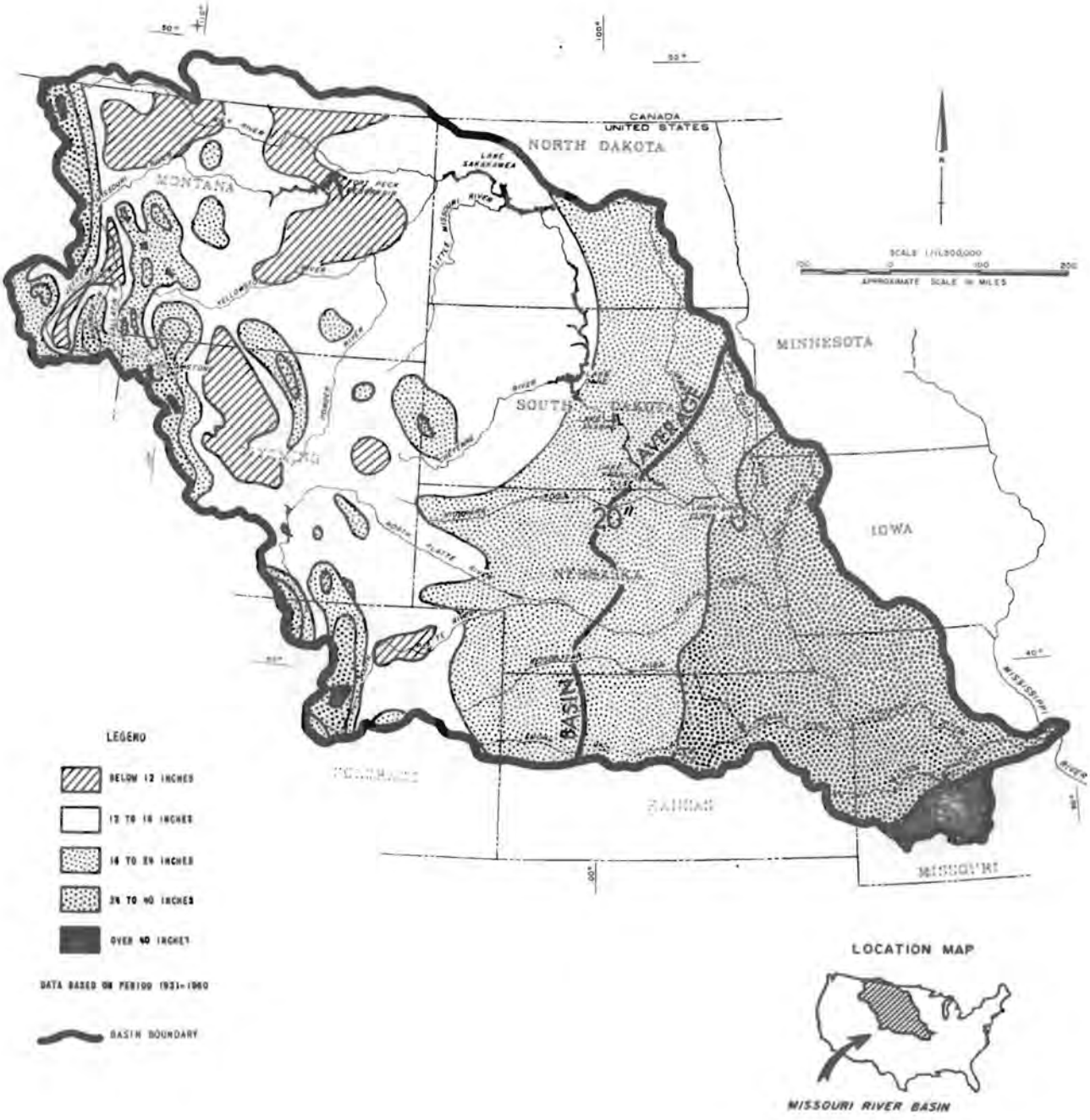
In the southeastern part of the basin is a 7-million-acre area of hilly to mountainous land called the Ozark Plateaus of the Interior Highlands.

The climate within the basin is determined largely by the interaction of four extensive air masses: warm, moist air from the Gulf of Mexico; cool, moist air from the northern Pacific Ocean; cold, dry air from the northern polar regions; and hot, dry air from the plateaus in north-central Mexico. Because of the extreme differences in the characteristics of these four air masses, weather changes are sudden and severe. Local climates can be greatly influenced by the Rocky Mountains, as evidenced by substantial temperature and precipitation anomalies. Lifting of air masses over the Rocky Mountains often produces precipitation on the windward side of the mountains and dry, warm chinook winds on the leeward side.

Primarily because of its mid-continent location, the basin experiences weather that is known for its fluctuations and extremes. Averages are misleading because average weather seldom actually occurs. Instead, weather tends to fluctuate widely around the annual averages.

Normal annual precipitation varies from west to east in the basin, averaging over 35 inches in the Rocky Mountains of the western boundary, about 14 inches on the Great Plains, about 26 inches on the Central Lowlands, and over 36 inches in the Interior Highlands. Figure 2-2 shows normal annual precipitation for the period 1931-1960. About 70 percent of the precipitation occurs as rainfall during the growing season.

Figure 2-2- Missouri River Basin, Normal Annual Precipitation.



One climatic factor of great importance because of the agricultural activity in the basin is the length of the frost-free period. The frost-free period is the average number of days each year between the last freezing temperature in the spring and the first frost in the autumn. While the frost-free period does not completely define the growing season for all crops and grasses, it is a general indicator of the most favorable period. The length of the frost-free period in the basin is about 30 days in the higher elevations of the Rocky Mountains, about 140 days on the Great Plains, and about 180 days in the Interior Highlands.

## BIOLOGICAL AND ESTHETIC CHARACTERISTICS

### Terrestrial Biological Resources

Ecosystems of the Missouri River Basin were originally dominated by of grasslands in the prairies and plains region, and by forests, shrublands, mountain grasslands, and alpine tundra in the mountainous regions. Gallery forests have developed along the major rivers and streams, especially in the Middle Missouri and Lower Missouri subbasins. During the last few years many grasslands of the plains and prairie region have been converted to cropland where soils, topography, and climate favorable to farming exist. Although river bottomland forests in many parts of the basin, have been eliminated or have deteriorated, many still afford key habitat for native plants and animals. Sizable acreages of natural grasslands also persist in several areas. The shrubland, woodland, and forest land of the mountains have not been subjected to the disturbances such as those which have occurred on the prairies and retain more of their natural characteristics.

Native plants and animals in the Missouri River Basin have been exposed to a succession of changing environments in the geological past, and only a few known endemic species have managed to survive the extremes of the ice age.

Many species which survived the glaciers were forced to migrate or were subsequently exposed to disturbances caused by man. As a result, some became extinct, others lost most of their habitat.

Big game animals such as moose, elk, deer, Rocky Mountain goats, big horn sheep, and grizzly and black bears, continue to inhabit the basin. Also, a nearly extinct species, the native bison, has made a comeback through development and management of herds on private and public lands.

Small game are in abundant supply in most basin States, although the white-tailed jackrabbit is now nearly extinct in Missouri, Kansas, and parts of Nebraska. Upland game birds tend to be scarce, with the exception of mountain grouse in mountainous western regions and sharptail and sage grouse in portions of Montana, Wyoming, South Dakota, and Nebraska. The northern greater prairie chicken is persisting in sizable numbers in a few prairie regions, particularly in Kansas, but is considered a threatened species in several other States. Ring-necked pheasants, a valuable hunting resource, has suffered severe population declines in several States. Quail surpluses are beginning to disappear as habitat declines over Nebraska, Iowa, Kansas, and portions of Missouri. Of the upland game birds, only wild turkey populations have increased during the past decade. Further enhancement is limited, however, because of lack of suitable woodland habitat.

Aquatic Biological Resources

The natural lakes and streams of the basin contain mostly plant and animal life common to other major river basins in North America. In the Missouri River, an original array of native fish species lives in free-flowing reaches. However, several species, the sturgeon, the paddlefish, and several forage types, have become rare, threatened, or endangered. Others such as the sauger

and blue catfish have also greatly declined in number. Consequently, the quality of sport fishing is generally only fair.

Tributaries of the upper Missouri, Yellowstone, and Platte Rivers and the alpine lakes in Colorado, Wyoming, and Montana have cold waters which support high quality trout fisheries. Management of the larger reservoirs has at times produced high quality fisheries of trout, bass, northern pike, and walleye. High quality warm water natural streams, especially the Gasconade and Niangua Rivers in Missouri, contain a highly diverse population of fish.

Although drainage has eliminated many of the wetlands in the lower States of the basin, extensive areas still exist in Montana, North Dakota, South Dakota, and in the Nebraska Sand Hills. Duck populations have varied, but the goose population has been more stable during the past decades and has increased slightly. In some semiarid portions of the basin, development of small reservoirs and stockponds has enhanced waterfowl populations. This development has only partially offset the loss of natural wetlands.

Historically, other aquatic or aquatic-dependent species have not fared as well as waterfowl. Large furbearers such as the river otter, now nearly extinct in the basin, and various large predatory birds such as the endangered whooping crane, and to a lesser degree, the northern bald eagle, the white pelican, the trumpeter swan, and the osprey, fall in this category.

Natural, Esthetic, and Cultural Resources

Many unique or outstanding large natural areas in the basin have been preserved or are managed by the Federal Government. These areas include scenic badlands, high mountain ranges, mountain streams and canyons, alpine lakes, extensive coniferous forests, lakes and marshes in the sandhill prairies, and several unique landmarks and geological formations. Several outstanding

wilderness areas within the national forest system have been preserved, and recently a number of grassland wilderness areas were set aside as national refuge or monument lands. Several national parks, including Glacier, Yellowstone, and Rocky Mountain, provide extensive outdoor recreation.

Since the passage of the national Wild and Scenic Rivers Act, increased attention has been given to qualifying rivers within the basin as wild and scenic or recreational. Federal efforts have been supplemented by State and private efforts to acquire outstanding natural areas. In some cases the private effort has been significant in filling in voids in Federal and State programs. Cultural, historic, and archaeological resources have also received Federal protection and interpretation, and several outstanding sites have been acquired.

## SOCIOECONOMIC CHARACTERISTICS

### Population

In 1975, the population of the basin was estimated at 9 million, or about 4.3 percent of the national total. Although the basin's population has slowly increased since 1940, its proportion of the U.S. population has declined, reflecting a decline in small-scale farming and agricultural employment.

Fifteen Standard Metropolitan Statistical Areas (SMSA's) are currently designated in the region. Their locations are shown on figure 2-3. They contained nearly half of the basin's total population and 75 percent of its urban inhabitants in 1975. All metropolitan areas in the basin have experienced population increases since the 1930's.

Two trends can be expected to influence future settlement in the basin. First, population is expected to increase in those urban areas near energy development sites. A second is the increased preference of persons not engaged in agriculture to settle outside of metropolitan areas.

Figure 2-3 - Missouri River Basin, Standard Metropolitan Statistical Areas

The native American Indian is an important ethnic group in the basin. In 1975, the estimated Indian population of the basin's 23 reservations totaled 65,400. Indian population on reservations is projected to grow to nearly 84,000, an increase of over 25 percent, by the year 2000. The 1970 U.S. Census showed the median income for Indian families to be about half that for non-Indian families and far below the federally defined poverty level.

As shown in table 2-1, basin population is projected to increase by 11 percent over the period 1975-1985 and by 30 percent over the period 1975-2000. Changes in the spatial distribution of the population will accompany increases in total population. Most notable is an expected 48 percent growth in urban population by the year 2000. Correspondingly, rural population is projected to decrease by 4 percent during the 1975-2000 period.

Employment

The Missouri River Basin is one of the Nation's most economically diverse areas. While agriculture has historically dominated the economy, the region also has produced metallic and precious minerals, timber products, energy fuels, and electric power. More recently, substantial increases in mining, manufacturing, and recreation-tourism have served to further diversify the economic activities.

Historical and projected employment characteristics of the basin generally correlate with those of the Nation. From 1940 to 1960, the region experienced a 35 percent decline in agricultural employment while realizing a 116 percent increase in the manufacturing sector and a 60 percent increase in the other employment sectors. Projected employment trends for the period 1975-2000 show a continuation of the historical employment distribution pattern, but at a slower rate of change. By 1985, manufacturing employment is projected to stabilize at 14 percent of the basin's employed population. Agricultural

TABLE 2-1
POPULATION AND EMPLOYMENT CHARACTERISTICS FOR
1975, 1985, AND 2000
MISSOURI RIVER BASIN

| Population/ Employment | 1975 | 1985 | 2000 | Percent Change 1975-2000 |
|---|---|---|---|---|
| Population | 9,068,000 | 10,063,500 | 11,805,300 | +30 |
| Urban | 5,942,900 | 6,974,300 | 8,810,300 | +48 |
| Rural | 3,125,100 | 3,089,200 | 2,995,000 | - 4 |
| Employment | 3,912,000 | 4,981,200 | 5,596,800 | +43 |
| Agricultural | 414,200 | 388,100 | 338,500 | -18 |
| Nonagricultural | 3,497,800 | 4,593,100 | 5,258,300 | +50 |

Source: 1975 National Water Assessment, Missouri Region
State-Regional Future

employment will continue to decline through 2000 and should achieve stabillty at about 6 percent of the basin's employed population around the turn of the century.

Between 1975 and 2000, Indian employment is projected to increase from 17 percent of the Indian population to 19 percent. In 1970, Indian unemployment was about seven times that for the United States overall, as high as 70 percent on some reservations.

Economy

Since the Federal Homestead Act of 1862 opened the land in the Missouri River Basin to agriculture, the basin has become an extremely important producer of the Nation's and the world's food supply. By the early 1970's, farmers and ranchers within the basin annually produced close to 33 percent of the U.S. wheat crop, 25 percent of the Nation's sorghum, 25 percent of the Nation's hay, and 22 percent of corn grown for grain. In addition, the region was producing in excess of 20 percent of the Nation's livestock and poultry. From a broader agricultural perspective, regional production accounts for 10 to 12 percent of the world corn harvest and 4 to 6 percent of the world wheat crop annually. Despite the decline in the number of workers engaged in agriculture, this sector is expected to continue as the dominant economic activity.

The basin possesses significant hardwood and softwood timber resources, primarily concentrated in the Rocky Mountains, the Black Hills, and the Ozark Plateau. Harvesting trends have shown increasing timber production since 1961. A large percentage of forests and woodlands are also grazed, providing a second valuable agricultural use.

Metallic and nonmetallic minerals and energy fuel resources developments are important factors in the basin's economic growth. Deposits of metallic ores in the Rocky Mountains and the Black Hills contribute to the Nation's

production of gold, silver, copper, lead, zinc, taconite, uranium, and molybdenum. In addition to metallic minerals extraction, large quantities of nonmetallics such as fluorspar, feldspar, phosphate, lime, mica, bentonite, and construction aggregate are mined in the basin.

Energy fuels presently constitute the largest and most valuable share of all nonrenewable resources produced in the basin. The 10 basin States collectively have more than 450 billion tons of recoverable coal reserves, or about 55 percent of the Nation's total. The national importance of the reserves is evidenced by recent dramatic increases in coal and lignite production. In the seven years from 1965 to 1971, coal production as a percentage of the national tonnage grew only slightly from 3 to 4 percent. For the period 1971 to 1973, however, the basin contribution to total national production increased from 4 percent to almost 8 percent. Except for Nebraska and the Minnesota portion of the basin, all basin States contain substantial coal reserves that are expected to be of increasing national importance in the future.

The Missouri Basin is also an important source of crude petroleum, natural gas, and uranium. Although total petroleum output had declined from 1971 levels, production in 1973 still accounted for 6.5 to 7 percent of the U.S. total. While the future outlook for crude oil, oil shale, natural gas, and uranium production is uncertain, new exploration and recovery efforts are taking place.

Manufacturing activities in the Missouri Basin are varied, but to a large degree reflect the economic predominance of agriculture. Food processing and production of agricultural machinery contribute substantially to manufacturing earnings and employment. Industrial composition projections indicate, however, that a decline in the relative economic importance of these types of activities is likely to occur. Other important types of manufacturing include

electronics, automobile assembly, light industrial activity, paper and lumber production, and chemical and petroleum production. At present, most industrial activities are located in the southern subbasins.

Opportunities to participate in diverse forms of outdoor recreation activities are numerous throughout the basin. In certain subbasins, including the Upper Missouri, Yellowstone, and in the western portion of the Platte-Niobrara subbasin, recreation and tourism are basic to the overall economy, with recreational activities serving as the primary industry for some local areas.

Land Use

The entire Missouri River Basin became the property of the U.S. Government as part of the Louisiana Purchase in 1803. Although substantial land holdings are retained today as Federal public domain, more than 86 percent of the basin's land is in private, Indian, State, and county ownership. Large Federal tracts are managed by the Forest Service (19.4 million acres), Bureau of Land Management (18.5 million acres), National Park Servce (2.3 million acres), Corps of Engineers (2.2 million acres), the Water and Power Resources Service (1.0 million acres); and lesser acreages (1.4 million acres) managed by the military, Fish and Wildlife Service, Bureau of Indian Affairs, and Agricultural Research Service. About 12 million acres, or 4 percent, of the nearly 284 million acres of privately held lands are Indian lands. Title to this land is held in trust by the U.S. Government, but it is legally considered private land owned either by individuals of native American or Indian descent or by tribes.

Based upon estimates made for the U.S. Water Resources Council's 1975 National Water Assessment, approximately 298 million acres or 92 percent of all land in the Missouri Basin is used for agricultural purposes. More than half of the agricultural land is used for pasture and rangeland. Forest and

woodlands occupy another 26.3 million acres. Forest and woodland and pasture and range acreages are expected to decline slightly during the next quarter century, contributing to a moderate overall decline in total agricultural lands.

Dryland farming is the second largest type of agricultural land use in the basin, exceeded only by pasture and rangelands. These nonirrigated croplands are projected to increase over the next 25 years by some 2 percent from their current level of nearly 90 million acres, while pasture and rangeland acreage may decline substantially.

Irrigated cropland, estimated at 11.4 million acres in 1975, constitutes about 4 percent of the present agricultural total. Irrigation is projected to be applied to an additional 2.8 million acres by 1985 and to 5.9 million acres by 2000, covering more than 17 million acres by the year 2000.

The basin's urban and transportation lands are expected to expand from the present 7.4 million acres by 10 percent by 1985, and by 23 percent by the year 2000. Estimates of Missouri Basin land and water acreage for 1975, 1985, and 2000 are summarized in table 2-2.

## WATER RESOURCES CHARACTERISTICS

The Missouri River Basin is, in general, well endowed with surface and ground water resources. However, the occurrence and availability of water is highly variable, subjecting portions of the basin to recurrent local and seasonal shortages.

### Surface Water Availability

Precipitation annually provides more than 500 million acre-feet of water. Infiltration and evaporation deplete a large amount of this naturally occurring moisture. Runoff entering the streams varies widely across the basin, ranging annually from less than an inch in parts of the plains to more than 12 inches in the mountains and the humid southeast. This runoff would account for an

TABLE 2-2
LAND AND WATER ACREAGE FOR
1975, 1985 AND 2000
MISSOURI RIVER BASIN

| Land Use | 1975 | 1985 | 2000 |
|---|---|---|---|
| | | 1,000 acres | |
| Agricultural Lands | | | |
| Cropland | | | |
| Nonirrigated | 89,659 | 91,133 | 91,024 |
| Irrigated | 11,303 | 14,139 | 17,154 |
| Pasture and Range | 167,450 | 162,298 | 158,465 |
| Forest and Woodland | 26,296 | 26,156 | 26,072 |
| Other | 3,698 | 3,689 | 3,697 |
| Subtotal | 298,406 | 297,415 | 296,412 |
| Nonagricultural Lands | | | |
| Transportation, | | | |
| Urban Built-up | 7,435 | 8,149 | 9,099 |
| Other | 18,069 | 18,114 | 17,954 |
| Subtotal | 25,504 | 26,263 | 27,053 |
| Total Land Area | 323,910 | 323,678 | 323,465 |
| Total Water Area | 4,598 | 4,830 | 5,043 |
| Total Area | 328,508 | 328,508 | 328,508 |

Source: 1975 National Water Assessment. Missouri Region State-Regional Future

average of about 65 million acre-feet of natural flow annually at the mouth of the Missouri River near St. Louis, Missouri, exclusive of evaporation and consumptive uses attributable to water resource project developments.

Under 1970 conditions of development and utilization, the net average annual outflow from the basin was estimated to be 53.6 million acre-feet.[1] Recent appraisals, based upon an aggregation of basin State estimates of water use, indicate a 1975 average annual flow of 49.4 million acre-feet at the mouth of the Missouri River near St. Louis.

Abnormally high and low streamflows are not uncommon in most parts of the basin. Indicative of the drought potential is the fact that natural runoff as low as half the mean has occurred in nearly 10 percent of the years of record. At the other extreme, severe flooding caused by snowmelt, spring rains, and thunderstorms, is common in many drainages throughout the basin.

Surface Water Quality

Overall, the water quality of the basin's waterways can be classed as fair. In the western portions, in their headwaters many of the mountain streams remain pristine and pollution-free. Sediment and dissolved solids concentrations become major problems in the rivers as they flow across the plains. In areas where irrigation is practiced, return flows from croplands are often laden with fertilizers, pesticides, and herbicides, degrading nearby watercourses. Runoff containing high concentrations of organic wastes from animal feedlots is another major agriculture-related water quality problem. Finally, municipal and industrial wastes continue to pollute many of the basin's major and minor streams, although ongoing plans and programs are striving to alleviate many of the problems.

## Ground Water Availability

Ground water is the principal supply source in many areas of the Missouri River Basin. Fortunately, the basin has been endowed with abundant ground water of quality suitable for most purposes. Shallow alluvial deposits are found along most major watercourses. Also, extensive quantities of relatively shallow ground water underlie large portions of Nebraska, western Kansas, eastern Wyoming and Colorado, and parts of Missouri and South Dakota. In all, reserves lying at less than 1,000 feet deep are estimated at greater than 3 billion acre-feet.[2] Further, large amounts of ground water are known to exist in extensive sandstones and limestones at depths greater than 1,000 feet. Although these deeper deposits contain more water than the more accessible shallow aquifers, its use is limited by excessive pumping costs and variable quality.

Water tables in some areas of the basin are declining due to withdrawals in excess of recharge. Areas experiencing significant adverse effects include northwestern Kansas, eastern Colorado and Wyoming, northwestern Nebraska, portions of the Platte and Blue Basins in Nebraska, and parts of eastern Missouri. On the other hand, the ground water level is rising in portions of south-central Nebraska due to irrigation canal seepage and infiltration from irrigated lands.

## Ground Water Quality

The quality of ground water in the basin is variable. Water of highest quality is generally derived from dune sand, such as that found in north-central Nebraska, and from deep igneous and metamorphic rock formations. Major sources of ground water are generally sedimentary deposits and valley alluviums. In the former, abundant shallow sandstone and limestone deposits generally yield water of adequate quality for most uses. Water recovered from valley alluviums is influenced by the quality of the surface water, the rock types in the valley, and the surrounding vegetation. Alluviums along many streams contain water with high sulfate concentrations.

Ground water containing concentrations of total dissolved solids exceeding 2,000 miligrams/liter, considered very poor quality, is found in highly developed aquifers in eastern Montana, central South Dakota, western Iowa, and northwestern Missouri.

Interrelationship of Surface and Ground Water

With increasing development of both surface and ground-water resources, their hydrologic interrelationship is becoming increasingly more important to users. Several types of effects have resulted from public and private water and land resource developments. One of the most significant effects occurring in certain areas of the Missouri Basin has been the reduction of inflow to the surface system caused by withdrawals of associated ground water. Ground-water pumping for sprinkler irrigation is diminishing streamflows otherwise available for instream and offstream uses in parts of Colorado, Kansas, and Nebraska. Other notable effects of development occurring within the basin include alteration of runoff and infiltration caused by changes in land use and management, such as conversion of grassland to cropland, and increased aquifer recharge due to surface water storage.

Existing Major Water Resources Development

Initial water resources developments in the Missouri River Basin, beginning more than 100 years ago, were earthen structures built on smaller streams to meet single-purpose needs, primarily water supply. Since the 1930's, surface-water developments have often been supplemented with ground-water development, particularly for privately developed irrigation on the plains of Colorado, Kansas, and Nebraska.

In the past 40 years, a number of major reservoirs have been constructed in the basin. Most of these projects were built to serve multiple purposes and

differed markedly from the earlier single-purpose developments. Project purposes include irrigation water supply, flood control, hydroelectric power generation, navigation, recreation, fish and wildlife enhancement, and industrial water supply.

Perhaps the most prominent multipurpose projects in the basin are the six major Missouri River main-stem reservoirs--Fort Peck, Sakakawea, Oahe, Sharpe, Francis Case, and Lewis and Clark. With the exception of Fort Peck Reservoir, these large projects were constructed by the Army Corps of Engineers under the Pick-Sloan Missouri Basin Program, originally adopted by the Congress in 1944. The Corps was authorized to construct Fort Peck Reservoir in 1933. Each of these projects serves most or all of the purposes listed above. In addition, other large multipurpose projects have been or are being built by the Corps of Engineers and the Water and Power Resources Service in every subbasin in the Missouri Basin. Among these are Canyon Ferry in the Upper Missouri Subbasin; Boysen and Yellowtail in the Yellowstone; Shadehill and Keyhole in the Western Dakotas; Jamestown in the Eastern Dakotas; Seminoe and Glendo in the Platte-Niobrara; Smithville in the Middle Missouri; Tuttle Creek and Milford in the Kansas; and Stockton and Harry S. Truman in the Lower Missouri.

To meet land conservation and management needs, thousands of smaller reservoirs and farm ponds have been installed by the Soil Conservation Service, States, local soil conservation districts, and private individuals. These impoundments provide rural domestic, stock, and irrigation water supply, control sediment and rural flooding, and often provide municipal supply and control urban flooding. Other measures aid in the control of erosion and alleviate drainage problems.

A recent major development in the plains areas of the basin is the advent of center pivot irrigation. Center pivot units use ground water almost

exclusively and usually irrigate a quarter section of cropland each. They have grown quickly in popularity during the last decade because of their ease of installation and operation. The aggregate investment in center pivot systems within the basin now ranges into the billions of dollars.

Hydroelectric power generation facilities are a major component of water development activity in the Missouri Basin. Their installed capacity currently exceeds 3,300 megawatts, representing over 15 percent of the basin's total. The significance of this capacity is perhaps greater than its percentage of the total, since it provides a very efficient, pollution-free source of peaking power for vast areas within as well as outside the basin. The largest hydroelectric power installations are at the main-stem dams.

Another major development in the basin is navigation on the main stem of the Missouri River from Sioux City, Iowa, to the mouth near St. Louis, Missouri. Supported by regulated releases from the main-stem reservoirs and tributary inflows, a channel 9 feet deep and 300 feet wide is maintained over a distance of 732 river miles. The normal navigation season is April 1 through December 1 of each year.

Water Use

Estimates of present and projected water use given in this report reflect, with minor modification, the results of the study conducted by the Commission for the 1975 National Assessment in cooperation with the U.S. Water Resources Council. The estimates for present and projected water supply and utilization were based primarily on basin State estimates of withdrawals and consumption, flow data contained in the 1971 the Missouri River Basin Comprehensive Framework Study, and supplemental information provided by Federal agencies.

Water withdrawals from both ground and surface sources in 1975 were estimated at 38.3-million acre-feet. Withdrawals are projected to increase by

26 percent, to 48.4-million acre-feet by 1985; and by 40 percent, to 53.8 million by the year 2000. Water for irrigation accounts for about 80 percent of all withdrawals in each time frame. Withdrawals for cooling at steam-electric power plants, predominantly from surface sources, run a distant second, accounting for about 10 percent of withdrawals. All other purposes constitute the remaining 10 percent of water withdrawn.

Consumptive use of water is the estimated amount of water loss to the area. Thus, estimated totals shown for consumptive use reflect water taken from all sources including surface, related ground water, and mined ground water, and are not necessarily equal to streamflow depletions.

Consumptive use of water for all purposes was estimated to be 17.6 million acre-feet in 1975. Overall consumption of water is expected to increase to 22.5 million acre-feet by 1985, and to exceed 28.5 million acre-feet by the year 2000. Irrigation dwarfs all other consumptive uses, accounting for some 90 percent of the total in each time frame. Water consumption for livestock production and municipal and industrial purposes each comprise another 3 percent of total consumptive use.

Table 2-3 summarizes Missouri Basin gross withdrawals and consumptive use for seven major purposes for 1975, 1985, and 2000. Table 2-4 displays subbasin totals of gross withdrawals and consumptive use for all functions for the same three time periods.

## LEGAL AND INSTITUTIONAL CHARACTERISTICS

Development and management of water resources has long been recognized in the Missouri River Basin as a joint responsibility of private interests, the States, and the Federal Government. Their resource objectives and programs are largely complementary, as are many of their water laws and policies, though areas of uncertainty and challenge do exist.

TABLE 2-3
WATER WITHDRAWALS (WD) AND CONSUMPTIVE USE (CU) FOR
1975, 1985, AND 2000 BY FUNCTION
MISSOURI RIVER BASIN

| Purpose | 1975 WD | 1975 CU | 1985 WD | 1985 CU | 2000 WD | 2000 CU |
|---|---|---|---|---|---|---|
| | 1,000 acre-feet | | | | | |
| Municipal & Industrial | 1,223 | 479 | 1,668 | 651 | 2,107 | 809 |
| Rural Domestic | 188 | 122 | 204 | 127 | 202 | 122 |
| Manufacturing (Self-Supplied) | 728 | 217 | 1,020 | 376 | 1,308 | 567 |
| Mining | 350 | 127 | 362 | 131 | 446 | 154 |
| Irrigation | 31,390 | 16,053 | 37,688 | 20,351 | 43,226 | 25,331 |
| Livestock | 489 | 480 | 653 | 643 | 826 | 814 |
| Steam Electric | 3,960 | 75 | 6,804 | 264 | 5,690 | 713 |
| Missouri Basin Total | 38,328 | 17,553 | 48,399 | 22,543 | 53,805 | 28,510 |

Source: 1975 National Water Assessment, Missouri Region State-Regional Future

TABLE 2-4
WATER WITHDRAWALS (WD) AND CONSUMPTIVE USE (CU) FOR
1975, 1985, AND 2000 BY SUBBASIN
MISSOURI RIVER BASIN

| Subbasin | 1975 WD | 1975 CU | 1985 WD | 1985 CU | 2000 WD | 2000 CU |
|---|---|---|---|---|---|---|
| | 1,000 acre-feet | | | | | |
| Upper Missouri | 7,043 | 3,527 | 7,923 | 4,086 | 8,804 | 4,645 |
| Yellowstone | 7,445 | 3,181 | 8,267 | 3,654 | 9,155 | 4,150 |
| Western Dakotas | 1,576 | 703 | 3,198 | 1,185 | 4,673 | 1,990 |
| Eastern Dakotas | 518 | 304 | 782 | 474 | 1,175 | 786 |
| Platte-Niobrara | 12,434 | 4,923 | 15,554 | 6,261 | 16,670 | 8,550 |
| Middle Missouri | 2,258 | 232 | 3,244 | 325 | 2,342 | 432 |
| Kansas | 5,556 | 4,506 | 7,622 | 6,261 | 9,171 | 7,496 |
| Lower Missouri | 1,498 | 177 | 1,809 | 297 | 1,815 | 461 |
| Missouri Basin Totals | 38,328 | 17,553 | 48,399 | 22,543 | 53,805 | 28,510 |

Source: 1975 National Water Assessment, Missouri Region State-Regional Future

State Water Laws

In the general field of water law, basin States have adopted two fundamental doctrines which reflect both the origin of those who formulated the doctrines and also the variation in climatic and hydrologic conditions found from subhumid east to arid west.

The common-law doctrine of riparian rights is based primarily on the ownership of land and the beneficial uses of water thereon from a contiguous source. Under the riparian rights doctrine the owner of land contiguous to a natural stream or natural lake may use the waters for such beneficial purposes and in such quantities as he chooses, so long as he does not appreciably diminish the flow or impair the quality of water for downstream uses.

Under the appropriation rights doctrine, the first beneficial appropriation in time is prior in right. Unlike the riparian doctrine, appropriations are established through a legal process for a definite rate of direct-flow diversion or storage. Often the total quantity is specified as not to exceed a given acre-foot total per acre per season, or simply in total acre-feet, as in storage.

Of the Missouri Basin States, Minnesota and Missouri recognize primarily the riparian doctrine while Colorado, Montana, North Dakota and Wyoming have specifically repudiated it and have established the doctrine of appropriation rights. The Iowa water rights law makes diversion, storage, or withdrawal of water in the State subject to permit and administrative regulation and limits permits to a time period not to exceed 10 years. Kansas, Nebraska, and South Dakota depend mainly on the appropriation rights doctrine, but also use the riparian doctrine in varying degrees.

With respect to ground water, there are three common-law rules which are applied throughout the basin. First, there is the so-called "English rule"

which gives the overlying landowner the absolute ownership of water percolating beneath the surface of his lands. Second, is the "American rule", which gives the overlying landowner the right to a "reasonable use" of such water. Third, is the "California rule", which gives the overlying landowner a correlative right to the use of the ground water underlying his land, but which requires him in times of shortage to share the resource with neighbors whose lands also overlie the water resource.

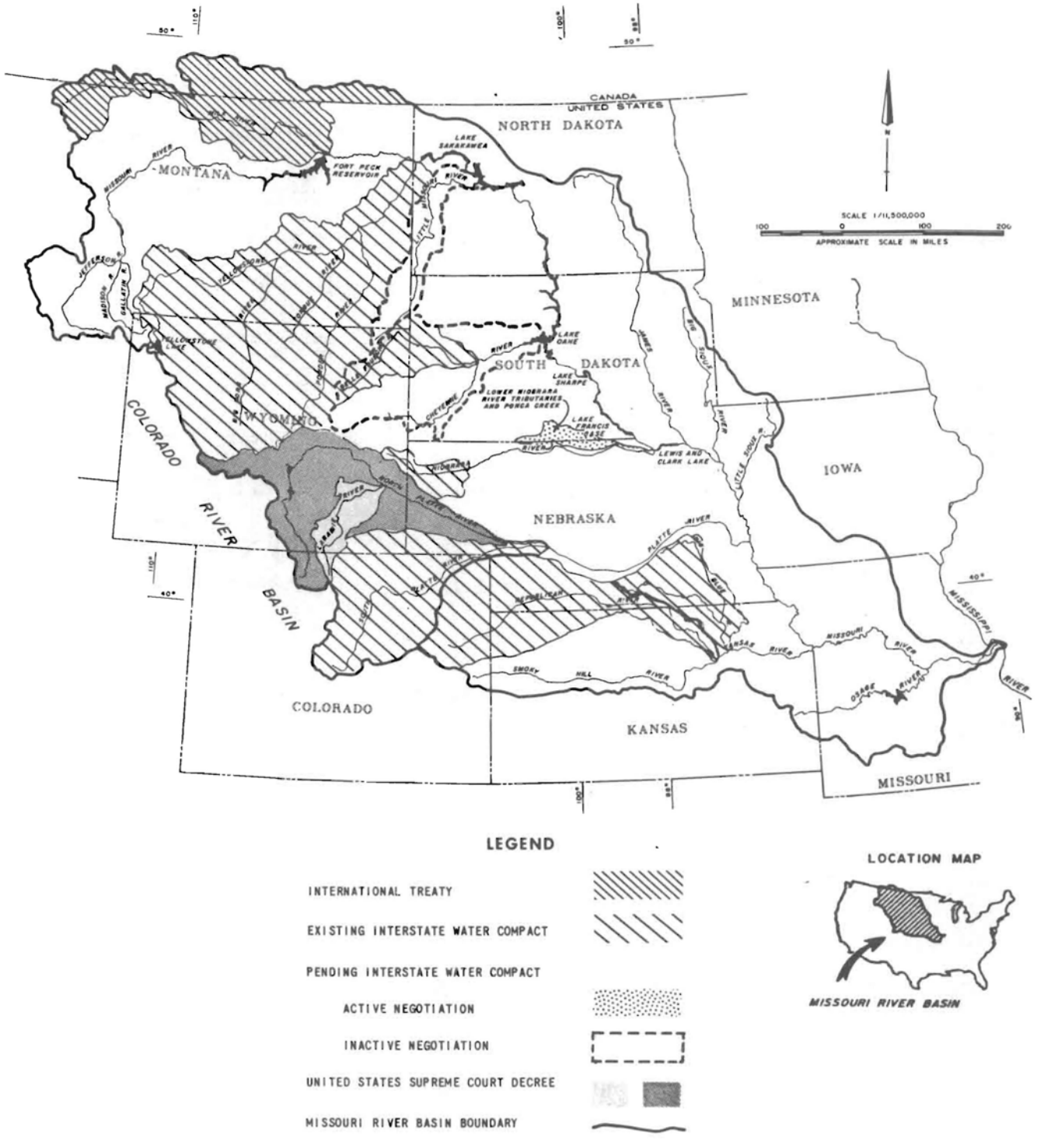
The States of Iowa, Minnesota, and Missouri apply the rules of reasonable use to ground water; Iowa and Minnesota require permits. The States of Colorado, Montana, North Dakota, South Dakota, and Wyoming treat ground water use similarly to surface water appropriation. Other basin States apply minimal control over landowner use of ground water, but usually require well permits. Further, the States of Colorado, Kansas, Montana, Nebraska, and Wyoming provide for designation of controlled ground water areas subject to more stringent management.

Interstate Compacts, Court Decrees, and International Treaty

Problems often develop in allocating interstate waters and administering water rights when rivers cross State boundaries and as water use increases. To deal with these problems in some Missouri River Basin river systems, several States have entered into interstate compacts or requested court apportionment of the affected waters. The U.S. Constitution provides that no State may enter into any agreement or compact with another State or with another Nation without the consent of Congress.

Figure 2-4 shows areas affected by the interstate compacts, interstate court decrees, and an international treaty. Interstate compacts control waters in seven basin States and four subbasins. Compacts on the Colorado River permit transbasin diversion from the Colorado into the Missouri drainage. Two

Figure 2-4 - Missouri River Basin, International Waterways Treaty, Interstate Water Compacts, and Supreme Court Decrees



U.S. Supreme Court decisions have adjudicated basin streams in three States, and an international treaty exists between the U.S. and Canada. Table 2-5 summarizes information on the treaty compacts and decrees affecting waters of the Missouri River Basin.

Federal Water Law, Programs, and Responsibilities

Federal water law is derived from two major sources, the Constitution and Federal statutes. Constitutional provisions account for those powers of the Federal Government which are expressly delegated or reasonably implied by the U.S. Constitution. Water-related provisions include powers granted under the Commerce Clause, the Property Clause, the General Welfare Clause, the Treaty Clause, the Congressional Water Power, and Supreme Court Powers of water rights adjudication between States.

Federal statutory provisions include several major water laws, a great number of lesser acts, and specific project authorizations. It is within the complementary pattern and application of these laws and those of the States that federally assisted water and related land resource development has proceeded.

Many Federal agencies administer programs designed to accomplish comprehensive water and related land-use planning. Also, water-related research and data collection are carried out by many of these and other agencies. Federal agencies carry out programs relating to navigation on the Missouri River, including regulatory measures, maintenance of channels, structural improvements, and reservoir-river management to maintain streamflow. Federal activities with respect to the Nation's flood problems include structural measures to contain flood flows, land treatment measures to retard runoff, mechanisms such as insurance and disaster assistance to redistribute losses, and programs to promote regulations of land uses in flood prone areas to reduce the amount of flood damages.

TABLE 2-5
SUMMARY OF WATER TREATY, COMPACTS AND COURT DECREES
MISSOURI RIVER BASIN

| Item | Affected States | Affected Subbasins | General Principles |
|---|---|---|---|
| **Treaties** | | | |
| International Treaty | U.S. (Montana) and Great Britain (Canada) | Upper Missouri | Apportions waters of St. Mary and Milk Rivers equally between U.S. and Canada; major developments subject to International Joint Commission. |
| **Interstate Compacts** | | | |
| Belle Fourche River Compact | South Dakota, Wyoming | Western Dakotas | Established apportionment of direct diversion and storage; limits construction and operation of dams and reservoirs. |
| Big Blue River Compact | Nebraska, Kansas | Kansas | Apportionment of interstate flows of the Big Blue and Little Blue Rivers and affected ground waters. |
| Republican River Compact | Colorado, Kansas, Nebraska | Kansas | Allocates a given quantity, in acre-feet, for consumptive use to each State based on average virgin supply. |
| South Platte River Compact | Colorado, Nebraska | Platte-Niobrara | Apportions the waters of this stream to the two States; maintains stateline flow during specific periods of time. |
| Yellowstone River Compact | Montana, North Dakota, Wyoming | Yellowstone | Allocates unused and unappropriated waters of four tributaries for storage and direct diversions; affects future construction and regulation. |
| Upper Niobrara River Compact | Nebraska, Wyoming | Platte-Niobrara | Allocation of unused and unappropriated waters for storage and direct diversions; also affects ground water for potential apportionment thereof. |
| Upper Colorado River Compact | Arizona, Colorado, New Mexico, Utah, Wyoming | Platte-Niobrara | Equitable division and apportionment of the use of water of Upper Colorado River between the five upper basin States. Transbasin diversions presently made to the Missouri River Basin. |
| Colorado River Compact | Colorado, Wyoming, Arizona, California, Nevada, Utah, New Mexico | Platte-Niobrara | Apportions the waters of the Colorado River between the upper and lower basin States; transbasin diversions presently made from the Colorado River Basin to the Missouri River Basin. |
| **Interstate Decrees** | | | |
| Laramie River | Wyoming vs. Colorado, 1922 (amended 1932, 1936, 1940, 1957) | Platte-Niobrara | Limits aggregate diversions in Colorado and those for transbasin diversions; also post-July 31 diversions, and Wyoming is entitled to remaining flow. |
| North Platte River | Nebraska vs. Wyoming and Colorado, 1945 (amended 1953) | Platte-Niobrara | Limits irrigated acreage, total annual storage and out-of-Basin diversions in Colorado; irrigated acreage, total annual storage and apportionment of natural flow with Nebraska in Wyoming. Provisions are made also for use of Federal storage located in Wyoming on Wyoming and Nebraska land under contracts. |

Source: MBIAC Framework Study Report

Federal water supply programs are undertaken to capture and deliver water for agricultural, industrial, and domestic uses, to conserve available supplies and to increase usable supplies through measures such as land treatment and weather modification. Hydroelectric power programs include both Federal development and regulation of private development. Water quality is the object of regulatory programs and programs that include both structural and land treatment measures to control and prevent water pollution. Management and development of the Nation's fish and wildlife resources are the responsibility of a number of Federal agencies and, in connection with Federal water and water-related programs, the value of these resources is recognized and measures are included for their conservation and development.

Promoting outdoor recreation is still another function of some Federal water programs. Recreation facilities are usually provided at Federal water projects. Federal agencies also regulate certain aspects of water-based recreation activities. Other programs are directed at preserving the natural or undeveloped state of designated rivers, adjacent areas, and park or wilderness areas. Many national forests have been established in the basin. Like the other Federal public lands found extensively in the western half of the basin, they are administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.

**PLAN OVERVIEW**

The regional plan is a series of recommended water resources projects, programs, studies, and data collection activities which address the basin's major water resources problems and opportunities, within the structure of State planning objectives. Each of the 10 basin States has prepared planning objectives for water and related land resources management. These objectives, which are presented in appendix G, are summarized in the subbasin chapters. In

conjunction with the development of planning objectives, descriptions of major water resources problems and opportunities were prepared for each subbasin. They are presented in appendix H and highlighted in the respective subbasin chapters.

Recommended programs and conclusions and additional recommendations for each of the subbasins are presented in chapters 3 through 10.

This chapter presents basinwide components of the regional plan in three sections: recommended basinwide programs; recommended statewide programs; and conclusions and additional recommendations. Each recommended basinwide program relates to several or all of the eight subbasin plans presented in subsequent chapters of this report. Similarly, each recommended statewide program generally relates to two or more subbasins. Therefore, the complete plan for each subbasin consists of those elements specifically stated in the subbasin chapter as well as relevant basinwide and statewide recommendations in this chapter.

The basinwide and statewide recommendations address all the functions listed in the Introduction. Some of the recommended programs are particularly important to the Missouri River Basin and these are highlighted briefly. However, it is the total, coordinated implementation of all of these recommendations, not just those which are highlighted, which will serve to meet the future water resources management needs of the basin.

The importance of the first function addressed in the program recommendations, comprehensive planning and support activities, is partially illustrated by the relatively large number of recommended basinwide and statewide programs in this category. A firm understanding of the planning setting--water resources needs and opportunities, resource availability, planning objectives and policies, and management alternatives--is necessary as

a sound basis for formulating and evaluating alternative courses of action. By evaluating these alternatives comprehensively, the interrelationships between alternatives and the cumulative effects of their implementation can be assessed across functional lines. The resulting management plan can then be expected to recognize and make the tradeoffs necessary to best satisfy the region's needs and objectives. In the Missouri Basin, its subbasins, and States, much additional groundwork is needed in order to reach this desirable level of planning refinement.

Several recommended basinwide and statewide comprehensive planning programs play a particularly important role in meeting the basin's comprehensive planning needs. Perhaps the most central program is conducted under title III of the Water Resources Planning Act of 1965. This program is listed among the recommended basinwide programs. Title III and its amendments provide the authority for the Congress to appropriate funds to the U.S. Water Resources Council. These funds are in turn passed through to the States for use in State comprehensive planning and water conservation. Programs already developed by the States through this authority, shown in the recommended statewide programs have greatly enhanced State water resources planning and management.

Another program which will advance comprehensive planning basinwide is the Missouri River Basin Hydrology Study. This study is being conducted by the Missouri River Basin Commission to prepare a basinwide hydrologic data base to be used to develop a computerized system for evaluating the hydrologic effects of water resources management alternatives.

A serious problem affecting most of the Missouri Basin States and many of their water resources management programs is uncertainty surrounding water rights associated with Indian and Federal lands. There is no authorized

program to resolve this problem. Therefore, the first of the basinwide conclusions and additional recommendations is that the Commission should address this problem following the completion of the Missouri River Basin Hydrology Study in 1982. Implicit in this problem is the need to integrate planning activities for Indian lands into the comprehensive planning process.

A number of basinwide and statewide programs are recommended to address flooding problems in the Missouri Basin. These recommendations range from the structural programs of the Corps of Engineers and Soil Conservation Service to flood plain management programs administered by States and the Federal Emergency Management Agency. Efforts by the National Weather Service to improve flood forecasting techniques and effectiveness supplement these structural and nonstructural measures. By addressing flooding problems through the vigorous implementation of these programs, flood damages can be controlled and, in some areas of the basin, even decreased.

Recognition of both Federal and State roles in promoting fish and wildlife resources in the Missouri Basin is reflected in the growing number and prominence of basinwide and statewide programs directed at better managing these resources. On the Federal side, Fish and Wildlife Service programs address virtually every aspect of fish and wildlife management, especially the protection of endangered species and migratory birds and the enhancement of the Missouri Basin's fisheries. On the State side, State agency programs are directed primarily at improving fisheries and hunting and protecting and managing nongame species.

Continued and wise development of irrigation is sought in many parts of the Missouri Basin. Agriculture is by far the predominant industry in the Missouri Basin. Irrigated lands can play an important role in the continued growth and prosperity of the basin.

Most of the irrigation facilities and structures already developed in the Missouri Basin were built or financed through either Federal or private efforts. State programs have not yet had major impact on irrigation. Large costs associated with major project construction has been one limiting factor. Also, much of the private development that has occurred serves only one or a few farmers.

Colorado and Wyoming, are initiating programs for financing water development programs by taxing mineral development. However, in Colorado, Wyoming, and other basin States, future irrigation development will continue to depend largely on Federal and private investment. The relative importance of Federal irrigation programs, therefore, will continue to be great. This is reflected not only by the basinwide and statewide irrigation programs recommended for implementation, but also in the numerous irrigation programs recommended for individual subbasins. Most of these programs are those of the Water and Power Resources Service.

Land conservation and management has long been the function of a group of U.S. Department of Agriculture programs whose significance in the Missouri River Basin is well recognized. These programs, which involve primarily the Soil Conservation Service and the Agricultural Stabilization and Conservation Service are directed not only at preserving the soil base but also at reducing the introduction of sediment into streams. Efforts to preserve the soil, therefore, serve also to improve water quality, which is increasingly important in the Missouri Basin.

Water supplies are both sparse and of poor quality in many rural areas where much of the Missouri Basin population resides. One pressing water resources need, therefore, is to improve municipal and domestic water supplies in rural areas. One of the most effective tools for addressing this need is

the Farmers Home Administration assistance in building rural water and waste disposal systems, the basinwide program named, "Rural Water and Waste Disposal Systems". In many parts of the Missouri Basin this program provides the only source of funds for constructing needed water supply systems. It is a key program in the region's water resources management plan.

The perceived value of natural, historical, and cultural resources has grown noticeably during the last few years. This has led to the recognized need for preserving these resources to the maximum possible extent. Programs of the Forest Service, Heritage Conservation and Recreation Service, and National Park Service are oriented toward preserving wilderness areas and wild and scenic rivers and documenting and preserving the trails taken by early explorers of the Missouri River Basin. As institutions in the Missouri River Basin mature and development occurs, the value of these resources will grow, creating a greater need for advancing programs oriented toward preserving these limited resources.

Basinwide recommendations addressing development of hydroelectric and wind energy are of far-reaching significance. Methods for utilizing these pollution-free sources of energy are being and should continue to be promoted basinwide by the Water and Power Resources Service, Corps of Engineers, Western Area Power Administration, and the Bureau of Indian Affairs.

Most planning for water-associated outdoor recreation is conducted by the States with assistance from the Heritage Conservation and Recreation Service. The need for continuing such planning is specifically recognized in the recommended statewide programs. However, because the responsibility for conducting recreation planning rests primarily with the States, an information base using consistent geographical units, units of measure, and groupings of data is not available for the entire Missouri River Basin. It is, therefore,

suggested in the basinwide conclusions and additional recommendations that the Heritage, Conservation and Recreation Service initiate an effort to restructure the information bases of the individual States in order to construct a uniform recreation data base for the entire basin.

Concerns for water quality in the Missouri Basin have grown during the last few years. The need for careful water quality planning and implementation of water quality plans is now clearly recognized. Several Environmental Protection Agency and numerous State programs are designed to evaluate the extent of water quality problems in the Missouri River Basin and to explore ways for improving water quality. Many of the water quality problems in the Missouri Basin stem from nonpoint sources, mainly runoff from farm and range lands. The U.S. Department of Agriculture's Rural Clean Water Program, is a recommended basinwide program of considerable promise for addressing these pollution sources. This program should help to link efforts toward both land conservation and water quality enhancement. While the relationship between land conservation and water quality is reasonably well established, there are many other water resources functions which relate closely to water quality and water quality programs. These links suggest the need for better integrating water quality planning into the comprehensive planning process.

1/ The Missouri River Basin Comprehensive Framework Study, Vol. 1, Report (Missouri Basin Inter-Agency Committee, 1969), p. 58.

2/ Ibid, p. 63.

## RECOMMENDED PROGRAMS - BASINWIDE

| NAME, LEAD AGENCY, AND FUNCTIONS | DESCRIPTION |
|---|---|
| **COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES** | |
| 1-MISSOURI RIVER BASIN HYDROLOGY STUDY<br>Missouri River Basin Commission<br>Comprehensive | Ongoing special study for FY 80 and 81 for the development of a hydrological model and accounting system for Missouri River Basin; total cost $2.3 million. |
| 2-NATIONAL FOREST SYSTEM MANAGEMENT<br>USDA/Forest Service<br>Comprehensive | Ongoing implementation program that includes preparation of management plans for national forests and grasslands. |
| 3-COOPERATIVE PROGRAMS<br>USDA/Forest Service<br>Comprehensive | Ongoing that provides assistance to States, private landowners, and local entities in forest protection and management, urban forestry, rural fire protection. |
| 4-YOUTH CONSERVATION CORPS<br>USDA/Forest Service<br>Comprehensive | Ongoing implementation program that provides work experience and training for youth in natural resources development and management and other skills. |
| 5-RESOURCE CONSERVATION AND DEVELOPMENT (RC&D) PROGRAM<br>USDA/Soil Conservation Service<br>Comprehensive | Ongoing program of assistance to local groups in conserving and developing natural resources; specific programs are listed in each subbasin. |
| 6-NATIONAL DAM SAFETY PROGRAM<br>Army Corps of Engineers<br>Comprehensive | Ongoing program implementation that includes an inventory and inspection of dams in potential high hazard areas. |

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| 7-WATER RESOURCES INVESTIGATIONS ON INDIAN RESERVATIONS<br>DOI/Bureau of Indian Affairs<br>Comprehensive | Ongoing special study of water resources on Indian reservations that includes a four phase program; total cost $12 million; FY 81 cost $100,000. |
| 8-RESOURCE INVENTORIES AND MANAGEMENT FRAMEWORK PLANS<br>DOI/Bureau of Land Management<br>Comprehensive | Ongoing river basin planning programs that include resource inventories, management framework plans, and environmental assessments on public lands; specific programs are listed in subbasins. |
| 9-ENERGY MINERALS REHABILITATION INVENTORY AND ANALYSIS PROGRAM<br>DOI/Bureau of Land Management<br>Comprehensive | Ongoing special study of resource rehabilitation potential and impacts in the strippable coal region on BLM lands. |
| 10-EXAMINATION OF EXISTING STRUCTURES PROGRAM; SAFETY OF DAMS<br>DOI/Water and Power Resources Service<br>Comprehensive | Ongoing implementation program to review structural and hydraulic adequacy of dams. |
| 11-SMALL WATERSHED PROGRAM<br>USDA/Soil Conservation Service<br>Comprehensive | Ongoing implementation program to assist local organizations in watershed planning and construction; specific projects are shown in subbasins. |
| **Assistance to State Water Planning** | |
| 12-TITLE III ASSISTANCE TO STATES<br>U.S. Water Resources Council<br>Comprehensive | Ongoing river basin planning program that provides financial assistance to States to develop water plans and to integrate programs that emphasize water conservation. |
| 13-SECTION 22, ASSISTANCE TO STATE WATER PLANNING<br>Army Corps of Engineers<br>Comprehensive | Ongoing river basin planning program that provides technical planning assistance to States. |
| **Support Activities** | |
| 14-TECHNICAL ASSISTANCE TO STATES<br>DOI/Water and Power Resources Service<br>Comprehensive | Ongoing river basin planning program that provides assistance to western States in the development of State water plans; FY 81 cost $150,000 for Lower Missouri Region. |
| 15-CONSERVATION OPERATIONS<br>USDA/Soil Conservation Service<br>Comprehensive | Ongoing implementation program to provide technical assistance in use of soil, water, and plant and animal resources. |

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| 16-SOIL SURVEYS<br>USDA/Soil Conservation Service<br>Comprehensive | Ongoing continuing data collection program that assesses and maps soil characteristics and capabilities for use in planning programs. |
| 17-RESOURCE AND ENVIRONMENTAL STUDIES<br>DOI/Bureau of Mines<br>Comprehensive | Ongoing river basin planning program that includes studies of mineral resources and water supplies relating to mineral development and exploration. |
| 18-TOPOGRAPHIC MAPPING<br>DOI/Geological Survey<br>Comprehensive | Ongoing continuing data collection program to prepare and update topographic maps. |
| 19-GROUND-WATER STATIONS<br>DOI/Geological Survey<br>Comprehensive | Ongoing continuing data collection program to obtain data on ground water use and availability in order to provide a base for ground water planning and development. |
| 20-WATER QUALITY STATIONS<br>DOI/Geological Survey<br>Comprehensive | Ongoing continuing data collection program to develop a data bank for water resources planning and management. |
| 21-STREAM GAGING STATIONS<br>DOI/Geological Survey<br>Comprehensive | Ongoing continuing data collection program of surface water data for planning and management purposes. |
| 22-NATIONAL WATER USE DATA SYSTEM<br>DOI/Geological Survey<br>Comprehensive | Ongoing continuing data collection and research program in cooperation with States to develop uniform and reliable water use data for Missouri River Basin States; FY 80 cost $1,924,000. |
| 23-SEDIMENT STATIONS<br>DOI/Geological Survey<br>Comprehensive | Ongoing continuing data collection program to develop a data bank on stream sedimentation for use in planning. |
| 24-FLOOD PLAIN MANAGEMENT SERVICES<br>Army Corps of Engineers<br>Comprehensive | Ongoing continuing data collection program to provide information to agencies and communities for flood plain management; FY 81 cost $542,000; FY 82 cost $514,000. |

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| 25-FISH AND WILDLIFE RESEARCH PROGRAMS<br>DOI/Fish and Wildlife Service<br>Comprehensive | Ongoing research program on ecologies, species, relationships, and species' responses to land management alternatives. |
| 26-STANDARD HABITAT CLASSIFICATION SYSTEM<br>DOI/Fish and Wildlife Service<br>Comprehensive | New start special study to develop uniform system for classifying wildlife habitat. |
| 27-WATER RESOURCES PLANNING AND ENGINEERING RESEARCH<br>DOI/Water and Power Resources Service<br>Comprehensive | Ongoing special study of water resources research to improve planning design, construction, and operation and maintenance for economical and safer projects; FY 81 cost $4 million. |
| 28-RESEARCH IN WATER AND RELATED LAND RESOURCES<br>DOI/Office of Water Research and Technology<br>Comprehensive | Ongoing research program that funds projects in water resources research institutes. |
| 29-BASIC WEATHER OBSERVATIONS<br>DOC/National Weather Service<br>Comprehensive | Ongoing continuing data collection program to provide weather data for forecasting and related purposes; cost averages $4.3 million per year. |
| 30-AUTOMATIC HYDROLOGIC OBSERVATION SYSTEM<br>DOC/National Weather Service<br>Comprehensive | Ongoing continuing data collection program providing telemetered river and rainfall information; cost averages $1.4 million per year for each State. |
| 31-VECTOR CONTROL<br>HEW/Public Health Service<br>Comprehensive | Ongoing implementation program continuing to inventory and analyze potential disease vectors with emphasis on water bodies. |

## FLOODING

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| 32-SECTION 205, SMALL FLOOD CONTROL PROJECTS<br>Army Corps of Engineers<br>Flooding | Ongoing implementation program to construct projects up to $2 million or $3 million for disaster areas; specific projects are shown in subbasins. |
| 33-SECTION 208, SNAGGING AND CLEARING PROJECT FOR FLOOD CONTROL<br>Army Corps of Engineers<br>Flooding | Ongoing continuing implementation program to straighten and clear channels to alleviate flooding; cost limited to $250,000 per project, national program limited to $10 million per year. |
| 34-SECTION 14, EMERGENCY BANK PROTECTION<br>Army Corps of Engineers<br>Flooding | Ongoing continuing implementation program to protect streambanks in order to prevent damage; cost limited to $250,000 per project, national program limited to $10 million a year. |
| 35-RIVER AND FLOOD FORECASTING AND WARNING<br>DOC/National Weather Service<br>Flooding | Ongoing continuing implementation program to provide forecasts and warnings to public and operational agencies; cost $600,000 per year. |
| 36-NATIONAL FLOOD INSURANCE PROGRAM<br>Federal Emergency Management Agency<br>Flooding | Ongoing implementation program to provide flood insurance and flood plain management. |
| 37-FLOOD PLAIN MANAGEMENT ASSISTANCE PROGRAM<br>USDA/Soil Conservation Service<br>Flooding | Ongoing special studies identifying flooding problems and management alternatives; cost-shared with local governments. |

## FISH AND WILDLIFE

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| 38-WATER BANK PROGRAM<br>USDA/Agricultural Stabilization and Conservation Service<br>Fish and Wildlife | Ongoing implementation program to identify and preserve wetlands; costs vary with States. |
| 39-ENDANGERED SPECIES<br>DOI/Fish and Wildlife Service<br>Fish and Wildlife | Ongoing program implementation to plan, coordinate, and manage habitat for endangered species. |
| 40-MIGRATORY BIRDS<br>DOI/Fish and Wildlife Service<br>Fish and Wildlife | Ongoing implementation program to maintain migratory bird population; FY 79 cost $7,250,000, future years undetermined. |
| 41-FISHERY RESOURCES PROGRAM<br>DOI/Fish and Wildlife Service<br>Fish and Wildlife | Ongoing implementation program to establish and enhance sport fish population and recreational fishing opportunities; costs vary with facility. |
| 42-WETLAND HABITAT INVENTORY<br>DOI/Fish and Wildlife Service<br>Fish and Wildlife | Ongoing inventory of all wetlands of the U.S. using color infrared and black and white aerial phographs as primary inventory tool. Flights are flown in the early spring. |

## IRRIGATION

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| 43-IRRIGATION FACILITIES REHABILITATION AND BETTERMENT PROGRAM<br>DOI/Water and Power Resources Service<br>Irrigation | Ongoing feasibility studies to modernize and improve irrigation facilities through a loan program; total cost $6.1 million. |
| 44-SMALL RECLAMATION PROJECTS LOAN PROGRAM<br>DOI/Water and Power Resources Service<br>Irrigation | Ongoing feasibility studies for irrigation or multipurpose projects for local districts with Federal loans. |
| 45-WATER MANAGEMENT STUDY OF THE HIGH PLAINS<br>DOI/Geological Survey<br>Irrigation | Ongoing special study to define hydrologic characteristics of Ogallala formation and evaluate effects of different management practices; FY 80 cost $50,000. |

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| 46-HIGH PLAINS STUDY<br>DOC/Economic Development Administration<br>Irrigation | Ongoing special study to determine economic effects of declining water levels in the High Plains; total cost $6.1 million. |

**LAND CONSERVATION AND MANAGEMENT**

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| 47-RESOURCE INVENTORY AND MONITORING<br>USDA/Soil Conservation Service<br>Land Conservation & Management | Ongoing continuing data collection program to report current conditions of land use, erosion, and treatment; costs vary in States. |
| 48-AGRICULTURAL CONSERVATION PROGRAM<br>USDA/Agricultural Stabilization and Conservation Service<br>Land Conservation & Management | Ongoing continuing implementation program to provide funding for land and water resource recommendations. |
| 49-SHELTERBELT DEVELOPMENT PROGRAM<br>USDA/Agricultural Stabilization and Conservation Service<br>Land Conservation & Management | Ongoing continuing implementation program to assist landowners in shelterbelt protection. |

**MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY**

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|---|---|
| 50-RURAL WATER AND WASTE DISPOSAL SYSTEMS<br>USDA/Farmers Home Administration<br>Municipal & Industrial Rural Supply | Ongoing implementation program to provide loans and grants to develop water supply and waste treatment facilities in rural areas; costs vary in States. |
| 51-WATER AND WASTEWATER SYSTEMS ON INDIAN RESERVATIONS<br>HEW/Indian Health Service<br>Municipal & Industrial Rural Supply, Water Quality | Ongoing implementation program to assist Indian tribes and Indians in securing water supply; costs vary. |

**NATURAL, HISTORIC, AND CULTURAL RESOURCES**

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| 52-WILDERNESS AREA RECOMMENDATIONS<br>USDA/Forest Service<br>Natural, Historic, & Cultural | Ongoing feasibility study required by Congress of wilderness areas related primarily to national forest system lands. Costs vary. |

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| 53-WILD AND SCENIC RIVER RECOMMENDATIONS<br>USDA/Forest Serivce<br>Natural, Historic, & Cultural | Ongoing feasibility study of wild and scenic rivers required by Congress, related primarily to national forest lands; costs vary. |
| 54-WILD AND SCENIC RIVER SYSTEM PLANNING<br>DOI/Heritage Conservation and Recreation Service<br>Natural, Historic, & Cultural | Ongoing feasibility study of rivers and streams with potential for addition to national wild and scenic river system; costs average $3,000 per State per year. |
| 55-LEWIS AND CLARK NATIONAL HISTORICAL TRAIL<br>DOI/National Park Service<br>Natural, Historic, & Cultural | Ongoing implementation of program to develop features along historical water trail; cost to be determined. |

**POWER AND ENERGY**

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| 56-ENERGY DEVELOPMENT ON INDIAN RESERVATIONS<br>DOI/Bureau of Indian Affairs<br>Power and Energy | Ongoing feasibility study investigating potential energy development on Indian reservations. |
| 57-SECTION 167, HYDROELECTRIC POWER RESOURCES UTILIZATION<br>Army Corps of Engineers<br>Power and Energy | Ongoing special study to evaluate the feasibility of adding hydrologic generating facilities at existing and selected potential dam sites; total cost $7 million. |
| 58-WESTERN HYDROELECTRIC POWER INVENTORY SPECIAL STUDY<br>DOI/Water and Power Resources Service<br>Power and Energy | New start special study to evaluate lowhead hydroelectric development in 17 western States; total cost $963,000. |
| 59-REGIONAL WIND ENERGY STUDY<br>DOI/Water and Power Resources Service<br>Power and Energy | New start data collection of wind energy at various locations throughout Missouri River Basin with potential for wind generation of electricity; total cost $8 million. |
| 60-HYDROPOWER RESOURCES DEVELOPMENT<br>DOE/Federal Energy Regulatory Commission<br>Power and Energy | Ongoing program of compiling data on the capacity, generation, construction and operating costs of hydroelectric resources, including pumped storage resources. |
| 61-REEVALUATION OF HYDROPOWER SITES<br>DOE/Federal Energy Regulatory Commission<br>Power and Energy | New start special study of compiling and providing information to facilitate the reactivation of retired hydropower sites. |

**WATER-ASSOCIATED OUTDOOR RECREATION**

**TRANSPORTATION**

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| 62-SECTION 158, WATERWAYS SYSTEM ASSESSMENT<br>Army Corps of Engineers<br>Transportation | Ongoing special study to assess current national waterway system and its capacity to meet current and projected needs; total cost $6 million. |

**WATER QUALITY**

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| 63-IMPLEMENTATION OF WATER QUALITY PLANS<br>Environmental Protection Agency<br>Water Quality | Ongoing program to implement water quality management plans; costs vary by State. |
| 64-SECTION 201, WASTE TREATMENT FACILITY CONSTRUCTION GRANTS<br>Environmental Protection Agency<br>Water Quality | Ongoing implementation program that assists local agencies in planning and construction of waste treatment facilities; costs vary by State. |
| 65-CLEAN LAKES PROGRAM<br>Environmental Protection Agency<br>Water Quality | Ongoing special study that inventories lakes and implements methods for controlling and improving water quality; costs vary by State. |
| 66-RURAL CLEAN WATER PROGRAM<br>USDA<br>Water Quality | New start implementation program that provides technical and cost-share assistance in controlling nonpoint source pollution. |

**LEGAL AND INSTITUTIONAL FACTORS**

## INSTREAM FLOWS

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| 67-DETERMINATION OF MINIMUM INSTREAM FLOW NEEDS<br>DOI/Fish and Wildlife Service<br>Instream Flows | Ongoing research program to determine minimum streamflow levels for various instream uses. FWS's Cooperative Instream Service Group; annual funding $730,000. |

## WEATHER MODIFICATION

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| 68-HIGH PLAINS COOPERATIVE PROGRAM<br>DOI/Water and Power Resources Service<br>Weather Modification | Ongoing research program that develops cloud seeding capability for increasing useful summer rainfall over semiarid High Plains; FY 81 cost $8.6 million. |
| 69-WEATHER MODIFICATION RESEARCH<br>DOC/National Weather Service<br>Weather Modification | New start research program for weather modification involving North Dakota and Utah; total cost $1.2 million. |

## RECOMMENDED PROGRAMS - STATEWIDE

| NAME, LEAD AGENCY, AND FUNCTIONS | DESCRIPTION |
|---|---|
| **COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES** | |
| **Colorado** | |
| 1-COMPREHENSIVE WATER PLANNING, COLORADO<br>Colorado Dept. of Nat. Res./Water Conservation Bd.<br>Comprehensive | Ongoing statewide comprehensive planning; interstate compact admin; flood plain designation, EIS, min instream flow and lake level studies, FY 80 cost $1.1 million. |
| 2-STREAM GAGING AND SEDIMENT STATIONS<br>Colorado Dept. of Nat. Res./Water Conservation Bd.<br>Comprehensive | Ongoing continuing data collection; cooperative stream gaging program with USGS; and CODNR/ DWR; FY 80 total state cost $222,500. |
| 3-GROUND WATER DATA COLLECTION NETWORK<br>Colorado Dept. of Nat. Res./Div. of Water Resources<br>Comprehensive | Ongoing continuing data collection; measurement of ground water levels, development of water level maps & hydrographs; cooperative program with USGS; cost $820,000 per year. |
| 4-STATEWIDE GROWTH AND HUMAN SETTLEMENT PROGRAM<br>Colorado Dept. of Local Affairs/Div. of Planning<br>Comprehensive | Ongoing data collection; population projections; cooperative with HUD; policy recommendations, goals & objectives; FY 80 cost $50,000. |
| **Iowa** | |
| 5-WATER DATA COLLECTION ACTIVITIES<br>Iowa Natural Resources Council<br>Comprehensive | Ongoing continuing data collection of surface-ground water use assists reservoirs operations, industries, forecasting, legal, requirement, research, and special studies. |

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| 6-COOPERATIVE SOIL SURVEY PROGRAM<br>Iowa Soil Conservation Department<br>Comprehensive | Ongoing continuing data collection; conduct soil survey investigations in field in cooperation with SCS; FY 80 cost $326,000. |
| 7-COUNTY GROUND WATER AVAILABILITY RESEARCH<br>Iowa Geological Survey<br>Comprehensive | Ongoing continuing data collection;collect existing info, reformat,add supplemental info to prepare regional ground water atlas for local agency & water related industry,well drillers;cost per FY $26,000. |

**Kansas**

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| 8-STATE WATER PLANNING<br>Kansas Water Resources Board<br>Comprehensive | Ongoing interdisciplinary water planning designed to resolve conflicts & problems; formulation & modification of water policy & objectives; WRC grant FY 80 $80,000; state cost FY 80 $105,000. |
| 9-SPECIAL STUDIES<br>Kansas Water Resources Board<br>Comprehensive | Ongoing special study; hydrology, economics modeling, inventories, & field investigation provide guidance to State agencies, gov., legislature & political subdivisions; FY 80 cost $26,000. |
| 10-USGS COOPERATIVE PROGRAM<br>Kansas Water Resources Board<br>Comprehensive | Ongoing continuing data collection; basic data collection streamflow and sediment; FY 80 cost $299,000. |
| 11-WATER PLANNING COORDINATION<br>Kansas Water Resources Board<br>Comprehensive | Ongoing program implementation; coordinate local, State, Federal, & regional programs and plans; FY 80 cost $283,000. |
| 12-APPLIED AND BASIC GROUND WATER RESEARCH<br>Kansas Geological Survey<br>Comprehensive | Ongoing continuing research; ground water investigations, develop new geophysical & geochemical techniques, models; investigate problem systems, forecasts, FY 80 cost $147,000. |

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| 13-SPECIAL PROJECTS<br>Kansas Bd. of Agriculture/Div. of Water Resources<br>Comprehensive | Ongoing special study; program to monitor ground water areas to determine level changes and development potential; administer 4 interstate compacts; FY 80 cost $68,000. |
| 14-NATIONAL DAM INSPECTION PROGRAM<br>Kansas Bd. of Agriculture/Div. of Water Resources<br>Comprehensive | Ongoing program implementation; determine number of existing dams, inspect & report conditions of "high hazard" dams; COE cost FY 80 $347,000; total cost COE $993,000. |

**Minnesota**

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| 15-MINNESOTA LAND MANAGEMENT INFORMATION SYSTEM<br>Minnesota State Planning Agency<br>Comprehensive | Ongoing continuing data collection; statewide land & water inventory on a 40-acre parcel data cell; cost FY 80 $550,000; total cost-State $862,473, Fed $206,536; project total $1.1 million. |
| 16-FEDERAL PROGRAM COORDINATION<br>Minnesota Dept. of Nat. Res/Div. of Waters<br>Comprehensive | Ongoing river basin planning; coordinate the department role in Federal programs and regulations; FY 80 cost $35,000. |
| 17-FRAMEWORK WATER AND RELATED LAND RESOURCES PLANNING<br>Minnesota Water Planning Board<br>Comprehensive | Ongoing river basin planning; development of programs and policies for the management of water and related land resources; WRC FY 80 match $60,000; MWPB FY 80 cost $288,000. |
| 18-STREAM HYDROLOGY PROGRAM<br>Minnesota Dept. of Nat. Res./Div. of Waters<br>Comprehensive | Ongoing continuing data collection; promotion of of wise use of water through understanding and monitoring the stream hydraulic system; FY 80 cost $204,000. |

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| 19-GROUND WATER HYDROLOGY PROGRAM<br>Minnesota Dept. of Nat. Res./Div. of Waters<br>Comprehensive | Ongoing data collection; promotion of wise use of water through understanding and monitoring the ground water hydraulic system; FY 80 cost $500,000; total cost $810,000. |
| 20-STATE CLIMATOLOGY PROGRAM<br>Minnesota Dept. of Nat. Res./Div. of Waters<br>Comprehensive | Ongoing continuing data collection program to provide needed information and expertise on meteorology & climatology; FY 80 cost $70,000. |

**Missouri**

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| 21-STATE WATER PLANNING PROGRAM<br>Missouri Dept.of Nat.Res./Div.of Planning & Policy Dev. | Ongoing state comprehensive water resources planning; FY 80 cost $60,000. |
| 22-COOPERATIVE SOIL SURVEY PROGRAM<br>Missouri Dept.of Nat.Res./Div.of Environmental Quality<br>Comprehensive | Ongoing continuing data collection; conduct soil survey investigations in field in cooperation with SCS; FY 80 cost $433,000. |
| 23-GEOLOGICAL WATER DATA COLLECTION ACTIVITIES<br>Missouri Dept.of Wat.Res./Div. of Geology & Land Survey<br>Comprehensive | Ongoing data collection of mineral and energy resources,engineering geology, and geological investigations; FY 80 cost $1.6 million. |

**Montana**

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| 24-STATE WATER PLANNING<br>Montana Dept. of Nat. Res. and Conservation<br>Comprehensive | Ongoing river basin planning; development of State water plan; FY 80 cost $500,000; WRC match FY 80 $107,000. |

## Nebraska

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| 25-NATURAL RESOURCES DATA BANK<br>Nebraska Natural Resources Commission<br>Comprehensive | Ongoing continuing data collection; compile and make available statewide natural resource data; cost per year $70,000. |
| 26-STATE WATER PLANNING AND REVIEW PROCESS<br>Nebraska Natural Resources Commission<br>Comprehensive | Ongoing special study; process incl. policy issues analysis & recommendations, problem analysis & area planning, project planning and design; FY 80 cost $348,000. |
| 27-BASIC WATER MONITORING PROGRAM<br>Nebraska Dept. of Environmental Control<br>Comprehensive | Ongoing continuing data collection; includes discharge permits, water quality assessments, management strategies; FY 80 cost $130,000. |
| 28-DATA COLLECTION/WATER USE<br>Nebraska Conservation and Survey Div.<br>Comprehensive | Ongoing continuing data collection; water use data collection storage, manipulation and dissemination; FY 80 cost $60,000. |
| 29-SPECIAL GEOHYDROLOGY STUDIES<br>Nebraska Conservation and Survey Div.<br>Comprehensive | Ongoing special studies; test drilling; modeling in Twin Platte and Republican NRD's; FY 80 cost $80,000. |
| 30-REMOTE SENSING PROGRAM<br>Nebraska Conservation and Survey Div.<br>Comprehensive | Ongoing data collection; land use and resource inventories; FY 80 cost $100,000. |
| 31-STREAM GAGING STATIONS<br>Nebraska Dept. of Water Resources<br>Comprehensive | Ongoing continuing data collection; collect surface water data; cooperative with USGS; FY 80 cost $427,000. |

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| 32-TEST HOLE DRILLING PROGRAM<br>Nebraska Conservation and Survey Div.<br>Comprehensive | Ongoing data collection; stratigraphic investigations; FY 80 cost $30,000. |
| 33-GROUND WATER STATIONS<br>Nebraska Conservation and Survey Div.<br>Comprehensive | Ongoing continuing data collection; cooperative program with USGS & DWR; collect water level data for planning and management. |
| 34-WATER QUALITY STATIONS<br>Nebraska Natural Resources Commission<br>Comprehensive | Ongoing continuing data collection; cooperative program with USGS to provide water quality data for planning and management; FY 80 cost $70,000. |
| 35-SOIL SURVEYS<br>Nebraska Conservation and Survey Div.<br>Comprehensive | Ongoing continuing data collection; cooperative soil mapping and interpretations; cost FY 80 $410,000. |

**North Dakota**

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| 36-STATE WATER MANAGEMENT PLANNING PROGRAM<br>North Dakota State Water Commission<br>Comprehensive | Ongoing river basin planning; comprehensive State water resource planning; WRC FY 80 grant $60,000; state cost $120,000. |
| 37-WATER RESOURCES INVESTIGATIONS<br>North Dakota State Water Commission<br>Comprehensive | Ongoing data collection and analysis; water supply & quality information; coop with USGS; annual cost $841,000. |

**South Dakota**

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| 38-STATE WATER PLANNING<br>South Dakota Dept. of Water and Natural Resources<br>Comprehensive | Ongoing river basin planning for conservation, development, and management of all waters; FY 80 cost, WRC $171,000; South Dakota $171,000; FmHA $50,000; OWRC $75,000; total $467,000. |

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| 39-COMPREHENSIVE PLANNING PROGRAM<br>South Dakota State Planning Bureau<br>Comprehensive | Ongoing State comprehensive planning; cost $100,000 annually. |
| 40-COUNTY GROUND WATER STUDIES<br>South Dakota Dept. of Water and Natural Resources<br>Comprehensive | Ongoing continuing data collection; financial & technical assistance in ground water studies; State share 75%; conservancy subdistricts share 25%, total FY 80 cost $774,000. |
| 41-LAND COVER INVENTORY<br>South Dakota State Planning Bureau<br>Comprehensive | Ongoing data collection; compilation of land cover maps and statistics using remote sensing techniques; cost $110,000 annually. |
| 42-WATER RIGHTS PROGRAM<br>South Dakota Dept. of Water and Natural Resources<br>Comprehensive | Ongoing continuing program implementation; control and regulate the development, conservation, and allotment of surface and underground waters; cost $465,000 annually. |

**Wyoming**

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| 43-STATE WATER PLANNING PROGRAM<br>Wyoming Water Development Commission<br>Comprehensive | Ongoing feasibility study to develop, maintain and update the State water plan & conduct project feasibility studies; FY 80 cost $610,000. |
| 44-STATE COOPERATIVE STREAM GAGING & GROUND WATER MONITORING<br>State Engineer's Office<br>Comprehensive | Ongoing continuing data collection; cooperative program with USGS; record stream stages, discharge quality, and monitor ground water resources. |

## FLOODING

### Iowa

45-FLOOD PLAIN MANAGEMENT PROGRAM
Iowa Natural Resources Council
Flooding

Ongoing program of flood plain regulation; coordination of National Flood Insurance Program; FY 80 cost $24,000.

### Kansas

46-WATERSHED PLANNING
Kansas State Conservation Commission
Flooding

Ongoing feasibility studies; assistance in Federal and non-Federal watershed projects; FY 80 cost $120,000.

47-FLOOD PLAIN MANAGEMENT
Kansas Bd. of Agricultural/Div. of Water Resources
Flooding

Ongoing program to coordinate FEMA national flood insurance program; reviews regulation and plans; FY 80 cost $48,000.

### Minnesota

48-FLOOD PLAIN MANAGEMENT PROGRAM
Minnesota Dept. of Nat. Res./Div. of Waters
Flooding

Ongoing program to coordinate National Flood Insurance Program with FEMA; FY 80 cost $155,000.

### Montana

49-FLOODWAY MANAGEMENT AND REGULATION PROGRAM
Montana Dept. of Nat. Res. and Conservation
Flooding

Ongoing feasibility studies; delienation and regulation of flood plain; cost $140,000 annually.

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| 50-DAM SAFETY PROGRAM<br>Montana Dept. of Nat. Res. and Conservation<br>Flooding | Ongoing special studies; inspection of State-owned flood protection structures; cost $26,000 annually. |

## Nebraska

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| 51-LOCAL PLANNING ASSISTANCE FOR SPECIAL PROJECTS<br>Nebraska Natural Resources Commission<br>Flooding | Ongoing data collection; topographic surveys and photographic assistance to aid local water projects; cost $85,000 annually. |
| 52-SMALL WATERSHED FLOOD CONTROL FUND<br>Nebraska Natural Resources Commission<br>Flooding | Ongoing program implementation; financial assistance for local watershed project development; FY 80 cost $961,000. |
| 53-FLOOD PLAIN MANAGEMENT PROGRAM<br>Nebraska Natural Resources Commission<br>Flooding | Ongoing program implementation; flood plain delineation for zoning and management; cost $85,000 annually. |
| 54-RESOURCES DEVELOPMENT FUND<br>Nebraska Natural Resources Commission<br>Flooding | Ongoing program implementation; cooperative State/local watershed project development; FY 80 State cost $1,250,000; local NRD cost FY 80 $615,000; total cost FY 80 $1.9 million. |

## South Dakota

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| 55-MAGNITUDE & FREQUENCY OF FLOODS IN SELECT DRAINAGE BSN;SD<br>South Dakota Dept. of Transportation<br>Flooding | Ongoing research to determine 50- and 100-year floods for selected basins; to be used in planning and design; USGS share FY 80 $16,200; SDDOT FY 80 cost $16,200. |

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| 56-DAM SAFETY PROGRAM<br>South Dakota Dept. of Water and Natural Resources<br>Flooding | Ongoing program implementation; inspection of water impoundment structures; cost $121,700 annually. |

## Wyoming

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| 57-DAM SAFETY PROGRAM<br>Wyoming State Engineer<br>Flooding | Ongoing program implementation inspection of water impoundment structures; cost $35,000 annually. |

# FISH AND WILDLIFE

## Colorado

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| 58-HABITAT IMPROVEMENT ON PUBLIC LANDS<br>Colorado Dept. of Nat. Res./Div. of Wildlife<br>Fish and Wildlife | Ongoing program implementation; habitat improvement on public lands; FY 80 cost $50,000. |
| 59-LAND ACQUISITION PROGRAM<br>Colorado Dept. of Nat. Res./Div. of Wildlife<br>Fish and Wildlife | Ongoing program implementation; acquisition & development of land to preserve wildlife populations & provide public access; cost $1 million annually. |

## Kansas

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| 60-PUBLIC LAND AND WATER MANAGEMENT<br>Kansas Fish and Game Commission<br>Fish and Wildlife | Ongoing program implementation; provision of wildlife use benefits at public areas; USDOI share 50%; KFGC FY 80 cost $1,072,000; total FY 80 cost $2.1 million. |
| 61-ENVIRONMENTAL AND TECHNICAL SERVICES<br>Kansas Fish and Game Commission<br>Fish and Wildlife | Ongoing program implementation; provide input to water resources planning and management; USDOI share FY 80 $84,000; KFGC FY 80 $29,000. |

## Minnesota

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| 62-WILDLIFE MANAGEMENT PROGRAM<br>Minnesota Dept. of Nat. Res./Div. of Fish & Wildlife<br>Fish and Wildlife | Ongoing program implementation; statewide program to maintain productive wildlife populations; habitat protection; FY 80 cost $5.4 million. |
| 63-FISH MANAGEMENT PROGRAM<br>Minnesota Dept. of Nat. Res./Div. of Fish & Wildlife<br>Fish and Wildlife | Ongoing program implementation; statewide program to maintain productive fish populations and to develop adequate data from lake & stream surveys; FY 80 cost $5.1 million. |

## Missouri

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| 64-DESIGN FOR CONSERVATION-LAKE DEVELOPMENT STUDY<br>Missouri Dept. of Conservation<br>Fish and Wildlife | Ongoing feasibility study to provide fishing lakes; total cost $750,000. |
| 65-DESIGN FOR CONSERVATION-STREAM ACCESS & FRONTAGE STUDY<br>Missouri Dept. of Conservation<br>Fish and Wildlife | Ongoing feasibility study to provide access to floatable and nonfloatable streams; FY 79 budgeted cost $2.3 million. |
| 66-DESIGN FOR CONSERVATION-WATERFOWL ACCESS STUDY<br>Missouri Dept. of Conservation<br>Fish and Wildlife | Ongoing feasibility study; purchase, develop, and operate five new waterfowl areas; budgeted FY 79 $1.5 million. |

## Montana

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| 67-FISH PROGRAMS AND ECOLOGICAL SERVICES<br>Montana Dept. of Fish, Wildlife and Parks<br>Fish and Wildlife | Ongoing program implementation; State programs dealing with dish and ecological services; FY 80 cost $3 million. |

68-WILDLIFE PROGRAMS
Montana Dept. of Fish, Wildlife and Parks
Fish and Wildlife

Ongoing program implementation; statewide wildlife program; annual cost $2.6 million.

## Nebraska

69-HABITAT PROGRAM
Nebraska Game and Parks Commission
Fish and Wildlife

Ongoing program implementation; acquisition and development of wildlife acreage; FY 80 cost $2.5 million.

## Wyoming

70-FISH AND WILDLIFE PLANS,PROGRAMS,AND IMPLEMENTATION
Wyoming Game and Fish Department
Fish and Wildlife

Ongoing feasibility study; Wyoming strategic plan for fish and wildlife management.

# IRRIGATION

## Colorado

71-WATER PROJECT CONSTRUCTION FUND PROGRAM
Colorado Dept. of Nat. Res./Water Conservation Board
Irrigation

Ongoing program implementation; cooperative State/local water project development; uses mineral severance tax revenue; FY 80 cost $10.5 million.

72-AQUIFER RECHARGE
Colorado Dept. of Nat. Res./Div. of Water Resources
Irrigation

Ongoing special study; pilot project for recharging the Ogallala aquifer with surplus surface water; cost $10,000 annually.

## Montana

73-SMALL WATERSHEDS PROGRAM
Montana Dept. of Nat. Res. and Conservation
Irrigation

Ongoing continuing program implementation; State assistance to small watersheds; annual cost $62,500.

## South Dakota

74-CONSERVANCY SUBDISTRICT STUDIES
South Dakota Conservancy Subdistrict
Irrigation

Ongoing feasibility studies; assembly of data and feasibility of project implementation; FY 80 cost $240,000.

## Wyoming

75-STATE WATER DEVELOPMENT PROGRAM
Wyoming Water Development Commission
Irrigation

Ongoing program implementation; design & construction of water projects; funds from coal severance tax revenue; FY 80 cost $7.6 million.

# LAND CONSERVATION AND MANAGEMENT

## Iowa

76-COST SHARE PROGRAM
Iowa Soil Conservation Dept.
Land Conservation and Management

Ongoing program implementation; provide funds to landowners for land treatment measures; annual cost $5 million.

77-SMALL WATERSHED PLANNING AND DEVELOPMENT PROGRAM
Iowa Soil Conservation Dept.
Land Conservation and Management

Ongoing feasibility studies; accelerated watershed planning; annual cost $25,000.

## Minnesota

78-SOIL AND WATER CONSERVATION COST-SHARING PROGRAM
Minnesota Soil and Water Conservation Board
Land Conservation and Management

Ongoing program implementation to educate & inform private landowners about conservation practices & give technical assistance in planning & applying conserv. measures; FY 80 cost $2.6 million.

## Missouri

79-SMALL WATERSHED PLANNING AND DEVELOPMENT PROGRAM
Missouri Dept. of Nat. Res./Div. of Environ. Quality
Land Conservation and Management

Ongoing feasibility studies; accelerated watershed planning; annual cost $300,000.

## South Dakota

80-EROSION AND SEDIMENT CONTROL PROGRAM
South Dakota Dept. of Agriculture
Land Conservation and Management

Ongoing program implementation; program to control erosion and reduce sedimentation; cost shared by USDA FY 80 $89,000 and counties FY 80 $280,000 total cost FY 80 $369,000.

## MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER

## Colorado

81-WATER USE INVENTORY
Colorado Dept. of Nat. Res./Div. of Water Resources
M&I Rural Supply

Ongoing continuing data collection; to determine feasibility of applying municipal water conservation measures; annual cost $95,000.



## Kansas

82-RURAL WATER DISTRICTS
Kansas Bd. of Agriculture/Div. of Water Resources
M&I Rural Supply

Ongoing program implementation; financial assistance to rural water districts for plans and construction of water supply and distribution facilities; annual cost $1 million.

83-WATER MARKETING
Kansas Water Resources Board
M&I Rural Supply

Ongoing program implementation; sale of water from State-controlled conservation storage in major Federal reservoirs; KWRB FY 80 cost $1.5 million.

84-BUREAU OF WATER SUPPLY
Kansas Dept. of Health and Environment
Water Quality

Ongoing program implementation; surveillance of public water supplies and promotion of const. of treatment facilities and development of new sources of water;cost $187,000 annually; EPA FY80 $317,000.

## Missouri

85-RURAL WATER SUPPLY AND SEWAGE SYSTEMS
Missouri Dept. of Nat. Res./Div. of Environ. Quality
M&I Rural Supply

Ongoing program implementation; cash contributions for system construction; guarantee loans & grants; DNR FY80 cost $1.7 million; FmHA FY80 cost $15.6 million.

## Nebraska

86-SAFE DRINKING WATER ACT
Nebraska Dept. of Health
M&I Rural Supply

Ongoing program implementation; supervise management of public water supplies; plan for correction of problems; FY 80 cost $115,000.

## South Dakota

87-SECOND-STAGE AQUIFER STUDIES
South Dakota Dept. of Water and Natural Resources
M&I Supply

Ongoing intensive aquifer studies (including test drilling and computer modeling) to supplement information from county ground water studies.

# NATURAL, HISTORIC, AND CULTURAL RESOURCES

## North Dakota

88-STATE NATURAL AREA SYSTEMS
North Dakota Dept. of Parks and Recreation
Nat. Hist. & Cult.

New start feasibility studies to establish a system of natural preserves; total cost $200,000.

# WATER-ASSOCIATED OUTDOOR RECREATION

## Colorado

89-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Colorado Division of Parks and Recreation
Recreation

Ongoing program implementation of recreation plan.

## Iowa

90-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Iowa State Conservation Commission
Recreation

Ongoing program implementation of recreation plan.

## Kansas

91-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Kansas Park and Resources Authority
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan; total FY 80 cost $145,000.

## Minnesota

92-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Minnesota Dept.of Nat.Res./Bur.of Planning & Research
Recreation

Ongoing special studies; updating of Minnesota SCORP; cost FY 80 $173,800.

## Missouri

93-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Missouri Department of Natural Resources
Recreation

Ongoing program implementation of recreation plan.

## Montana

94-PARKS AND RECREATION PROGRAMS
Montana Dept. of Fish, Wildlife and Parks
Recreation

Ongoing special studies; planning, development, implementation of programs and facilities; FY 80 cost $1,930,000.

## Nebraska

95-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Nebraska Game and Parks Commission
Recreation

Ongoing special studies; planning and coordination of recreation; revenue from HCRS $5,800.

## North Dakota

96-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
North Dakota Department of Parks and Recreation
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan; total FY 80 cost $145,000.

## South Dakota

97-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
South Dakota Department of Game, Fish, and Parks
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan; total FY 80 cost $145,000.

## Wyoming

98-ACCESSS TO RIVERS AND STREAMS AND LAND ACQUISITION
Wyoming Game and Fish Dept.
Recreation

Ongoing program implementation; program to develop recreation access; annual cost $500,000.

99-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Wyoming Game and Fish Dept.
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan; total FY 80 cost $145,000.



# WATER QUALITY

## Kansas

100-AGRICULTURAL RUNOFF WATER QUALITY MANAGEMENT
Kansas State Conservation Commission
Water Quality

Ongoing program implementation; land treatment to alleviate nonpoint pollution; FY 80 cost $70,000.

101-WATER QUALITY MANAGEMENT
Kansas Dept. of Health and Environment
Water Quality

Ongoing special study; identification of critical water quality & use problems & establish priorities of treatment programs; KDHE FY 80 cost $350,000; EPA cost FY 80 $430,000.

## Minnesota

102-WATER QUALITY MONITORING PROGRAM
Minnesota Pollution Control Agency
Water Quality

Ongoing continuing data collection and program implementation program to establish water quality and effluent standards & to monitor & enforce those standards; annual cost $700,000.

## Montana

103-POLLUTION DISCHARGE ELIMINATION SYSTEM
Montana Dept. of Health and Environmental Sciences
Water Quality

Ongoing continuing program implementation; prevent and eliminate point source pollution thru permits & regulations; annual cost $185,000.

## Nebraska

104-CLEAN LAKES PROGRAM
Nebraska Dept. of Environmental Control
Water Quality

Ongoing program implementation; classification and survey of publicly owned lakes; FY 80 cost $67,000.

105-STATE WATER QUALITY MANAGEMENT
Nebraska Natural Resources Commission
Water Quality

Ongoing program implementation; water quality planning and coordination; cost FY 80 $120,000; EPA $50,000.

## North Dakota

106-NONPOINT SOURCE POLLUTION MANAGEMENT
North Dakota Dept. of Health
Water Quality

Ongoing program implementation; program to identify nonpoint pollutant sources and to develop plans for controlling those pollutants.

## South Dakota

107-CLEAN LAKES PROGRAM
South Dakota Dept. of Water and Natural Resources
Water Quality

Ongoing program implementation; pollution control measures to improve water quality in lakes; annual DWNR cost $300,000; EPA $600,000, local $300,000.

108-NONPOINT SOURCE POLLUTION MANAGEMENT
South Dakota Dept. of Water and Natural Resources
Water Quality

Ongoing program implementation;program to identify nonpoint pollution sources and to develop plans for controlling those pollutants.

109-DRINKING WATER QUALITY
South Dakota Dept. of Water and Natural Resources
Water Quality

Ongoing program implementation; improvement of water supply in small communities; annual cost $7,000.

110-STATEWIDE SOLID WASTE MANAGEMENT
South Dakota Dept. of Health
Water Quality

Ongoing program implementation; control and regulation of solid waste to prevent pollution of waters; annual State cost $78,000; EPA cost $143,000.

### Wyoming

111-CHEMICAL WATER QUALITY PROGRAM
Wyoming Dept. of Agriculture
Water Quality

Ongoing continuing data collection; monitoring of water quality for agriculture.

## LEGAL AND INSTITUTIONAL FACTORS

### South Dakota

112-HIGH WATER MARKS
South Dakota Dept. of Water and Natural Resources
Legal and Institutional

New start data collection; monitoring of public lake levels; cost FY 80 $71,400.

## INSTREAM FLOWS

### Iowa

113-PROTECTED FLOW PROGRAM
Iowa Natural Resources Council
Instream Flows

Ongoing program implementation; regulation of consumptive uses of streamflow; annual cost $40,000.

## WEATHER MODIFICATION

### Kansas

114-WEATHER MODIFICATION ACTIVITIES
Kansas Water Resources Board
Weather Modificiation

Ongoing research; comprehensive studies of altering precipitation patterns; grants to public & private agencies; FY 80 cost $197,000; Federal funds $60,000 annually.

### North Dakota

115-WEATHER MODIFICATION
North Dakota Weather Modification Board
Weather Modification

Ongoing implementation program of weather modification; total cost FY 79-80 bienium $1.3 million.

**CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS**

A. A relatively large portion of the Missouri Basin is Indian and Federal lands. For the most part, the water rights associated with these lands are not determined. Upon conclusion of the Missouri River Basin Commission's Hydrology Study, the Commission should consider a program directed at developing an administrative framework for resolving those water rights.

B. Each State in the Missouri River Basin has developed a recreational data base through its State Comprehensive Outdoor Recreation Plan (SCORP). For the most part, these data bases are not compatible between States. The Heritage Conservation and Recreation Service should initiate efforts to bring these data bases into a consistent format.

C. State and Federal programs involving flood plain management should consider nonstructural alternatives. Data and information of the Federal Insurance Administration and others should be used in planning to avoid duplication. Further, Federal and State agencies should strive to achieve the goals of the Unified National Program for Flood Plain Management.