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MISSOURI RIVER BASIN WATER RESOURCES MANAGEMENT PLAN



Appendix H Water Resources Problems and Opportunities

MISSOURI RIVER BASIN COMMISSION
MAY, 1980



The Missouri River Basin Commission is the principal agency for the coordination of Federal, State, interstate, local, and nongovernmental plans for the development of water and related land resources in the area served by the Missouri River and its tributaries. As an independent regional commission, it also provides a forum in which States meet with Federal agencies to conduct and coordinate water and related land resources planning. The Commission Chairman is appointed by the President; its Vice Chairman is elected from among State members.

MRBC members are Colorado; Iowa; Kansas; Minnesota; Missouri; Montana; Nebraska; North Dakota; South Dakota; Wyoming; Department of Agriculture; Department of the Army; Department of Commerce; Department of Energy; Environmental Protection Agency; Federal Emergency Management Agency; Department of Health, Education and Welfare; Department of Housing and Urban Development; Department of the Interior; Department of Transportation; Yellowstone River Compact Commission; Big Blue River Compact Administration. Canada is an observer.

APPENDIX H - WATER RESOURCES PROBLEMS AND OPPORTUNITIES

This appendix contains the descriptions of the major water resources problems and opportunities in each of the eight subbasins in the Missouri River Basin. These problems and opportunities developed during the course of the regional plan update came from many sources. Included in the sources are water planning studies by State and Federal agencies, regional bodies and private entities. Together with the planning objectives, these problems and opportunities formed the basis on which planning recommendations were developed. The problems and opportunities for each subbasin are identified in this appendix as follows:

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UPPER MISSOURI SUBBASIN

FLOODING

Urban and Built-Up

Spring runoff causes urban flooding at many locations. Some of the more severe problems appear at Great Falls on the Sun River, Roundup on the Musselshell River, and Glasgow and Nashua on the Milk River.

Rural

Rural flooding is common along the Milk, Judith, Musselshell, Sun, Upper Marias and Cut Bank Creek tributaries, and tributaries to the Gallatin, Jefferson, and Madison River. Flooding causes stream bank erosion and often adversely affects irrigation pumps, roads, bridges, fences, and removes land from production.

FISH AND WILDLIFE

Riparian Habitat

Riparian habitat destruction is a major problem on many streams in this subbasin. Major reasons for this loss of habitat are agricultural practices being carried out up to the edge of the stream, livestock pasturing in the riparian zone, highway and railroad development, and second home construction. While recent concern has greatly increased, no comprehensive inventory has been undertaken to identify where specific lands have been damaged.

Fisheries Habitat

The high-quality fishery along Grasshopper Creek and Wise River is threatened by mine drainage from old copper, lead, gold, and silver mines in the area. Thermal pollution in the Madison River below Ennis Lake degraded the quality of that river's fishery. Other problems common throughout the subbasin affecting fisheries include irrigation return flows, erosion due to improper land-use practices, municipal outflows, and dewatering on many streams.

Lake level fluctuations at Fort Peck and Canyon Ferry Reservoirs affect fish propagation.

IRRIGATION

Water Shortage (Ground; Surface)

Irrigated acreage is increasing in this subbasin especially along the Milk River where competition for water use is intense.

Older surface systems throughout the subbasin need rehabilitation to increase efficiencies in water use. However, water users are often unable to finance the improvements.

Late season irrigation water shortages are common. The Big Hole, Milk, and Musselshell Rivers often experience these shortages.

LAND CONSERVATION AND MANAGEMENT

Upland Soil Erosion

Excess water application, improper tillage practices, and overgrazing contribute to wind and water erosion and sedimentation problems in this subbasin. By 1990, it is estimated that there will still be 15,000,000 acres in need of land conservation.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

There are ten communities in the subbasin with population over 3,000 which will need some type of improvement for water supply and/or quality within the next 20 years. The communities and their need are displayed in Table 1 that follows. There are 132 communities (some unincorporated) that have or anticipate problems of water supply or quality before year 2000. The present problems are associated with storage, treatment, and/or distribution facilities for which the smaller communities lack funds.

TABLE 1
COMMUNITY WATER SUPPLY AND QUALITY NEEDS
UPPER MISSOURI SUBBASIN

Community	Water Quality Problems				
	Water System Needs Upgrade for Increased Supply	Surface Supply Unreliable Quality	Fecal Contamination	Taste and Odor	Total Dissolved Solids
Dillon	X	X	X		
Bozeman	X	X			
Helena	X			X	
Great Falls	X	X			
Cut Bank	X				
Conrad*					
Lewistown	X				
Havre	X				
Glasgow*					
Wolf Point	X				X

* These are unspecified minor water quality problems.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

Development often conflicts with the "natural" values of all streams, including those suggested for designation in the national system of wild and scenic rivers. Water quality degradation, decreased flows, and stream-bank structures are some impairments to the natural condition.

POWER AND ENERGY

Hydroelectric Power Production

The national demands for more power may require assessment of new operating criteria and the possibility of installing additional capacity at dams with hydropower throughout this subbasin.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Access

Tourism is a major industry in the subbasin, requiring sound planning and management. Natural resources need protection for continued attraction. The greatest increase in recreation demand will occur in drainages 1002 and 1003 of the subbasin. The activities with the greatest need for additional facilities, access or lands are hunting, developed camping, boating, and nonurban swimming. The locations expecting the greatest increase in recreation demand are lands adjacent to Yellowstone Park and the Missouri River segment from Townsend to Cascade, Montana.

WATER QUALITY

Nonpoint Source Pollution

Nonpoint pollution due to erosion, acid mine drainage, saline seeps, improper grazing and logging, and irrigation return flows impair the quality of many subbasin streams. Problems occur on most streams and tributaries throughout the subbasin with one of the severest on Muddy Creek. Approximately 200,000 tons of soil is eroded and transported to the Sun River every year from the lower Muddy Creek drainage.

Point Source Pollution

Most of the point source discharges are from municipal wastewater treatment facilities, specifically primary treatment lagoons. This is an economically suitable treatment method for small Montana communities.

The most noteworthy problems include:

- a. East Gallatin River by the Bozeman sewage treatment plant;
- b. Prickley Pear Creek by the National Cylinder Gas Company, Hillbrook Nursing Home, Kaiser Cement and Gypsum Company, and Helena Municipal Treatment Plant;
- c. Midvale Creek by East Glacier Park and East Glacier Lodge.

LEGAL AND INSTITUTIONAL FACTORS

Reserved Water Rights

Indian and Federal water rights need definition throughout the subbasin in order to plan for future water management.

INSTREAM FLOWS

Determination of Stream Flow Requirements

Through the 1973 Montana Water Use Act, which identifies instream flow as a beneficial water use, Montana has an opportunity unique to the Missouri Basin States to reserve water for instream purposes. Currently there is no program to do this subbasinwide, however, the Fish, Wildlife and Parks Department is collecting data in several streams. Eventually these data will be the foundation for instream reservation applications on many streams or stream segments in the subbasin.

WEATHER MODIFICATION

Precipitation Shortages

There is insufficient rainfall during certain growing seasons. The opportunity exists to provide water at critical periods through research.

Hail Damages

Hail comes during the growing season and destroys crops. There is an opportunity to suppress destructive hail through research.

YELLOWSTONE SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

State comprehensive plans for the management of the water and related land resources in this subbasin should be updated and completed using the data and information from the recent Yellowstone Level B Study and relevant data from State and regional studies.

Interstate

Coordination and implementation of regional water and related land resource plans along the interstate streams in this subbasin require the support and financial assistance of each state.

FLOODING

Urban and Built-Up

Spring runoff causes urban flooding at many locations with some of the more severe problems at Billings and Miles City on the Yellowstone River and tributaries.

Rural

Rural flooding during the spring is common throughout this subbasin.

Flood plain use and development without suitable protection continues throughout the subbasin.

FISH AND WILDLIFE

Fisheries Habitat

Fish passage facilities are needed at the Intake diversion along the Yellowstone River.

IRRIGATION

Water Shortage (Ground; Surface)

Late season shortages are a common problem throughout the subbasin along Powder, Tongue, Clarks Fork Rivers, and Rosebud Creek.

Efficiency (Water; Energy)

Many irrigation systems need extensive rehabilitation to avoid leakage and to improve efficiencies.

Irrigation diversion facilities are hampered by low flows, flooding, and erosion on the Bighorn and Yellowstone Rivers.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Streambank erosion is a problem along the Yellowstone River and tributaries in Montana, Wyoming, and in McKenzie County, North Dakota.

Upland Soil Erosion

Some farming, forest, and range practices contribute to erosion and sediment problems along the Powder River in Wyoming.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

Additional water supplies are needed to meet urban growth in communities such as Lander, Wyoming and Billings, Montana.

Communities in eastern Montana and in Wyoming such as Riverton, Lander, Powell, and Basin need improved water systems as a result of increased population growth and expansion. Many supplies do not meet Federal standards.

POWER AND ENERGY

Hydroelectric Power Production

The national demands for more power may require assessment of new operating criteria and the possibility of installing additional capacity at dams with hydropower throughout this subbasin.

Mining

Energy-related water demands are increasing rapidly in this subbasin. Along the Tongue and Powder Rivers in Wyoming additional storage areas are needed to meet coal and uranium industry demands.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Access

Additional public access to streams and hunting grounds is needed throughout the subbasin to meet recreational demands; notably on the Tongue, Bighorn, and Yellowstone Rivers. In the Miles City area there is a need for additional flat water recreation

WATER QUALITY

Nonpoint Source Pollution

Irrigation return flows have contributed to increasing stream salinity in the Yellowstone River, near Billings, Montana; the Shoshone River between Lovell and Kane, Wyoming; and generally along the Wind and Bighorn Rivers, in Wyoming.

Silt and salinity problems affect seasonal recreation use of streams in the southern portion of the Powder River Basin.

Point Source Pollution

Oil, grease, and coliforms affect Yellowstone River water quality from Laurel to Billings, Montana. There is a lack of suitable treatment facilities at Sheridan, Wyoming.

LEGAL AND INSTITUTIONAL FACTORS

Reserved Water Rights

Indian and Federal water rights need definition throughout the subbasin in order to plan for future water management.

INSTREAM FLOWS

Determination of Stream Flow Requirements

Instream flow requirements may need to be considered on certain rivers such as the Powder, Wind, and Clarks Fork Rivers in Wyoming.

WEATHER MODIFICATION

Precipitation Shortages

There is insufficient rainfall during certain growing seasons. The opportunity exists to provide water at critical periods through research.

Hail Damages

Hail comes during the growing season and destroys crops. There is an opportunity to suppress destructive hail through research.

WESTERN DAKOTAS SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

There are many water resource problems in the Bad River and White River-Medicine Creek Basins that need resolution by a comprehensive analysis.

In the Black Hills, streams passing over the Paha Sapa Limestone Formation can lose some or all of their water.

Interstate

The data problems in this subbasin include the lack of geohydrologic information in most of western South Dakota. In addition, the inadequate data and information on water resources presents problems of interstate communication and coordination in water resources management.

FLOODING

Urban and Built-Up

Throughout this subbasin, spring runoff causes urban flooding at many locations. The most severe problems occur in Hay Creek and Redwater River at Belle Fourche and the Bad River at Ft. Pierre in South Dakota and in the Cannonball River at Mott, Little Missouri river at Medora, Antelope Creek at Hazen, Heart River at Belfield, and Apple Creek south of Bismarck in North Dakota. In South Dakota, localized flooding occurs at Spearfish, Hot Springs, Box Elder, Hill City, New Underwood, and Keystone. North Dakota communities experiencing localized flooding problems include Hebron, Halliday, Zap, Beulah, Mandan, Linton, Underwood, Dickinson, White Earth, Parshall, and Napoleon.

Rural

Rural flooding is fairly common along many tributary streams although problem areas may be isolated. The Battle Creek and Bear Butte Creek watersheds in South Dakota are particular problems. In North Dakota, the Heart River near Belfield, and the Apple Creek, Painted Woods Creek, Shell Creek, and the Little Missouri are all problem areas.

Aggradation at the headwaters of Lake Oahe is raising the ground-water table and may cause serious problems in the southern Bismarck area.

FISH AND WILDLIFE

Fisheries Habitat

Heavy sediment loading in the White River is adversely affecting fish and wildlife habitat.

The inadequacy of regular streamflows is a fishery problem in the Western Dakotas.

Fisheries habitat problems are common to all of the main stem reservoirs. These problems are due to pool fluctuations and the resultant lack of near shore vegetation.

IRRIGATION

Water Shortage (Ground; Surface)

Irrigation water shortages occur in Perkins and Corson Counties, South Dakota, and along the Grand River late in the growing season.

Additional water storage for irrigation is needed on the Moreau River in Perkins, Ziebach, and Dewey Counties on the Bad River near Philip; and along the White and Little White Rivers in South Dakota.

Belle Fourche irrigation project is in need of rehabilitation and potentially irrigable lands are located along the Belle Fourche River below the project that need to be served by diversions from the river.

All streams, except the Missouri main stem, annually experience water shortages, especially after mid-July with water quality deteriorating as the flow decreases.

Deerfield Dam is in need of modification as a result of reevaluation under the safety of dam program. Revised design flow criteria showed the need to increase the height of the structure and to rehabilitate and reinforce the spillway. Work has been authorized and funds appropriated. Construction to start in 1980.

Sedimentation in Angostura Reservoir is a problem and needs continuous monitoring.

Federally certifiable land irrigation suitability needs to be established for subbasin Indian reservations in order to help establish substantiated Indian irrigation associated water rights.

With the exception of the Pine Ridge Unit, Federal irrigation studies of the Grand, Moreau, Cheyenne, Lower Belle Fourche, Bad, and White Rivers are technologically outdated, being 25 to 40 years old. Irrigation potential needs to be reevaluated.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Bank erosion is a significant problem which is causing the loss of agricultural lands and is threatening residences along the Missouri River between Garrison Dam and Lake Oahe. Severe erosion of agricultural lands also occurs in tributaries such as the White River.

Battle Creek and Bear Butte Creek have erosion and sedimentation problems.

Upland Soil Erosion

Upland erosion problems are especially significant in the Little Missouri, Grand, Moreau, Cheyenne, Bad, and White Rivers.

Saline seeps are a persistent problem in many areas west of the Missouri River.

Sediment Deposition

Sedimentation is a problem in most lakes in the Black Hills and at the headwaters of Lake Oahe.

Higher river levels caused by aggradation are contributing to the high ground water and salinity problems in the headwater areas of the main stem reservoirs.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

Much of the Cheyenne River Basin has insufficient quantity of good quality surface and ground water for most uses.

The South Dakota communities with water supply (*) and quality (x) problems include:

Philip (x)	Bison (x)	Draper (x)
Midland (x)	Dupree (x)	Kennebec (*)
Belevedere (x)	Isabel (*)	Reliance (x)
Vivian (x)	Lemon (x)	Faith (*)
Kadoka (x)	McIntosh (x)	Belle Fourche (*)
Murdock (* x)	Spearfish (*)	Sturgis (*)
Fruitdale (x)	Edgemont (* x)	Buffalo (x)
Morristown (* x)	Presho (x)	New Underwood (x)
Oacoma (x)	Oelricks (x)	

and in North Dakota:

Zap	Hazen	Dickinson (*)
Bucyrus (*)	Hettinger (*)	Haynes (*)
Amidon (*)	New England	Regent
Mott	Flasher (*)	Beach
Bowman (*)	Halliday	Reeder (*)
Sentinel Butte (*)	Belfield	Gladstone
Taylor	Richarton	Hebron
Manning (*)		

These North Dakota communities have expressed an interest in obtaining a new or supplemental water supply source in the recently completed southwest North Dakota Water Supply Study. The communities with asterisks (*) have the most severe problems.

Rural Domestic

Ground-water quality for rural domestic uses in most of the area included in the Western Dakotas Subbasin does not meet national drinking water standards.

The quantity of water for rural domestic supply is insufficient in the Bad River Basin.

South Dakota counties of Ziebach, Perkins, and Dewey and the Cheyenne Indian Reservation have poor water quality and insufficient water quantity for domestic and livestock purposes.

Seismic exploration for oil and other minerals is causing or contributing to the loss or impairment of rural domestic wells in North Dakota.

POWER AND ENERGY

Hydroelectric Power Production

There is an opportunity to add additional units to the existing dams and to place some additional pump-back storage hydropower units on the Missouri River and along main stem reservoirs to meet peak energy needs.

Opportunities exist for water development in western South Dakota for energy and other industrial uses.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

Water management practices at the Missouri River main stem reservoirs often cause lowered recreational opportunities and the loss of aquatic habitat.

Water Access

There is a shortage of public access points at Lakes Sakakawea and Oahe in North Dakota for water-oriented recreation uses.

Lack of Facilities

There is a shortage of water-oriented recreation facilities in the Cheyenne River Basin.

There is a need for fishing areas and swimming beaches closer to the population centers throughout the Western Dakotas Subbasin.

In western South Dakota, power boat facilities and ski beaches are needed.

WATER QUALITY

Nonpoint Source Pollution

The Heart and Little Missouri Rivers have high concentrations of nitrates, phosphates, TDS, and coliforms.

Coliform bacteria often indicate point pollution sources such as feedlots. However, cattle grazing over large areas "may" be considered a nonpoint source.

The White River has high metal concentrations. The Missouri River in general has high mercury concentrations.

Point Source Pollution

Increases in energy-related activity are adding to the waste load carried by the Knife River and tributaries.

Removal of lignite aquifers could result in disturbance of ground-water supplies in the Knife and Cannonball River Basins.

Portions of the Cheyenne River and Belle Fourche River have high mercury, arsenic, and cyanide concentrations.

Rural residential developments, road construction, timber industry practices, and livestock wastes are reducing water quality in the Belle Fourche River Basin.

It is expected that increased mining and oil drilling activities could adversely affect both ground water and surface water over large segments of the Missouri River Basin.

Natural Resources

Eutrophication is a problem in most lakes in the Black Hills.

LEGAL AND INSTITUTIONAL FACTORS

Reserved Water Rights

Indian and Federal water rights persist as an issue in the subbasin.

INSTREAM FLOWS

Evaluation of Effects of Changing Streamflows

During dry cycles, irrigation diversions are dewatering many streams, especially the White River.

EASTERN DAKOTAS SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

South Dakota has completed the resource inventory phase of its State water planning activities for all of the subbasin. As presently scheduled, current and future water supply and use will be analyzed; then water resource development alternatives will be formulated.

North Dakota published its State Water Plan in 1968 and a major effort to update and revise the plan is presently underway.

Nebraska published its State Water Plan in 1971 and presently needs to implement a trial period to make its new "State Water Planning and Review Process" operational.

Iowa published its State Water Plan in 1978.

Minnesota is scheduled to publish its State Water Plan in 1979.

Many conflicts between competing, offstream water uses and instream vs. offstream water use need to be resolved in each of the five States through their State water planning processes.

Interstate

The North Dakota State Water Commission has received many water permit applications from persons interested in using water from the James River. But it is unable to determine whether water is available because of inadequate water supply and water use data. A need exists to develop a hydrologic model of the river that would help determine water availability. The South Dakota Department of Water and Natural Resources also lacks water supply and water use data, especially data concerning the impact of water use along the James in

North Dakota on water availability in northern South Dakota. At the present time, a useful model cannot be developed because the hydrologic effects of Sand Lake National Wildlife Refuge are unknown.

South Dakota and Iowa need to ensure compatibility of water supply and water use data and to coordinate their flood plain management activities along the Big Sioux River since the river is their border. Nebraska and South Dakota need to ensure data compatibility and to coordinate their activities along the Missouri River because that river is their border.

Federal/State

Lack of ground-water quantity and quality information and an inadequate streamgaging network are problems throughout the subbasin. To a lesser extent, water use, soils, and topographic data need to be collected.

FLOODING

Urban and Built-Up

The slope of the James River is much less than that of its tributaries. On the average, one major flood has occurred along the James River every 15 years. The Jamestown and Pipestem Reservoirs have essentially curtailed major flood damage at Jamestown and downstream to the South Dakota State line, although some local flooding from tributaries occurs in Oakes, North Dakota. Other cities along the James experience minor flooding problems.

The Big Sioux River has caused flooding problems at Brookings, South Dakota, that are compounded by Six Mile Creek runoff; at North Sioux City; at Flandreau, and Trent, South Dakota, where damages occur almost every year; Dell Rapids, South Dakota, with six floods in 25 years; Rock Valley, Iowa, with five floods in 38 years; and Castlewood, Bruce, Watertown, Dempster, and Estelline, South Dakota.

Mocassin Creek also has caused flooding in Aberdeen, South Dakota.

Rural

Due to high discharge from the Elm River, the James River may flow upstream, spilling into Sand Lake National Wildlife Refuge. Slow drainage caused by silt build-up in small irrigation dams and trapped debris near inadequate bridge and culvert openings result in long periods of flooding in the Lake Plain area in northern South Dakota. Along this reach from Columbia to near Redfield, 30,000 acres are subject to prolonged flooding. Also along the James, 3,000 acres lie in the flood plain between Turtle and Foster Creeks; from Foster Creek to the mouth of the James, 40,500 acres are flooded in a 10-year flood and 46,000 acres in a 100-year flood. James River tributaries of Crow Creek, Elm River, and Turtle Creek can cause flooding on 45,000 acres, 11,500 acres, and 16,800 acres, respectively.

Along the Big Sioux River, 34,800 acres upstream of Sioux Falls and 25,600 acres downstream of Sioux Falls are subject to flooding. Big Sioux River tributaries of Skunk Creek, Split Rock Creek, and Willow Creek also cause rural flooding problems.

Localized rural flooding can occur on many other waterways in the subbasin.

FISH AND WILDLIFE

Wetland Habitat

Farming techniques, especially private irrigation development and cropping of unsuitable land, are causing wetlands to be destroyed throughout the subbasin (2 percent decline in wetlands annually in some portions of North Dakota). This is especially costly in North Dakota and northern South Dakota because the region is very important as a breeding area for migratory waterfowl, especially ducks. Loss of wetlands may also reduce flood storage capability, nutrient retention, and ground water recharge.

Riparian Habitat

Riverine habitat is deteriorating because of increased land use along almost all waterways in the subbasin. This habitat is also declining along shores of many lakes in the subbasin.

Fisheries Habitat

Sediment loading in the James and Big Sioux Rivers, accompanied by increased nutrient levels, is inhibiting fish propagation. Sedimentation in all lakes in Eastern South Dakota is decreasing fish habitat.

Fluctuating water levels in rivers and lakes throughout the subbasin are causing fisheries habitat problems.

Endangered Species

The bald eagle is an endangered species living in the bluffs along the Missouri River.

IRRIGATION

Water Shortage

There is considerable interest in expanding the acres of privately irrigated land because land suitable for irrigation exists in many portions of the subbasin. However, two problems exist: (1) lack of information on how much ground and surface water is available, and (2) where data have been collected, no water of sufficient quantity or quality is available.

Large-scale water diversion opportunities exist at many points along Missouri River and along some of the other major rivers in the subbasin.

Efficiency

Since water and energy will become increasingly expensive in the future, efficient methods of transmitting water from available sources and delivering the water to the crop will need to be developed and implemented.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Streambed and bank degradation problems exist below the main stem reservoirs. An estimated 30 acres of land is lost per year below Fort Randall Dam and 200 acres per year is the estimated loss below Gavins Point Dam.

Below Fort Randall Dam where channel capacity has been diminished by delta formation, flooding and waterlogging have occurred in five of the last 8 years.

The streambank is eroding along the James River in some areas, especially in New Rockford, North Dakota and in Hutchinson and Yankton Counties in South Dakota.

Upland Soil Erosion

Changing farming techniques and Dutch Elm disease are destroying many shelterbelts. Many of these shelterbelts are being replanted as a single row of trees which are not as effective in reducing soil erosion as the previous wind breaks. Mature trees have been harvested from shelterbelts for use as fuel.

Sediment Deposition

Sediment deposition in Lewis and Clark Lake may be smothering fish eggs, reducing storage capacity.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

The cities of Sioux Falls, Huron, Aberdeen, and Mitchell, South Dakota, and Worthington, Minnesota, are expected to need additional water supply in the future.

Rural Domestic

Ground-water sources supply most of the rural domestic water in the subbasin, except for those areas served by rural water systems from the Missouri River. The quantity of water for domestic supply in rural areas has generally been sufficient in the past, however, conflicts between rural domestic supply and large ground water withdrawals for irrigation are emerging. These problems are most apparent in the southern portion of eastern South Dakota and throughout the James River basin. The quality of water in most rural areas does not meet standards established in the Safe Drinking Water Act. This is due to the naturally poor quality of available water and from continued quality degradation from both point and nonpoint sources of pollutants in the area. Many of these problems can be solved by the development of large rural water systems. Funding for large systems, however, is becoming increasingly difficult to obtain. Currently each rural water system functions independently, and conflicts may arise between systems in the future as more systems are added or as existing systems increase their service areas.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

Most of the Missouri River has been modified from its natural state by man. There is an opportunity to preserve the Missouri River from below Fort Randall Dam to the headwaters of Lewis and Clark Lake as a national recreational river.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

Extreme fluctuations in flows of many streams caused by precipitation and irrigation water removal hamper recreational activities especially during the summer. Fluctuations in the water level of Lewis and Clark Lake also inhibit some recreational opportunities.

Lack of Facilities

There is a shortage of recreation facilities in the Sioux Falls, South Dakota, southwestern Minnesota, area. An opportunity exists to utilize the Missouri River from Yankton, South Dakota, to Ponca State Park in Nebraska as a national recreation river.

Sedimentation and eutrophication of most lakes in South Dakota reduces their use as recreation areas.

At some water-oriented recreation areas, existing facilities are not being maintained.

WATER QUALITY

Nonpoint Source Pollution

Runoff from agricultural land, especially cropland, with its sediment, fertilizers, herbicides, and pesticides causes almost all the water quality problems in the subbasin. The levels of total solids, nitrogen, and phosphates in most streams and rivers is higher than optimum. This leads to severe eutrophication of many lakes, and reduces the possible uses of the water.

Each State's nonpoint source pollutant management program needs to be reflected in landowner's farming practices. Inadequate Federal, State, and local funds have been appropriated to implement this program.

Point Source Pollution

Point source pollution is generally controlled, and the problem is localized. Presently in North Dakota, there are 12 point sources of pollution: eight municipal sewage disposal facilities, one sand and gravel pit, one private sewage disposal system, and one private water treatment plant. In South Dakota, half of the point sources present pollution problems.

Natural Sources

Most ground water quality problems are caused by natural factors. Ground water quality ranges from good to very poor. Most rural supplies come from ground water and most of the water does not meet the Safe Drinking Water Standards.

Natural contamination of surface water is caused by nitrates and dissolved and suspended sediment.

LEGAL AND INSTITUTIONAL

Legal Definition of Ground/Surface Water Relationships

Nebraska does not have a legal basis for relating ground water pumping to surface water depletion.

Legal Definition of Beneficial Uses of Water

None of the five States in this subbasin recognize water used for hydropower production as a beneficial water use. Nebraska does not recognize fish propagation and assimilation of water pollutants as a beneficial instream use of water.

Institutional Conflicts

The Fish and Wildlife Service and the State of North Dakota disagree on the implementation of the Service's Small Wetlands Acquisition Program. The Water and Power Resources Service is deferring acquisition of fish and wildlife mitigation for the Garrison Diversion Project until the above stated disagreement between North Dakota and Fish and Wildlife Service is settled.

Communication among State, Federal, and local water resources organizations needs to be improved, especially in the James River Basin area.

INSTREAM FLOWS

Evaluation of Effects of Changing Streamflows

Information on the impacts of differing levels of flow needs to be compiled for all major rivers in the subbasin. There will be impacts to instream water users if flow is reduced and impacts to offstream water users if flow is not allowed to drop below a specified level.

Determination of Streamflow Requirements

The water requirements of instream water uses need to be determined for all major rivers in the subbasin. In Nebraska, North Dakota, and South Dakota, streamflows are not effectively protected.

WEATHER MODIFICATION

Precipitation Shortages

Growing season rainfall is extremely variable in the subbasin. In 30 to 40 percent of the years, rainfall is less than 85 percent of the long-term average.

PLATTE-NIOBRARA SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

The State of Colorado is in need of accelerated funding for the cooperative development of the third phase of its State Water Plan with the Water and Power Resources Service.

Nebraska needs to implement a trial period to make its new State Water Planning and Review Process operational; to work out the procedural details; assess its strengths and weaknesses; and develop plans, information, and reports.

The Wyoming State Water Plan contains some out-of-date information and is in need of updating.

The USGS/State cooperative water-use information system needs to be expanded throughout the basin.

Collection of ground-water data needs to be expanded and accelerated in the western portion of the subbasin.

FLOODING

Urban and Built-Up

Severe and recurring urban flooding occurs at communities having flood-plain areas adjoining the basin's major streams and tributaries. These include but are not limited to: the South Platte River and tribs along Colorado's front range; the North Platte River from Casper, Wyoming, to Glendo Reservoir; the lower Loup River Basin near Columbus, Nebraska; the middle and lower Platte River in Nebraska; and the lower Elkhorn River Basin in Nebraska.

Ice jams aggravate spring flooding upstream from the confluence of the Platte and Elkhorn Rivers, particularly at Valley and North Bend, Nebraska.

Rural

Flash floods caused by summer thunderstorms occasionally flood agricultural lands on the eastern plains in Wyoming and Colorado and often damage irrigation systems.

North Platte tributaries in Wyoming and Nebraska are subject to frequent spring floods, damaging rural lands, communities, farmsteads, and utilities.

The Platte River channel has accumulated brush and tree growth in central Nebraska due to diminished annual discharge, causing overbank flooding during periods of high runoff.

The South Platte River in Colorado and into Nebraska floods adjoining agricultural lands during spring runoff, and when tributaries rapidly carry excess flows to the river.

Agricultural lands, roads, and utilities are subject to occasional severe flooding along the Platte River and its major tributaries in central and eastern Nebraska.

FISH AND WILDLIFE

Wetland Habitat

Wetland drainage in Nebraska's Rainwater Basin has in the past adversely affected waterfowl habitat. In the middle Platte area, drainage of wetlands has reduced wetland acreage, but is partially offset by return flows from surface irrigation systems.

Declining water tables also have negative effects on the occurrence and quality of wetland wildlife habitat.

Riparian Habitat

Changes in stream regimen caused by upstream depletions and reservoir operations may have affected critical waterfowl habitat along the central

Platte River Valley in Nebraska. Portions of the area have been designated as "critical habitat" for endangered species by the Secretary of the Interior.

Fisheries Habitat

The annual "silt run," whereby silt-laden water is flushed out of Guernsey Reservoir into irrigation canals in Wyoming and Nebraska in order to seal leaks, may adversely affects fisheries habitat in the North Platte River.

Periodic low flows caused by extended droughts, sub-normal snowpack, land conservation measures, and/or depletions adversely affect subbasin fisheries.

Endangered Species

Conflicts involving water and land use exist in some portions of the Platte River at certain times in areas designated as "critical habitat" for the endangered whooping crane.

IRRIGATION

Water Shortages (Ground, Surface)

Certain areas in the central Platte Valley in Nebraska, an area of highly concentrated irrigated agriculture, are suffering declines in ground-water levels due to irrigation pumping.

Ground-water reserves throughout the High Plains/Ogallala area are declining due to pumping for irrigation. Severe economic stress is projected as water supplies dwindle and pumping costs increase.

Surface water shortages regularly occur along the South Platte and tributaries in Colorado, Wyoming, and Nebraska. Additional storage and improved management to reduce seasonal and annual shortages is required.

The Mirage Flats project in northwestern Nebraska is chronically short of surface water to meet demands.

The Box Butte area and aquifers underlying portions of the lower Niobrara drainage in Nebraska have declining ground-water tables due to irrigation pumping.

Opportunities exist for irrigating additional lands in the Loup Basin, upper Elkhorn Basin, and areas on the high plains separating the North and South Platte Rivers, but water availability and cost may present problems.

Efficiency (Water, Energy)

A number of irrigation systems along the North Platte and South Platte Rivers and tributaries in Wyoming and Nebraska are in need of rehabilitation and betterment. It should be noted, however, that some junior appropriators and wetland habitat are dependent on the return flows and seep from canals upstream.

Opportunity for improved in-field management to upgrade water efficiency exists in many areas of the subbasin.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Severe bank erosion occurs along several reaches of the Elkhorn River and tribs in eastern Nebraska; bank sluffing diminishes agricultural production and threatens roads, farmsteads, and utilities. Bank erosion is also a problem on other small tributaries to the lower Platte River.

Upland Soil Erosion

The Ponca Creek drainage in Nebraska and South Dakota is subject to severe gully erosion.

The Sand Hills in Nebraska are vulnerable to wind erosion, causing blowouts when the fragile, thin top soil is disturbed. Encroachment of irrigated agriculture is a threat to these thin soils.

Sheet erosion is a problem in steeper tributary drainage in the South Platte Basin.

Sediment Deposition

Sediment is a problem in storage structures in the Loup River Basin due to the heavy stream load.

Drainage

High ground-water tables due to irrigation system leakage, deep percolation, and return flows cause waterlogging, lowland flooding and drainage problems in portions of the central Platte Valley and Farwell area in the Loup Basin.

Seepage from canals and return flows are a problem in Wyoming's Kendrick Project.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC SUPPLY

Municipal

Provision of municipal supplies for the "front-range" area in Colorado, including Denver is a problem. In-basin supplies are limited, and further transbasin diversions are becoming more difficult to implement.

Cheyenne, Wyoming's, municipal supply is dependent upon transbasin diversions from the Colorado River Basin. Provision of additional supplies faces potential institutional conflicts.

Rural Domestic

Rural water supply is inadequate in certain areas in Colorado's South Platte River Basin, the eastern end of Nebraska's Platte and portions of the Niobrara River Basins, and in eastern Wyoming. Major problems are unreliable ground-water supplies and poor quality.

Nitrate concentrations are a problem for users of sub-surface water supplies in portions of the central Platte and Niobrara basins in Nebraska.

Industrial

Projected additional coal production in the North Platte Basin in Wyoming will strain existing water supplies and may conflict with agricultural and other water users.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

Streams designated for study as components of the national system of wild and scenic rivers in Nebraska, Colorado, and Wyoming, including the Niobrara, Sweetwater, Encampment, North Platte, Big Thompson, and Cache le Poudre, need to be investigated. Conflicts with other users may develop in certain areas.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

Reservoir operations at Glendo and Guernsey Reservoirs on the North Platte in Wyoming occasionally adversely affect recreational use.

Public power and irrigation district reservoirs in central Nebraska sometimes are drawn down to levels adversely affecting recreational use.

Some reservoir pools on South Platte tribs are dedicated to power supply or irrigation and are subject to fluctuating levels during the recreation season.

Water Access

Public access to trout streams in the North Platte and Niobrara Basins in Nebraska is very limited.

Private reservoirs on the Colorado eastern plains lack recreation access or facilities.

Lack of Facilities

Eastern Nebraska's densely populated areas are deficient in water-based recreation. Development of the lower Platte, Missouri, and Elkhorn Rivers' recreation potential is needed.

Front range area residents in Colorado have a shortage of water-based recreation.

TRANSPORTATION

Slurry Pipelines

Water proposed for use in a coal slurry pipeline originating in Wyoming conflicts with other existing or proposed uses.

WATER QUALITY

Nonpoint Source Pollution

Nebraska's Salt Creek carries excessive concentrations of organic pollutants and dissolved solids. Major problems are municipal and industrial outflows at Lincoln and occurrence of natural salts.

South Platte River water quality in Colorado is degraded due to irrigation return flows and natural salt pick-up.

The North Platte River below Casper, Wyoming, carries excessive TDS concentrations.

LEGAL AND INSTITUTIONAL FACTORS

Water Allocation

Opportunities for further development of North Platte River water in Wyoming for irrigation or energy use is restricted by Supreme Court Decree.

Legal Definition of Ground/Surface Relationships

Opportunity for improved management of existing surface- and ground-water supplies exists in Nebraska if ground- and surface-water relationships were better defined.

Interbasin Water Transfer

Potential conflicts involving the transfer of water from one basin to another exist for the following areas:

- a. Platte River to Little Blue River, Nebraska - proposed diversion of surplus spring flows to be stored in Little Blue Basin for irrigation use;
- b. Colorado River to South Platte River, Colorado - transmountain diversions for water supply for Front Range communities face institutional conflicts; and
- c. Little Snake River (Colorado Basin) to North Platte River, Wyoming - increasing transmountain diversion for Cheyenne municipal supply faces institutional conflicts.

Legal Definition of Beneficial Uses of Water

Instream uses of water for habitat and/or recreation are currently not recognized in Nebraska and Wyoming.

Reserved Water Rights

Indian and Federal reserved water rights need definition throughout the subbasin in order to plan for future water management.

INSTREAM FLOWS

Determination of Streamflow Requirements

Requirements for fish and waterfowl using the Platte River and Niobrara River in Nebraska need to be determined.

WEATHER MODIFICATION

Precipitation Shortages

Additional applied research is needed to determine how to augment snowpack and water supply in Colorado's and Wyoming's mountain areas.

Hail Damages

Hail damage is a serious problem in extreme southwestern Nebraska, southeastern Wyoming, and northeastern Colorado, causing extensive crop and property damage.

MIDDLE MISSOURI

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

Nebraska needs to implement a trial period to make its new State water planning and review process operational; to work out procedural details; assess its strengths and weaknesses; and develop plans, information, and reports.

Federal/State

States need support for a broad base of data collection activities including more streamgaging stations, additional funding, and State involvement in cooperative programs.

Funds should be provided to States that are required to assist Federal activities such as fish and wildlife, recreation, natural historic, and cultural programs.

FLOODING

Urban and Built-Up

Flooding is still a problem along many of the tributary streams in the Middle Missouri subbasin. One of the more critical areas in the subbasin is the area in Sioux City affected by flooding from Perry Creek. Other communities have experienced flooding over the years and flood insurance studies will identify communities which may have flood threats in the Middle Missouri subbasin. There may be some structural solutions to the flooding threat in some of the communities that will be identified in appropriate flood control studies.

Rural

Rural flood damages, including crop and pasture, other agricultural, and other rural damages, range from minor to severe in small watersheds in the southeastern part of Nebraska. Some watersheds in the northeastern part also suffer severe damages.

Missouri River flood damages along most of the reach of the Missouri River downstream of the Platte River in Nebraska continue to be a problem even though

levees have been constructed. The reach around Nebraska City, Nebraska, appears to be a major problem area. Flooding becomes more widespread further downstream. Levees in the lower reaches are predominantly private and are being moved or constructed too close to the river. Aggradation of the stream bed in some reaches is also another factor that is affecting the flooding problem.

Missouri River tie-back levees are designed to provide protection from large floods. In most cases, the protection is greater than that needed from a 100-year flood. The tie-back levees on the tributary streams (in the reaches of the river with levees) were designed to provide protection from flooding caused by main stem and tributary flooding. The design level of protection from the tributary floods was set at the 50-year level. Due to numerous factors, including aggradation of the tributary stream beds, this level of protection has been reduced to more frequent flooding occurring from 10-years to 25-years.

FISH AND WILDLIFE

Wetland Habitat

There is a net loss of water surface area due to the loss of wetlands not being replaced by maturing wetlands.

Riparian Habitat

The transition of existing uses with the conversion of woodlands to agricultural use has effected riparian habitat.

Fisheries Habitat

Oxbow elimination and channel straightening have reduced and changed fishery habitat.

Endangered Species

The bald eagle is an endangered species in this subbasin.

IRRIGATION

Water Shortage (Ground; Surface)

There is a shortage of water in northwest Iowa. In the Cass-Otoe County areas of Nebraska water shortage has been identified by a Water and Power Resources Service study.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

The statewide 208 plan identified the second largest problem in Nebraska as being erosion in the Nemaha Basin. Other erosion problems occur in the Nishnabotna and Nodaway Basins in Iowa.

Upland Soil Erosion

Steep slopes and soil types cause upland soil erosion especially in northwestern Missouri and northwestern Iowa.

The Missouri Water Quality Management Plan prepared in 1979 identified gully erosion in northwestern Missouri as a severe to very severe problem in the Middle Missouri subbasin portion of the State. These two classifications indicate that gully erosion is in the range of 200 to 499 tons per square mile (severe) or 500 to 750 tons per square mile (very severe). The Nebraska counties in the area between Omaha and South Sioux City have the highest soil loss rate from the sloping uplands in the State. Iowa counties bordering the Missouri experience similar erosion problems.

Land Use Changes

Conversion from agriculture to urban or other developed uses increase the problems associated with the land. First, stripping of top soils and removal of trees occurs; the changing drainage then causes serious erosion; when the development is staged over a period of time the full realization of the immediate and continuing effects are not evident.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

There is a lack of dam sites or storage areas for municipal facilities in various parts of this subbasin.

Rural Domestic

Water quality problems occur in Otoe and Cass Counties, Nebraska, and in the Sioux City area and southwest Iowa. Better planning and coordination are needed for rural domestic systems between service areas. In Nebraska, rural domestic systems are designed either to meet existing users with no provision for expansion or too large to be economical with the result that users leave the system.

Industrial

Small water districts cannot accommodate industrial users.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

The Loess Bluffs area should be clearly identified and related to the other historical site preservation work such as Lewis & Clark Trail, the Mormon Trail, and other related cultural projects with the river resource.

POWER AND ENERGY

Power Plant Cooling

The maximum energy potential from water use by low head hydropower should be realized in this subbasin. Power plants should be located on a major river for assimilation of cooling water. Thermal pollution is a problem on smaller streams.

Disposal of power plant cooling into smaller bodies of water such as Browns Lake where thermal pollution can be controlled could be considered opportunity in the production of fish.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Access - Lack of Facilities

There is a documented demand for water access and facilities in metropolitan areas such as Sioux City and Council Bluffs as well as in southwestern Iowa.

TRANSPORTATION

Navigation

The opportunity exists for port facilities in the Council Bluffs area to make increased use of transportation on the Missouri River.

WATER QUALITY

Nonpoint Source Pollution

Urban runoff in the metropolitan areas is a major source of nonpoint source pollution.

Herbicides, pesticides, and fertilizers are nonpoint sources of pollution in rural areas.

Feedlot operations need enforcement in Iowa to prevent organic material from getting into the water system.

Natural Sources

The Missouri River is noted for turbidity and high levels of suspended solids.

LEGAL AND INSTITUTIONAL FACTORS

Legal Definition of Ground/Surface Water Relationships

Important questions in Nebraska law and policy to be addressed in planning include additional ground water management policies and the allocation and management of competing uses of ground water and surface water, as well as long-term and short-term augmentation from available supplies of surface and ground water.

In Iowa, stream use for recreation purposes needs clarification--definition of access by boat and foot should be recognized by law. Land ownership near State perimeters need clarification by State boundary commissions. Identification of State-owned lands (oxbow lakes) in Iowa is a legal problem for enforcement.

Interbasin Water Transfer

Great concern is expressed that upstream diversions will affect all downstream uses and decrease navigation.

Possibility of State compacts may be required.

INSTREAM FLOWS

Evaluation of Effects of Changing Streamflows

The season variation of flow affects stream water quality on those with waste water treatment outfalls.

States in this subbasin are not uniform in recognizing instream uses. As a result there is a lack of uniformity between States for streamflow requirements in the establishment of standards for fish and wildlife on a stream-by-stream basis.

Consumptive use and diversions by upstream States decrease the amount of water available for downstream users.

KANSAS SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

The State of Colorado is in need of accelerated funding for the cooperative development of the third phase of its State Water Plan with the Water and Power Resources Service.

Nebraska needs to implement a trial period to make its new State Water Planning and Review Process operational; to work out the procedural details; assess its strengths and weaknesses; and develop plans, information and reports.

The Kansas State Water Plan contains some dated information.

Opportunity exists for a regional comprehensive water plan for the subbasin to tie together the the many recommendation contained in agencies' ongoing and completed studies.

The USGS/State cooperative water-use information system needs to be expanded throughout the basin.

FLOODING

Urban and Built-Up

Severe and recurring urban flooding occurs at communities having flood-plain areas adjoining the Big Blue and Little Blue Rivers and their tributaries.

Rural

Rural flooding occurs on streamside lands throughout the subbasin; particularly the major tributaries. Clogged channels and sediment deposits aggravate the problem in the Big and Little Blue basins.

Encroachment of riparian vegetation as a result of reservoir operations and irrigation diversions on the Republican River below Harlan County Reservoir diminish channel capacity, contributing to overbank flooding.

FISH AND WILDLIFE

Wetland Habitat

Drainage of wetland acreage necessary for waterfowl habitat is a serious problem in the upper reaches of the Big Blue, Little Blue and Republican River basins, in the area known as the Rainwater Basin.

Fisheries Habitat

Reservoir operations at Harlan County reservoir on the Republican River can have negative effects on fish propagation in the lake and fish habitat downstream.

Ground-water pumping by irrigators in the upper Republican and Frenchman River basins in southwestern Nebraska and northeastern Colorado reduces base flows for instream habitat.

IRRIGATION

Water Shortages (Ground; Surface)

Pumping by irrigators using privately operated ground-water systems in the upper Republican basin in Nebraska reduce water supplies available to Federal reservoirs needed for local irrigation districts.

Ground-water pumping for irrigation in the Big Blue and Little Blue basins in Nebraska is rapidly dropping water tables throughout the area, notably in Adams, Clay, Fillmore, York, and Hamilton Counties.

Ground-water reserves throughout the High Plains/Ogallala area are declining due to pumping for irrigation. Severe economic stress is projected as water supplies dwindle and pumping costs increase.

Lands suitable for irrigation in the upper Little Blue and Republican basins in Nebraska are without a source of water. Opportunities for storage and/or transbasin diversion need further investigation.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Severe bank erosion occurs along several reaches of the Kansas River; bank sluffing diminishes agricultural production and threatens roads, farmsteads, and utilities.

Upland Soil Erosion

Soil losses due to sheet erosion are most severe in the northeastern portion of the subbasin, where precipitation is greatest.

Wind erosion is a problem on the high plains in western Kansas, southwestern Nebraska, and eastern Colorado.

Gully erosion is a problem in the tributary drainage to the Republican and Kansas Rivers.

Sediment Deposition

Sediment adversely affects water quality in the Big Blue and Little Blue Basins above Tuttle Creek Reservoir.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC SUPPLY

Municipal

Periodic low flows aggravate saline concentrations and impair the quality of municipal supplies along the Kansas River at Manhattan, Topeka, and Lawrence.

Rural Domestic

Rural water supply is inadequate in many areas in the 3-State basin due to poor quality of ground-water supplies or inadequate distribution systems.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

River reaches in Kansas and Nebraska need studies to determine their potential as "protected streams" in order to preserve their esthetic values for recreation and other nonconsumptive uses.

Wetlands necessary for waterfowl propagation in the upper Big Blue, Little Blue, and Republican basins are threatened with drainage for agricultural production.

Historic Site Preservation

Archeological sites at Federal reservoirs in Kansas need protection.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

Water level fluctuations at Harlan County Reservoir have adverse effects on boating, swimming, fishing, and other recreational pursuits.

Water Access

Public access for recreation is limited on many stream reaches in the basin.

Lack of Facilities

Serious deficiencies of water-based recreation opportunities exist in the Big and Little Blue Basins in Nebraska and in Kansas' upper Republican and Solomon Basins.

WATER QUALITY

Nonpoint Source Pollution

Quality of many of the basin's streams is degraded during recurring low-flow periods. Dissolved solids and organic pollutant concentrations are a problem due to irrigation return flows and overland runoff.

Point Source Pollution

Outflows from municipalities and industries with below-standard treatment throughout the basin contribute to water quality problems.

Natural Sources

Naturally occurring mineral intrusion is a continuing problem in the Kansas River, raising saline concentrations and limiting some uses.

LEGAL AND INSTITUTIONAL FACTORS

Water Allocation

In Kansas, water stored in Federal reservoirs may need to be reallocated in order to fulfill municipal demands.

Legal Definition of Ground/Surface Relationships

Important questions in Nebraska law and policy to be addressed in planning include additional ground water management policies and the allocation and management of competing uses of ground water and surface water, as well as long-term and short-term augmentation from available supplies of surface and ground water.

Legal Definition of Beneficial Uses of Water

Instream uses of water for habitat and/or recreation are currently not recognized in Nebraska and Kansas.

Reserved Water Rights

Indian and Federal reserved water rights need definition throughout the subbasin in order to plan for future water management.

Institutional Conflicts

In Kansas, local and State policies conflict with rules and regulations of the Farmers Home Administration regarding rural systems development, often stifling progress.

INSTREAM FLOWS

Determination of Streamflow Requirements

Requirements for waterfowl and fisheries need to be determined on the basin's water courses.

WEATHER MODIFICATION

Precipitation Shortages

Additional applied research and application by State and local entities needs to be conducted to augment precipitation in the arid high plains area during the growing season.

Hail Damages

Reduction of crop damage from hail storms needs continued research in central and western Kansas and eastern Colorado.

LOWER MISSOURI SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

Increased pressure on land and water resources in this subbasin has led the States to prepare water plans that will result in a coordinated regional planning effort. Each State should complete its State water plan.

Federal/State

Iowa needs continued support for its water and related land resources data collection activities. The subbasin lacks a good land use data base. Water use information for all needs should be a continuing effort. There is a need for more data on instream water use.

FLOODING

Urban and Built-Up

Problems with urban stormwater runoff and flooding occur in the subbasin SMSA's and is especially noticeable along flood plains on many streams that flow through developed areas: Kansas City, Columbia-Jefferson City, Springfield, and St. Louis.

Rural

The Grand River Basin has significant flood problems and recurring flooding is serious to crops and improvements in the flood plains; annual flooding in the Grand River Basin involves some 370,000 acres, 80 percent of which is agriculture in nature. Flooding also occurs in the Chariton, Marais des Cygnes-Osage and Fishing River Basins.

Third class counties in Missouri must adopt county wide planning and zoning in order to participate in the Federal flood insurance program. Few counties can obtain public support needed to pass local referendums.

FISH AND WILDLIFE

Wetland Habitat

Wetlands and forest lands are declining in the flood plains. Wetlands have been converted to agricultural or urban uses.

Riparian Habitat

On the Missouri River, channel improvements have reduced backwater areas, islands, and sandbars. Elsewhere on tributaries such as the Grand, South Grand, Chariton, and Blackwater channel straightening has reduced riparian habitat.

Fisheries Habitat

Missouri River channel modifications and bank stabilization activities have reduced fisheries habitat.

IRRIGATION

Water Shortage (Ground; Surface)

Additional research is needed on the feasibility of irrigation in this basin.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Stream systems in north- and west-central Missouri and southern Iowa are unstable with increased bed load and active bank erosion, particularly in channelized stretches.

Upland Soil Erosion

Erosion of upland soils is a major problem in the northern half of the subbasin. The soils in South Grand, Blackwater, Grand and Chariton basins are primarily of loess or loess over glacial till. These soils are productive cropland and are often tilled. Due to the rolling topography, annual soil

loss on unprotected tilled cropland often exceeds 25 tons per acre. This loss is five times the rate of allowable loss to maintain sustained crop production and also is a major contribution to nonpoint water pollution.

Sediment Deposition

Heavy sediment loads have occurred on tributaries such as the Grand, South Grand, and Chariton primarily as the result of mismanagement of land resources.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

In order to supply local municipalities, combined rural water supply districts are needed in north- and west-central Missouri to provide dependable supplies; either ground water, large stream or surface storage is required.

Federal Governmental procedures prohibit rural domestic water supply systems from being designed for expansion in growth areas; regional solutions are needed for more efficient county water systems.

Reallocation of uses from Federal reservoirs may be necessary to meet new water requirements.

Industrial

Local ground water of unacceptable quality occurs in north- and west-central Missouri.

NATURAL, HISTORIC, AND CULTURAL

Opportunities exist to intergrate projects such as Lewis and Clark trails and other trails into water oriented recreation activities in the subbasin.

POWER AND ENERGY

Hydroelectric Power Production

Opportunities exist in this subbasin to meet national and regional power demands for additional power generation at existing projects or potential sites.

Power Plant Cooling

Future plants would require large quantities of cooling water. At times of low flow in the Missouri River, the Labadie power plant water cooling operations affects the water levels for recreation at the Lake of the Ozarks.

Coal Gasification

Coal gasification is possible in the Grand River Basin in north central Missouri if water supplies are sufficient and along the Missouri River in central Missouri. High sulphur coal is contained in this area. Additional opportunities exist for by-products resulting from conversion of coal to gas.

Tar sands in Bates, Vernon and Barton counties possess potential for energy production, but water demand for processing is presently unknown.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

The opportunity exist to examine and monitor the effects of reservoir operations at Harry S. Truman Dam.

Water Access

Access to water-oriented recreation along the Missouri River and the Marais des Cygnes Basin are limited.

Lack of Facilities

Present Federal laws conflict with State laws regarding State's ability to repay its portion of recreation facilities at Federal projects over time. A similar problem exists for the operation and maintenance costs for which the State is responsible.

TRANSPORTATION

Navigation

During water short periods, increasing upstream depletions may shorten the navigation season on the Missouri River.

WATER QUALITY

Nonpoint Source Pollution

Agricultural runoff has affected water quality in the subbasin. There is an opportunity to alleviate this problem through implementation of Best Management Practices (BMP) listed in State water quality management plans. Periodic monitoring, evaluation, and refinement of the recommended practices are part of the plan.

Mine drainage including suspended solids and acid wastes were responsible for pollution on such streams as Locust Creek; lower east fork of the Chariton River and the Chariton River in Putnam, Schuyler, Sullivan and Adair counties. A major problem occurred on the east fork of the Chariton River with acid-mine drainage in the Macon-Randolph area. In the Henry and St. Clair county and the Boone-Callaway county areas, acid water from abandoned strip mines are a problem. Inactive orphaned strip mines developed prior to 1973 are not covered by State reclamation laws.

Treatment of sanitary wastes by use of individual septic tanks in areas that experience rapid growth, recreation and urban sprawl areas, can and has increased the difficulty of long-term comprehensive management of ground- and surface-water quality.

Point Source Pollution

The opportunity exists to attain stream standards with completion of waste treatment facilities through 201 programs. Sewage overflows and stormwater drainage occur in some cities including St. Louis and Kansas City SMSA's that periodically cause point source pollution.

Natural Sources

The opportunity exists to determine how natural sources affect land use in north- and west-central Missouri.

LEGAL AND INSTITUTIONAL FACTORS

States

There is a problem of reallocating water storage on Federal reservoirs to meet new and expanding needs of industrial and rural domestic users.

The opportunity exists for a planned river corridor on the Lower Missouri River to implement and enforce planned development and flood management.

Interbasin Water Transfer

Future diversions to other basins concern Missouri for navigational flows and for other water purposes.

INSTREAM FLOWS

Determination of Streamflow Requirements

Quantity of water available in Missouri River for instream uses such as navigation, fish and wildlife, waste assimilation, and downstream area energy use depends on water utilized in upstream States. Interstate agreements on water rights may be required on the Missouri River.

Evaluation of Effects of Changing Streamflow

Programs that result in modification of the streamflows influence other programs that make decisions based on flow. Modification of low-flow statistics are normally the most significant in terms of program conflicts. Opportunities exist for coordination and planning of water quality/quantity for all uses. Water conservation programs should be an important part of the solution to this problem.

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