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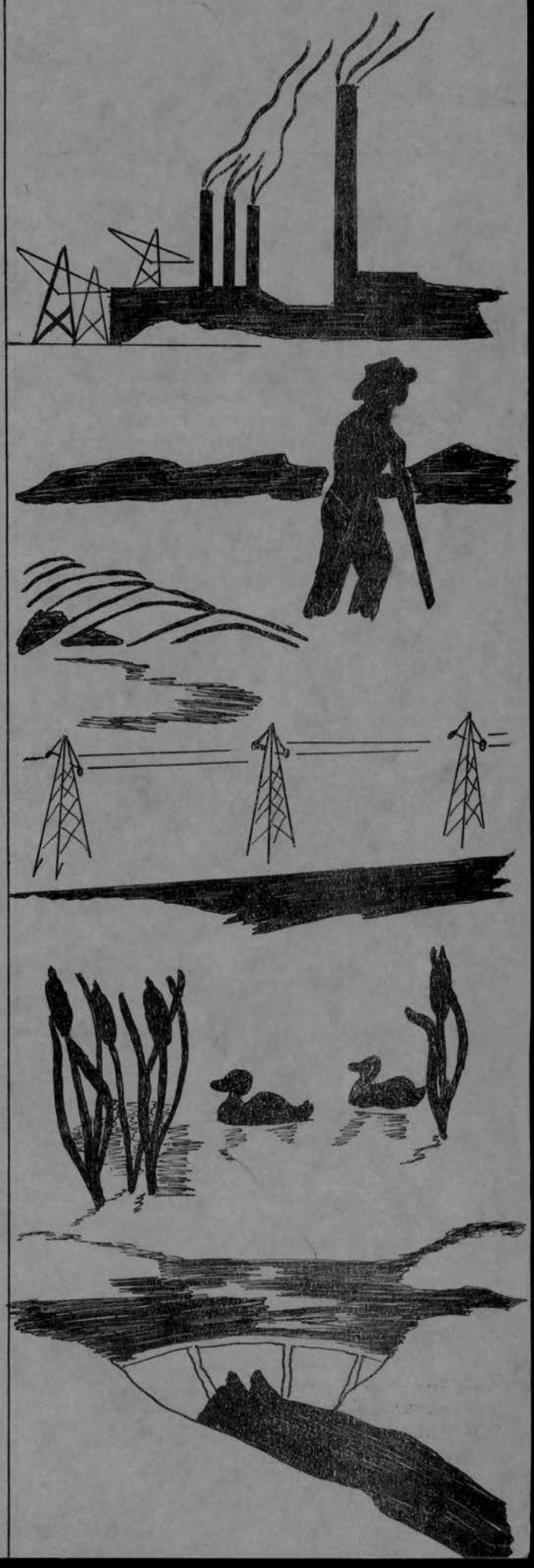
RED RIVER BASIN OF THE NORTH

WATER RESOURCES AND NEEDS



Red River Basin Committee
League of Women Voters
of Minnesota and North Dakota

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Please note the following corrections:

Page	Paragraph	
5	5	"-and the Ottertail Power Company should be included in the third sentence.
11	2	State Water Conservation Commission
11	4	Red River Drainage Basin Interstate Sanitation Committee
14	Last	The fifth sentence should read: "It should be noted that electric power from federally owned hydro projects on the Missouri river is marketed in the Souris-Red River Basin
15	6	Replace 12 with the basin
25	Title	Uses instead of Users
25	3	The second sentence should read: "Already power companies, municipal utilities and co-operatives are receiving hydro power transmitted from Bureau of Reclamation facilities at Garrison Dam and their use of Garrison power is likely to increase as it becomes available, but so is their use of lignite coal of which there are vast deposits in North Dakota.
27	4	The sixth sentence should read - "The Fargo project also included the building of a cut-off channel in a riverbend with the new cut-off being in Moorhead, Minn. and this required approval from the Minnesota authorities.
29	1	The fourth sentence should read - "The local Chambers of Commerce are active promoters of Garrison Diversion along with the Greater North Dakota Association and the North Dakota Water Users Association which was recently formed by the merger of the North Dakota Reclamation Association and the Missouri-Souris Projects Association.
38		Mission should read Missouri

Forward

Our study of the water resources and needs of the Red River Basin of the North is just one of a number of similar studies being done by League of Women Voters' members throughout the United States. The League's role is not that of an expert, but rather of the well-informed citizen. Our aim is to spell out criteria for sound water resource development and conservation in simple and general terms; then to use these as a basis for evaluating various proposals affecting our Red River Basin and the rest of the country.

The following criteria are emerging as a result of League study of water resources throughout the United States during the past three years:

A. Coordination and Planning at the Regional Level

1. Machinery suited to particular region which provides systematic and effective cooperation among federal-state-local and private interests in formulating and administering water programs.
2. Procedures which offer the public alternative choices in early stages of planning.
3. Regional development which not only meets needs of region but also is desirable or at least not in conflict with needs of country as a whole.

B. Equitable Financing

1. Uniform standards for project evaluation and for repayment.
2. Desirable to aim at assumption, as far as possible, by state and local governments and private users of their share of the costs.
3. The amount of federal contribution should be considered in the light of the national interests involved. In this connection, who receives the subsidies should be made quite clear to the public.

C. Coordination and Planning at the Federal Level

1. Better organization of the Executive Branch needed to provide greater coordination in over-all planning in water resource development.
2. Effort should be made to eliminate inconsistencies and conflicts in basic policies between federal agencies.
3. Executive and Congressional procedures should be developed which offer alternative choices before plans are formalized.

We wish to thank the many public officials and private citizens who have given generously of their time to furnish information and suggestions for this study. The map of the Red River basin was prepared for us by Eugene Kohlman, a graduate student, through the courtesy of the University of North Dakota Geography Department.

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CHAPTER I

WHAT ARE THE CHARACTERISTICS OF YOUR RIVER BASIN?

A. Physical Characteristics (Map is included in booklet.)

1. What geographical area is included? What is the character of the terrain: plains; mountains; gently rolling hills; other? What types of soils? Where located? What are the most common types of vegetation? Where located? Is land erosion a big problem?

The Red River of the North is formed by the junction of the Ottertail and Bois de Sioux rivers at the twin cities of Wahpeton, North Dakota and Breckenridge, Minnesota. It flows northerly forming the North Dakota--Minnesota boundary, crosses the Canadian border and continues north, flowing into Lake Winnipeg about forty miles north of the city of Winnipeg, Manitoba. The distance from its source to its mouth is about 310 miles, but its course through the ancient plain of glacial Lake Agassiz is so tortuous and so tightly meandering that the actual river mileage is approximately twice the air line mileage.

At the international boundary the Red River drains an area of about 40,200 square miles. Approximately half of that consists of the extremely flat lake plain, the bed of former glacial Lake Agassiz, now commonly known as the Red River Valley. That glacial lake was formed when the retreating continental glacier melted back from the south, but by its own mass blocked the natural drainage to the north. The sediments laid down in Lake Agassiz form the basis of the generally excellent soils of the Red River Valley.

This lake plain, the Red River Valley, varies in width from about 15 miles at the south to 70 miles at the Red Lake basin, at which point the beach ridge becomes indefinite in Minnesota, but remains definite in North Dakota. It dips northward with an average slope of about one foot per mile. It is almost incredibly flat. The plain slopes riverward with an average slope of less than three feet per mile. The general elevation of this plain above sea level varies from 980 feet at the southern end to 790 feet at the international boundary. The bordering upland consists of glacial drift over subdued rolling topography. The upland varies in elevation from 1200 to 2150 feet above sea level.

The Red River flows through the center of the broad Red River valley in a narrow V-shaped channel. The channel varies in width from 200 to 500 feet and its average depth at bankful stage varies from 10 to 30 feet. Its channel capacities are estimated to vary from 1,500 to 20,000 second-feet.

The inorganic parent material of nearly all of the soil of this area is transported glacial drift. The flat floor of the Red River Valley consists of fine sediments laid down in the great, ice-dammed glacial lake. The tremendous force of the massive, sliding, grinding continental glacier ground rock material to the finest of powder, and in the summer time the waters from the top and front of this glacier (which was at least a mile thick in many portions) spread the fine sediments throughout the lake water until those clays were hundreds of feet thick. Following the recession of the ice, grasses grew upon those clays for thousands of years, forming a dark, upper layer high in humus, or organic, matter, giving a soil that is easily worked and unexcelled for productivity.

Sandy, less productive beach soils lie on the immediate margins of the valley floor, and the soils of the rolling drift prairies beyond vary from fine, productive loams which match those of the valley, to poor, coarse soils on sandy or gravelly ridges. Occasionally, across the basin, there will occur a strip of rocky, bouldery soil, best suited to pasture. Such strips represent recessional moraines--deposition along the ice front where that front stood for a long period of time, or where it had temporarily readvanced.

Most of the soils of the valley are entirely free of stone, but occasionally an isolated boulder will occur in the fine textured soil. Such erratics were probably carried out into the lake in icebergs during the summers and were dropped when the ice melted.

Located as it is near the western, or drier, margin of the humid continental type of climate, the native vegetation of most of the Red River Basin is prairie grass. Deciduous trees are common along the permanent streams and on the eastern margins of the basin. Most of the original vegetation has now yielded to agricultural crops.

Because of the relative levelness of the land, water erosion is not a big problem. Wind erosion is more damaging.

2. Where are the major lakes, rivers, and streams located? Is there adequate underground water? What climate variations are there? Are some sections predominantly arid, semi-arid, humid? What is the average amount of precipitation? Is it seasonal or fairly evenly distributed throughout the year? From year to year?

Tributary streams rise in the hilly margins of the basin, flow with relatively flat gradients across the upland areas, increase in slope as they pass through the beach areas, then meander across the lake plain to the Red River. The larger tributaries built sandy deltas where they entered the lake. The principal tributary on the North Dakota side of the basin is the Sheyenne, which has a drainage area of 11,264 square miles (including 3,944 square miles in the closed Devils Lake subbasin). Other west side tributaries are the Wild Rice of North Dakota; the Maple and Rush Rivers, as tributaries of the Sheyenne; the Elm, Goose, Turtle, Forest and Park Rivers; and the Tongue as a tributary of the Pembina River. Tributaries from the Minnesota side include the Mustinka River which drains into Lake Traverse at the head of the Bois de Sioux; the Ottertail River, joined by the Pelican; the Buffalo, Wild Rice of Minnesota, the Marsh and Sandhill, Red Lake, Middle, Tamarac, Two Rivers, and Roseau River.

The Red River Valley in the United States is virtually devoid of natural lakes, although numerous poorly drained "flats" and sloughs remain. The uplands on either side of the broad, flat Red River Valley are pock marked with potholes and lakes, particularly on the Minnesota side. In the northeast portion there are quite extensive swamplands, especially in the Red Lake, Two Rivers, and Roseau basins.

For all practical purposes the world's total water supply is constant. The perpetual process through which it moves is called the hydrologic cycle. Part of the water which falls on land flows off as surface water; part of it evaporates back to the atmosphere; but the remaining part percolates downward to varying depths, forming the ground water supply of that place. Therefore, the ground water supply varies from place to place depending not only on amount of precipitation, but on other factors such as porosity of soil and underlying rock structure as well.

On the sandy beaches and drift prairies bordering the Red River Valley, the ground water supply is generally large, clean, and readily attainable, but on the valley floor and in the Devils Lake area, the situation is less favorable. Although

many local areas in these last named regions have adequate aquifers (water bearing strata), many others are not so fortunate. In many instances the ground water which is recovered (from either shallow or deep wells) has such a high content of chemical matter, or simply of "mud", that it has limited utility. Thus, a recent study of the ground water resources of the Fargo-Moorhead area by Dennis and others reveals that, while there are some 900 billion gallons of water in storage in the Cass and Clay county area, only a small fraction can be economically recovered.[2] It would seem, therefore, that much of the increased water needs of the future for this area must be met by greater utilization of surface waters.

The climate of the Red River Drainage Basin is humid continental. Located in the center of the continent, far from the moderating influence of any ocean, variations in temperature, both as between summer and winter and between daytime and nighttime, are relatively great. During the summer, a range of 50°F., from 100°F. in the daytime to 50°F. at night, sometimes occurs. Summer-winter variations may be as much as 140°F.

The mean temperatures of July (the warmest month) range between Pembina's 67.6°F. and Wahpeton's 71.0°F. Winter (January) means have a seven degree spread, from 2°F. at Pembina to 9°F. at Wahpeton at the southern end of the valley. It is not uncommon for summer maximum temperatures to reach 100°F. or higher. Winter temperatures lower than 40° below zero are less common, but nearly every winter two or three blizzards sweep out of the Arctic regions accompanied by strong winds, snow, and often very low temperatures. Extremely cold periods in the winter are usually of short duration, as are heat waves in summer. Frost-free periods vary somewhat with latitude but average between one hundred and ten and one hundred and forty-three days. The last killing frost usually occurs during the middle part of May, with the earliest frost coming from mid to late September.

One should not consider the climate of the Red River Valley without special mention of the long summer days and high percentage (65 per cent) of clear days. Because of its latitude, the region receives as much as sixteen hours of sunshine per day in June and nearly this much in July and August. These long periods of sunshine, in effect, add many days to the total growing season.

The amount and pattern of moisture received is of major concern in any non-irrigated agricultural area. The Red River Valley receives an average of about twenty inches of rainfall annually. This precipitation is primarily due to cyclonic activity resulting from the conflict between moist air masses from the south or southwest and the cooler and denser air from the north and northwest. Thunderstorms occur frequently during the summer when extreme heating causes local air masses to become unstable.

The average rainfall varies from eighteen inches to twenty-one inches throughout the valley and approaches the minimum considered necessary for successful crop production. The rainfall pattern is of particular importance. It should be noted that approximately three-fourths of the annual precipitation falls during the five-month growing period from April to September. Careful conservation of this moisture by recommended conservation practices designed to retard evaporation will in most years assure good crops.

It is a generalization in physical geography that the lower the average precipitation of a region the greater the range. Since the precipitation of the Red River Basin is relatively low (about 20 inches annually) it follows that there would be much variability throughout the years. Grand Forks, North Dakota may be taken as a good example: its average precipitation is 19.40 inches. However, that station recorded less than 10 inches in 1910 and in 1936; while it has frequently recorded over 25 inches and measured 29.57 inches in 1944. Only in one year, 1915, has it recorded the average of 19.40, although several other years have approached that figure.

B. Population Characteristics

1. What is the present population? What was it 20 years ago? What might it be 20 years from now? In 40 years?
2. How is it distributed? What is the average population per square mile? Where are the centers of population density? How are these related to geographical characteristics? In what sections is the most rapid growth occurring?

The population of the Red River Basin in 1950 was 550,000, which is an increase of 8 per cent since 1940. Approximately 74 per cent of the total population lives on farms or in communities with populations of less than 2,500. This is a decrease of 3 per cent since 1940. The population of urban communities has increased 24 per cent since 1940.

In North Dakota the population trend is one of rural loss and urban gain. This decline is influenced by unemployment in agriculture. Farms in North Dakota are well suited to large scale equipment and to mechanical power, which has a tendency to increase farm size and to decrease number of farms and farm population. In the Red River Valley, which has a more diversified crop pattern than the other areas of the state, the increase in farm size has not been so great; thus the decrease in farm units is much less. For the state the farm size increased 39 per cent, farm numbers declined 14 per cent and farm population declined 32 per cent. For the valley, farm size increased 15 per cent, and the decline in farm units was 6 per cent.

There has been a population shift to the eastern part of the state. Except for the counties of Ward and Burleigh, which have the cities of Minot and Bismarck, the counties of North Dakota which border on the Red River are those with the highest densities of population. Cass and Grand Forks counties have the highest population per square mile: 33.7 and 27.4 respectively. That density is due largely to the growth of Fargo and Grand Forks. In these two counties the per cent of population classed as urban is 68 and 65 respectively. Population in other counties on the North Dakota side of the basin did show a decline, however, from 1940 to 1950. In 1950 the average population per square mile for the basin counties was about 14 in North Dakota.

The 1950 census figures for population in the counties on the Minnesota side of the basin also indicate the pattern of rural loss and urban gain. Clay county, which has the rapidly growing city of Moorhead, showed the only substantial population increase. The increase from 1940 was 19.8 per cent, and population per square mile was 29. At present it is estimated that Moorhead has about two-thirds of the population of Clay County. Other counties of the basin showed a decline or a small increase. In 1950 the average population per square mile for the basin counties on the Minnesota side of the river was about 16.5. Generally, for the state of Minnesota, increases in population were in the metropolitan areas of Minneapolis and St. Paul.

Since the 1950 census the cities in the valley have shown rapid growth. Census figures are not available for later periods for the entire area.

The population growth of the basin will depend upon birthrate, farm employment opportunities, trade and service employment opportunities, and industrial development.

C. Economic Characteristics

1 and 2: What are the principal occupations in the area? Which provides the greatest source of income? Which employs the most workers? Is the economic wealth growing? What are some of the chief factors affecting the economic health? Is there sufficient water supply? Power? Is better utilization of natural resources needed?

The principal occupation of the area is agriculture. It employs the most people and provides the greatest source of income. The soils and climate of the Red River Valley favor the production of wheat--the principal crop of the basin--, small grains, corn, hay, flax, potatoes, sugar beets and soy beans. Livestock, dairy and poultry products also have a place in the diversified farming of the area. The industries are mainly those which process the locally produced crops, livestock, and livestock products. Some manufacturing of farm machinery and building products is done, and several fertilizer plants serve the needs of farms in the valley. Major industrial developments include creameries, flour mills, beet-sugar factories and, more recently, plants for processing various potato food products and one which processes potato starch to be used in paper production. Fargo and Grand Forks, North Dakota, and Moorhead, Minnesota serve as wholesale distributing centers in the region. Several cities are railroad division points. In the eastern portion of the basin, particularly in the Ottertail area, the development of wildlife and recreational facilities of the numerous lakes has produced considerable resort and tourist trade.

Sand and gravel deposits are found along the beach areas of the basin and are used extensively in road surfacing and concrete work. Limited deposits of marl and fuller's earth have been reported in the basin and beds of low-grade coal in the form of lignite are located in the western portion of the basin. Deposits of peat exist in the northeastern part of the basin but have not been developed commercially. Timber, found chiefly in the upland areas east of the river, is now nearly exhausted although several lumber mills still operate in this region. Small commercial fishing boats are operated by the Chippewa Indians on Red Lake.

The Ninth District Federal Reserve Bank reported in May, 1959 that bank debits, a usually reliable index of business conditions, showed healthy gains in the cities of the Red River Basin in May, 1959 over the same month in 1958,which indicates a growth in economic wealth.

The economy of the basin is so dependent upon agriculture that the prosperity of the area is closely related to its agricultural prosperity. Trade and service incomes tend to increase with increase of income in agriculture. A relatively small percentage of income is derived from manufacturing in the basin. Some of the factors which affect the economic growth in this area in regard to industry are its distance from markets, which results in most farm products being shipped out of state to be processed closer to markets, lack of investment capital to sponsor industrial and economic expansion, few centers of research to stimulate development of new products in the area. Also, an assurance of adequate water supply during periods of low flow is important in attracting industry.

With good water conservation practices and an adequate reclamation and water development program there should be a sufficient water supply. There is sufficient power. The Northern States Power Co. are well equipped to supply power needs. Power from Garrison Dam is also available in the basin area.

Better use of natural resources is needed. In agriculture, the growing acceptance of better farming methods will do much to aid in better utilization of both land and water, resources which directly affect our principal occupations. Successful development of a program to irrigate suitable land on the western section of the basin would increase utilization of soil and water in those areas. More processing of farm and agricultural products should be done in the valley.

3. What economic developments require change and which require preservation of the status quo in the basin?

Agriculture and food production should remain the basis of the economy, but food processing and development of natural resources should be increased. It is recommended by those who have been testing irrigation and planning its development that the irrigated areas change from small grain cropping, particularly wheat, to alfalfa and permanent pasture. This would mean a change to cattle and more diversified farming. The agricultural director of the Greater North Dakota Association points out that the development of a complete livestock feeder program holds great promise of increased income for the farmers and for the state.

Industrial development in the valley would provide more employment for those people not needed in agriculture. Also, irrigation can provide a stability of farm income, and should also provide added employment opportunities in agriculture.

D. Community Organization

What business groups are interested in water resources? What other civic organizations? What is the particular interest of each?

Some examples of business groups and civic organizations interested in water resources are the Greater North Dakota Association, interested in all phases of development in the state; the North Dakota Water Users Association, interested in the future water development program for North Dakota, particularly in the Garrison Diversion program; local Chambers of Commerce, interested in bringing in new business and the wise use of natural resources. The power companies are interested in water for producing steam and for cooling purposes, private industries need an adequate supply of water for plant operations. All conservation groups are interested, as well as fish and wildlife services and clubs. The Farm Bureau, Farmers Union, 4-H clubs, Rural Youth clubs, FFA, and the Boy Scouts all have phases of water conservation in land practices in their educational programs. In Minnesota there is a conservation group, the Wetlands club, organized specifically for the raising of money toward buying wetlands for preservation of nesting areas for waterfowl. Sportsmens groups are interested in fish and wildlife programs and development of recreational areas. In some instances special citizens non-profit organizations are organized to sponsor specific projects in local areas.

CHAPTER II

WHAT ARE THE WATER USE AND CONTROL PROGRAMS IN YOUR RIVER BASIN?

A. Water Supply

1. What are the principal sources of your local water supply? Is it supplied by a public or private system? Does it serve only your community or is your system part of a water district? How did your present water supply system develop? What proportion of the costs are absorbed by users and what proportion by the local taxpayers? What proportion of the costs are being subsidized through federally operated upstream reservoirs or other federal projects? Is the same true for construction as well as maintenance costs? In recent years, have there been restrictions on the use of water? If so, for what uses, and why?

Grand Forks, North Dakota obtains its water from the Red and Red Lake Rivers. In 1883 the first water main was laid in Grand Forks by the city, but water was pumped by a private company. In 1885 the city pumping plant was installed. After a severe typhoid epidemic in 1892-93 the city installed the first filtration system in 1894. It was a slow sand filter, the second of its kind in the United States. This water plant was enlarged in 1956 to care for the expansion of the city and to provide water for the Air Base 14 miles from the city. Prior to the expansion of the plant there were restrictions on the use of water, particularly in the summer when water use is increased. This was necessary because the old plant could not process enough water for the increased use and still maintain enough in storage for use in case of fire. The restrictions were placed on the use of water for sprinkling purposes. All the water is metered and users assessed according to amount used. Grand Forks is also a contributor to the Baldhill Dam and Reservoir; therefore they will be afforded water from this reservoir.

Fargo, North Dakota obtains its water entirely from the Red River. Considerable experimentation to develop a ground water supply was undertaken in the early years of Fargo's history, but the supply was limited in amount and very hard. Fargo's waterworks has been city-owned and self-supporting since 1911. It can take in and treat up to 15,000,000 gallons of river water daily. Water is treated to meet city and state health standards. Main industrial users are creameries and packing plants - these pay less per thousand gallons, but pay more service charge. Air conditioner users also pay more, unless they re-use their water. Fargo's water is entirely metered. During some summers past, lawn sprinkling was limited, but this was remedied when the water distribution system was enlarged and modernized in 1954 to meet the needs of the growing city.

Ten years ago, Fargo contributed $150,000 toward the cost of Baldhill Dam built on the Sheyenne River north of Valley City by the Army Corps of Engineers. Baldhill was one of the projects authorized by Congress under the Flood Control Act of 1944. In 1957 the State Water Conservation Commission granted Fargo rights to 52% of the water impounded there for use when needed and when the Sheyenne-to-Red Channel is completed. This long planned project should become a reality during 1959 through a cooperative arrangement between Fargo and the State Water Conservation Commission and thus greatly improves Fargo's potential water supply.

The City of Moorhead, Minnesota, is the largest of the urban centers in the Red River Basin depending wholly on well water for its supply. These wells tap aquifers, which are water-bearing formations that contain gravity ground

water. There are now six wells in number and they are 240-273 feet deep. By 1947 it was evident that these wells could not supply the water needs of an ever expanding community. Another aquifer located near Glyndon and the Buffalo River was tapped. This water-bearing bed is about 17 miles long and now supplies about two-thirds of the city's water supply. The water from the Buffalo River aquifer is high in iron; therefore, a water softener is added to the water at no added cost to the consumer who pays a minimum charge of $1.00 per month. Rates for commercial users are higher. The water is sand filtered and stored in reservoirs. The city water is supplied by a municipal Public Service Department which also included sanitation and electric power services. The consumer of these services absorbs all costs. The Department is in excellent financial condition and pays for services rendered by other departments of the city government which otherwise would be added to the taxpayer's burden.

At present the water supply is adequate for the community. No restrictions have been placed on the use of water although cooperation during dry periods has been requested and received. However, with the rapid growth of the community and possible industrial expansion, the city must find other sources of water and this leads Moorhead to the river. Present plans are to expand the water plant 150% immediately in order to be prepared to supply water to a community of 35-40 thousand people. An expenditure for the project of $1,500,000 over a seven-year period is contemplated. The plan is to conserve the water in the aquifers. In order to do so, river water* will be used in limited quantities not to exceed 10-15%.

The principal source of water for Fergus Falls, Minnesota, is the Ottertail River. This river originates in a chain of lakes and flows through wooded areas and farm lands before reaching Fergus Falls, the first municipality on the river. The city is supplied by a public system - The Fergus Falls Water Department. In 1883 the first water mains were constructed by Carroll Gray of St. Louis, Missouri, who had received a gas and water franchise. In 1894 this company went into receivership and was purchased by a group of local men. It was called the Fergus Falls Water Works Company. The city bought this company in 1907 for $77,000.

All the costs of the system are borne by the users. None of the costs are being subsidized through federally-operated projects. There have been no restrictions on usage other than for short periods in the summer due to an overload on an inadequate pipe distribution system. It has been stressed that this is not due to a shortage of water. As a result of a recent survey, the Public Utilities Commission was advised that the Fergus Falls water works has reached a point where major construction must be undertaken to continue the excellent service record of the utility to the growing community. From the studies made it is apparent that over the next five years an expenditure of approximately $1,034,000 is necessary to double the treatment plant facilities, increase feeder mains and provide elevated storage. It is likely that this would be financed by income of the water utility. The supply of water from the Ottertail River will be satisfactory and the best supply available even with the estimated population growth.

2. What are the principal sources of water supply in your basin? Is there sufficient water supply for present population and industry? Is the ground water being depleted faster than it is being replenished? Will anticipated demands intensify the problem? What plans are there for expansion of water supply systems? What is the estimated cost of increasing the supply?

* Red River

The principal sources of water supply in the Red River Basin would be on the Red River, its tributaries, reservoirs, underground water and wells. The farm supply of water is critical in the Red River Valley. In Minnesota this is especially true in the northwestern part of the state. On both sides of the Red River the problems of highly alkaline water in shallow wells and mineralized water in deep wells indicates the problem of usable water is widespread in the Red River Basin.

Most of the towns and villages of any size in the basin are situated on lakes or rivers. There appears to be sufficient water supply for present population and industry but further growth depends upon the assurance of increased and dependable water supply.

Several of the small municipalities in the basin have located underground water supplies which they use. In North Dakota the State Water Conservation Commission carries on an extensive program with its own equipment whereby it helps municipalities locate sources of water supply. This is essential since in many parts of the state, including the Red River Basin, suitable water is difficult to find and the necessary equipment and technical skill is beyond the resources of the smaller communities. An extensive study is being done of the ground water supplies in the basin. In this program North Dakota and Minnesota state agencies cooperate with the U. S. Geological Survey, with each bearing a share of the cost. Ground water supply varies greatly in depth and quantity depending upon the porosity of the soil and precipitation. It is estimated that by 1975 we will need 50% more water for domestic users and 170% more water for direct industrial needs.

3. What state agencies have a responsibility in connection with water supplies in the river basin? What federal agencies; other?

North Dakota state agencies responsible for water supply in the basin are the North Dakota State Water Conservation Commission, the North Dakota State Health Department, Division of Water Supply and Pollution Control, the North Dakota Game and Fish Department, the State Soil Conservation Committee, and the State Geologist. In Minnesota the interested agencies are the State Department of Health, the State Department of Agriculture, The Division of Waters and The Water Resources Board.

Federal agencies concerned are the Geological Survey, Fish and Wildlife Service, and the Bureau of Reclamation of the U. S. Department of Interior; the Army Corps of Engineers of the Department of Defense; the Soil Conservation Service of the Department of Agriculture; the International Joint Commission of the Department of State; the U. S. Public Health Service of the Department of Health, Education and Welfare; and the Weather Bureau of the Department of Commerce.

B. Pollution Abatement

1. What sections of your basin are polluted? To what degree? What are the sources of pollution: silt; sewage; industrial waste? Are there satisfactory sanitary sewage disposal systems in your community? In all basin communities? To what extent is industry treating its waste? Is the treatment adequate? Do local industries need to purify the water before returning it to the river or using it? Is fishing or swimming spoiled by pollution? If so, where? Are there state laws for pollution control? If so, are they adequate? Are they enforced?

The most serious pollution is caused by municipal and industrial wastes in several localized areas in the main stem of the Red River. This occurs principally from Fargo to Grand Forks although localized problems exist at other points in the basin. According to the North Dakota State Health Department, it is difficult to state to what degree pollution is occurring because of seasonal variations and the discharge from industries in the area.

The flow velocities in the Red River are generally relatively slow. This holds true for most of the tributaries and as most of the drainage into the basin is from rather heavy soil, pollution by silt is not great. The drainage from barn yards and farm facilities that are located adjacent to the streams in rural areas contribute very little to the pollution of this river system. Municipalities on tributaries from which sewage drains into the Red River or Red Lake River above and below Grand Forks have no treatment or unsatisfactory treatment of sewage. Red Lake River entering the Red at Grand Forks increases the stream flow. Aeration over dams in both rivers near Grand Forks raises the dissolved oxygen in the Red River. When the river is frozen little or no aeration takes place and the dissolved oxygen drops.

In regard to the sewage treatment plant at Grand Forks, at one time sewage was chemically treated, sludge was removed and burned and the liquid lagooned. Gradually as equipment has broken down it has not been replaced so that, at the present time, the only thing done with Grand Forks sewage is the removal of solids. The remainder is put directly into the Red River. Although this does not pollute the water that is reclaimed for drinking purposes it does pollute the stream to the north. The North Dakota State Department of Health cooperated with an engineering firm in doing a waste survey at Grand Forks. Determinations of quality and quantity of both industrial and domestic wastes were made. These determinations have been used as a basis for designing proper sewage disposal facilities for the city. Both Grand Forks, North Dakota and East Grand Forks, Minnesota will use the sewage lagoon system.

The sewage treatment plant owned by the City of Fargo gets all the city's output, including residential and industrial waste and street water where there is no storm sewer. After mechanical and organic treatment, the liquid is discharged into the river. The treatment plant, financed by bond issue in 1934, was originally built to handle 2,700,000 gallons daily. It now takes care of about 4,000,000 gallons daily. In 1958, the City Commission voted for preparation of plans and specifications to expand this plant sufficiently to serve a population of 70,000 to 100,000. The Fargo Sewage Disposal Plant tests the river once a week at seven different stations down to just below the mouth of the Sheyenne.

The sewage plant at Moorhead, Minnesota, had an addition in 1950 which was calculated to take care of problems until 1965. The addition has proven unsatisfactory and many parts of it stand unused because use of it would be prohibitive in cost. A change in treatment and a newly-designed digester have added 35% efficiency to the sewage treatment process. The solid residue which remains after run-off to the Red River is collected into trucks and sent to farms for fertilizer. Expansion of the sewage plant is in the planning state. An application for federal aid through the Federal Water Pollution Act for the project was made and refused but will be made again. The American Crystal Sugar Company is one of Moorhead's largest industries. It treats its own waste by means of lagoons where oxidation occurs with the wastes exposed to sun and air. The liquid is run off into the Red River about one mile below Moorhead. The company tests the river in accordance with the regulations from the Minnesota Department of Health (these are made above and below the dumping point). The company holds its treated wastes until time of high water and rapid river flow which makes dilution high and pollution negligible.

At Fergus Falls, Minnesota, the water of the Ottertail River is polluted very little when it enters the municipal water system. All sewage, even industrial, goes thrcugh the local sewage plant. Plans for an addition to the present sewage disposal plant has been approved by state and federal agencies. The estimated cost of the project is $525,000. The city's share of the cost will be about half. Federal funds will provide 30% and state funds 20%.

Pollution affects the fishing conditions in a stream and most of the game fish are rather sensitive to the lack of oxygen which follows pollution of a stream. Apparently some of the rough fish can tolerate such a condition and will remain because of the available food supply. The lakes in the Minnesota resort areas on the eastern edge of the basin are possible pollution problems. North Dakota does have state laws for pollution control and these controls are invested in the North Dakota State Department of Health. In most instances, this department works, with the cooperation of the State Water Conservation, in regard to approval of plans for municipal systems. The state laws are apt to be too general to be as adequate as desired. They are being enforced but it is understood that it takes considerable time to bring about the abatement of pollution conditions. In Minnesota, the Water Pollution Study Commission makes a good many recommendations to the Legislature as to what should be contained in the state laws. The lack of adequate funds and manpower for the State Department of Health is a decidedly limiting factor in the enforcement of present laws.

The Departments of Health in the States of North Dakota, South Dakota, and Minnesota; the North Dakota Water Conservation Commission; the Minnesota Department of Conservation; and the South Dakota agency concerned with water conservation formed an informal Red River Drainage Basin Interstate Sanitation Committee in 1944. In 1949, this committee adopted "Standards of treatment for municipal and industrial wastes for the Red River of the North". These standards have been adopted by the respective state regulatory agencies. With the work of this committee and the use of federal aid under the Federal Water Pollution Control Act, it appears that the water pollution problem on the Red River is working well towards solution.

The Federal agencies concerned with pollution abatement are the U. S. Department of Health, the U. S. Fish and Wildlife Service, the U. S. Department of Agriculture. The Red River Drainage Basin Interstate Committee, the Minnesota Water Pollution Study Commission, the Minnesota Department of Health, local boards of health in both states, North Dakota State Department of Health, State Water Conservation Commission, Industrial Commission and Water Conservation Districts.

C. Flood Control

Are floods a problem locally? How often have they occurred? Last year? Within the last 10 years? In 25 years? What has been the damage: to life; farms; business; industry? What are the causes of the floods? Are steps being taken to control them? Is there flood plain zoning in your locality? What are the local interests expected to contribute to local flood protection projects?

Although major floods on the Red River have been relatively infrequent, floods have been a yearly cause for concern to residents of the basin. Areas subject to inundation by major floods include parts of Wahpeton, Fargo and Grand Forks in North Dakota and Breckenridge, Moorhead and East Grand Forks in Minnesota. Seven times the Red River has exceeded the flood level by more than three feet. This occurred in 1882, 1897, 1907, 1916, 1943, 1947 and 1952.

There has been little danger to life in any of the floods as the rise of the river has always been predictable. With continued residential and industrial expansion of the larger communities located on the river urban flood problems are increasing. During the last peak flood years property damage has been high. Eight hundred and forty families were affected in Fargo by the flood of 1952 and St. John's Hospital alone suffered damage estimated at $220,000. Grand Forks and northern points estimated $10,000,000 loss in the 1948 flood, a year when Fargo and other cities on the southern part of the river were little affected. Minnesota estimates flood damage from the Red for the ten year period from 1945-55 to be near $25,000,000.

Flood problems on the Red River are caused by factors peculiar to its topography. The river drops only 260 feet over its entire length, less than 1' per mile. Ice break-ups and snow run-offs occur in the beginning reaches of the river causing a stock piling of water behind a frozen channel. Flood problems on the tributaries are caused primarily by inadequate channel capacity through the nearly level plain of the basin. Land slopes and stream channel slopes are relatively steep outside the area and flat within. Meandering channels combined with small high water slopes make small carrying capacity in these streams. This causes the streams' flood flows to leave their channel and to inundate farm lands. This relatively level terrain precludes development of storage reservoirs which would be expected to materially reduce downstream flood stages.

There is no flood plain zoning in the Red River Basin. Flood protection projects in the basin have been built by the Corps of Engineers and more recently by the Soil Conservation Service. Both programs provide that construction costs be paid for by the Federal Government. Local interests pay for the rights of way and local improvements connected with the projects such as storage dams for municipal water supply.

The Flood Control Act of 1937, established flood control as an activity of the Federal Government. The Corps of Engineers steps into flood control projects when petitioned to do so by local interests. The Corps then attempts to make an investigation and to plan in close cooperation with local, state and fother Federal agencies in solving basin or local problems. In 1949 the Corps submitted to Congress a report on the Red River of the North Drainage Basin. This report covered such subjects as flood problems, drainage, municipal water supply, pollution abatement, and other related water use problems such as recreation and wildlife. Estimated cost of projects recommended in this report totalled $11,538,700 of which $9,339,600 would be Federal and $2,199,100 local. In 1956 the Corps completed its preliminary examination of its review of the above report, bringing up to date what had been accomplished since 1949 and recommending projects still needed.

The Corps of Engineers has completed Orwell Dam on the Ottertail River, Baldhill Dam on the Sheyenne River, Homme Dam on the Park River, Red Lake Dam, and the Lake Traverse - Bois des Sious levees, channel improvements and reservoir. Grand Forks' levees were constructed by the Corps. The Fargo dike and rechanneling project is now under construction. Many projects, large and small, are contemplated. The Pembilier multi-purpose project on the Pembina River, in which the North Dakota State Water Conservation Commission is interested, may be a big step in the future.

In North Dakota there is provision for the establishment of water conservation and flood control districts. These districts have the power to investigate and construct or arrange for the construction of projects that will serve to develop the water resources in certain areas within the districts. These districts have the authority to enter into contract with the United States agencies (Corps of Engineers and Soil Conservation Service for example) or state agencies (State Water Conservation Commission and State Game and Fish Department) for construction purposes and can levy taxes to meet the cost of projects. There are eleven such projects in the Red River Basin.

In Minnesota there were three Drainage and Conservancy Districts formed in 1949-50 to improve river channels and to prevent flooding of agricultural lands. This work was done by the Corps of Engineers. At the present time there are eight watershed projects under Public Law 566 in the Red River Valley area. They are in various states of planning. The last eight are a part of the Soil Conservation Service assistance program. This work includes flood control, water storage, drainage, floodways, and land use measures that will hold the water back on the land, as do the North Dakota projects.

D. Irrigation

1. Are there any irrigation projects in your locality? How many areas are under irrigation? Are they mainly federal irrigation projects? Any private construction of irrigation facilities? What share of the cost of irrigation projects is borne by the industries or non-agricultural interests which will be benefitted directly or indirectly) by the project?

Other than a few private irrigation systems, land around Fargo and Grand Forks, North Dakota and Moorhead and Fergus Falls, Minnesota is not irrigated. Water for these few systems comes from tributaries of the Red or from wells and not from the Red River itself. On the North Dakota side of the basin the Bureau of Reclamation has established Irrigation Development Farms in cooperation with the North Dakota Agricultural College and the United States Department of Agriculture. They are the Sheyenne Farm in Eddy County, 118 acres irrigated and Ransom Farm, Ransom County, 132 acres irrigated.

2. Are there any irrigation projects authorized but not yet constructed in the basin? Are there reasons for proposed projects other than the land and food needs of the population? What are the plans for sharing the cost? Are government subsidies needed in order for the project to be built?

Land in the Red River Basin has been included in the Garrison Diversion Conservancy District which was established by the North Dakota Legislature in 1955. This District provides the overall legal entity that could deal for the construction, operation and maintenance of the Garrison Diversion Unit. Water from the Missouri River would be used with additional water for municipal use and the Red River would receive some of the return flow. To date, two of the six irrigation districts are in the main Red River Basin. They are the Warwick-McVille District with 47,000 acres and the Tri-County District with 88,000 acres. About one million acres of the Red River Valley land have been found irrigable. Because of the limited capacity of the Red River to handle return flows from the irrigation projects without flooding, only about 1/3 of the irrigable land in the Red River Valley can be irrigated.

3. What is the repayment period for the projects: 40, 50, 60, 80, or 100 years? How much of the costs allocated to irrigation are to be repaid by the water users? What portion of the revenues from power are assigned for repayment beyond the water users' ability to pay? What portion of the revenues from furnishing water for municipal water supply or miscellaneous purposes are assigned for repayment beyond the water users' ability to pay?

If irrigation in the Garrison Conservancy District is authorized, it will be a Bureau of Reclamation project. Reclamation law requires that water users repay a portion of the costs allocated to irrigation - in this case 17.4% of the total cost. Costs beyond the water users' ability to pay are repaid from revenue from the power. Repayment contracts are now being formulated with a 50 year repayment period. The State of North Dakota also is authorized to impose a one mill property tax in the

Conservancy District which represents a $300,000 annual potential. At present the tax is 1/10 of a mill. Thus federal, state and local agencies share in the cost of irrigation.

4. What are the acreage limitations? Are they enforced?

According to U. S. Reclamation Law, the district has a 160 acre limitation. However, there is nothing to prevent each member of a family from assuming title to 160 acres.

5. Does the law make clear the ownership of water or water rights?

With water increasingly in demand, the importance of the ownership of water or water rights is obvious. Both riparian and appropriation rights are recognized in North Dakota. Appropriation requires filing of a water right application with the State Engineer, and has been a major activity of the State Water Conservation Commission for a number of years. Uses for water rights acquired include municipal supply as well as irrigation. Water rights in North Dakota are considered property rights and not a personal right. In other words, a water right is appurtenant to the land for which the right is granted and transfer of ownership of the land carries the right to use its water.

In Minnesota, the Division of Waters of the Minnesota Department of Conservation issues permits for irrigation upon the receipt of an application from a farmer. "The Farmer must indicate clearly the number of acres to be irrigated and the inches of water to be placed thereon. A map showing the wells or water source, and the lands to be irrigated must be included." This law is not well known to the general public so that a sizeable number of Minnesota farmers are apparently irrigating land without benefit of permit from the Conservation Department.

6. What federal, state or local agencies are concerned?

In North Dakota, the Federal Bureau of Reclamation, the Soil Conservation Service, United States Department of Agriculture, the State Water Conservation Commission, Irrigation districts, the Garrison Diversion Conservancy District and Extension programs.

In Minnesota, the Soil Conservation Service, the Water Resources Board, and the State Extension Service are most apt to be working with irrigation.

E. Power

1. What are the sources of electric power in your basin?

Hydroelectric generating plants account for less than 5% of the power produced in the Red River Basin. Power is produced by steam plants using lignite coal mined in North Dakota and diesel fuel. Hydroelectric power is being brought into the Red River Basin from the Missouri Basin.

2. Is hydroelectric energy a key feature of the water development program for your basin? What is its importance for the regional economy? What are the existing hydroelectric power facilities?

Hydroelectric energy produced in the Red River Basin is not a key feature of the water development program for the Red River Basin. Water is necessary in the generation of electric power in that steam plants require water for cooling systems. This water is not actually consumed but is simply pumped from the river through condensers and back into the river. This determines the location of a plant near a good water supply. It should be noted that electric power from federally owned hydro projects on the Souris-Red River Basin -- Roughly one-fifth of the firm power requirements in this basin in 1958 were met by power from these Missouri River projects.

All the existing hydroelectric plants in the Red River Basin are in Minnesota. They are as follows:

Plant Location	River	Plant Size	Owner and Operator
Crookston	Red Lake	176 kw	Ottertail Power
Red Lake Falls	Red Lake	600 kw	Northern States Power
Thief River Falls	Red Lake	500 kw	City
Fergus Falls (5 plants)	Ottertail	4,830 kw	Ottertail Power

3. What are the estimates of the potential development of this resource? How many of the proposed projects are economically feasible?

The flat terrain of this area does not lend itself to developing water power. Likewise, the Red's stream flow varies widely from maximum to minimum flow, which is not conducive to cheap hydro generation.

4. What agencies and groups participate?

Participating agencies and groups would include power suppliers, regulatory agencies, industrial development commissions, farm groups and others. Power suppliers would include the Bureau of Reclamation, Rural Electric Cooperatives, municipally-operated power systems, and two private utilities (Northern States Power Company and Ottertail Power Company). There are no Public Utility Districts in operation in the Red River Basin area. The North Dakota Public Service Commission and the Federal Power Commission would be regulatory agencies and the U. S. Corps of Engineers would be involved with the development of water power.

F. Navigation

Navigation has played an important role in the history of the Red River and its tributaries. It was a highway for the Voyageurs and their furs, for the transportation of logs into treeless areas, and the transportation of settlers and their goods. At this time it is not known if this resource could be developed once again.

G. Watershed Management

1. What is your immediate watershed? Does local watershed management cover the many diverse local situations of soil, slope, cover, and climate?

The immediate watershed for Fargo, North Dakota is the Red River but nearby watersheds include the Sheyenne River which flows into the Red north of Fargo and the Sheyenne's tributaries, Swan Creek, Maple River and Rush River.

In the immediate area of Grand Forks there are several watersheds beside the Red River. They are the Tongue River, Park River, Forest River, Turtle River, Goose River, Elm River. Construction is expected to begin the summer of 1959 on 3 watershed projects under Public Law 566 (SCS) on the North Dakota side of 12 basins. They are Elm River, Swan-Buffalo Creek and Wild Rice Creek projects. A fourth project, Tewauken, has been authorized by Congress. A pilot project, the Tongue River, is 75% complete. Besides these 5 there are at least 8 others in various phases of development in the basin. The Wild Rice watershed is a joint venture between North and South Dakota with the North Dakota Soil Conservation Service office doing the planning. This watershed will have benefits mostly in South Dakota. The Tewauken project is also in both states but the work is being done by the North Dakota office of the Soil Conservation Service and benefits will be chiefly in this state.

In Minnesota, Fergus Falls is situated on the Otter Tail River, and Moorhead is on the Red River.

Watershed projects that have been organized in the Minnesota Red River Basin area are as follows: Middle Fork of Two Rivers, Kittson and Roseau Counties; Lost River, Clearwater and East Polk Counties; North Branch of Two Rivers, Kittson and Roseau Counties; Joe River, Kittson County; South Buffalo, Clay, Ottertail and Wilkin Counties; Lost River #2, Polk, Clearwater and Red Lake Counties.

The Soil Conservation Service works closely with several state, local and federal agencies when planning or surveying a watershed. Besides flood control and water conservation districts and county soil conservation districts, the State Game and Fish Department, State Water Conservation Commission, U. S. Wildlife Service and U. S. Forestry Service are consulted. In Minnesota the State Soil Conservation Districts, the State Water Resources Board and the State Conservation Department are consulted as well as cooperating federal agencies.

In 1954 Congress passed the Watershed and Flood Control Act (PL 566) authorizing the Secretary of Agriculture to cooperate with local organizations in planning and executing improvements for flood control or for agricultural phases of watershed control, including conservation development and utilization and disposal of water in watershed areas. The Soil Conservation Service of the Department of Agriculture was made responsible for this work. This program enables the conservation or watershed districts to construct retarding dams, floodways and to improve channels. The main object is flood control. Substantial side benefits include soil conservation practice, recreation, wildlife conservation and municipal supply. The federal government pays construction costs, state and local interests provide the rest.

2. What are the basin's watershed problems?

The basin's main watershed problem is flood control. The flat topography of glacial Lake Agassiz causes low surface water runoff. Wind erosion and water erosion are secondary problems. Maintaining a source of municipal and industrial water is another problem.

3. How many farms are under soil and water conservation practices? Which soil conservation farm practices remain to be established; contour plowing; deferred grazing; land preparation; strip cropping? How many farm ponds have been built? How many idle or marginal acres are planted to trees and wildlife protection areas? How many acres of woodland have improved management plans?

The following figures are from the county summaries which are considered representative of the Red River Valley in the North Dakota portion of the Red River Valley. They are Pembina, Walsh, Grand Forks, Traill, Cass and Richland Counties.

Number of cooperators with soil conservation districts - - - -	5,178
Number of farm ponds on the land - - - - - - - - - - - - - - - -	1,201
Acres of field and farmstead tree plantings- - - - - - - - - - -	25,036
Wildlife area plantings and wildlife area improvements - - - -	12,645

There is no woodland improvement or management practices because there are very limited acreages of native woods existing only along the Red River itself.

With only about 50% of the farmers now cooperating with soil conservation districts, it might be generalized that about 50% of the needed conservation practices have been established. Some of all needed practices have been put into practice and some of these same practices remain to be established on the land in sufficient amount. In Minnesota,

the following figures have been taken from county summaries of Area I and Area II of the Soil Conservation Service. In this case, there are a few extra counties outside the Red River Basin included in the report as these areas extend further into Minnesota than this basin.

Number of cooperators with soil conservation districts - - - -		9,289
Number of farm ponds on the land - - - - - - - - - - - - - - - -		126
Number acres planted to trees and wildlife protection areas- -		60,149
Number woodland acres that have improvement management plans		
Improvement cutting	8,361	
Reforestation, Natural	7,039	15,400

All soil conservation practices that pertain to this area have been established to some extent.

4. What agencies are concerned?

Agencies concerned with conservation in the Red River Basin are the following:

U. S. Department of Agriculture
- Soil Conservation Service
- Agricultural Stabilization Service

U. S. Department of Interior
- Fish and Wildlife Service

U. S. Corps of Engineers

North Dakota state agencies
- State Water Conservation Commission
- Soil Conservation Districts
- State Game and Fish Department
- Water Conservation and Flood Control Districts

Minnesota Agencies
- State Soil Conservation Committee
- State Soil Conservation Districts
- State Conservation Department
  - Division of Water
  - Division of Fish and Game
- State Water Resources Board
- Extension Service
- County Governments

H. Recreation, Fish and Wildlife

1. What are the park and water recreation assets in your locality? Are they being used fully? Can they be expanded?

The City of Fargo has an extensive park system which is widely used not only by residents but by people from nearby. Other than some canoeing, speedboating and fishing on the Red near Fargo, the only places suitable for boating and fishing near Fargo are Lake Ashtabule above Baldhill Dam, Lake Tewauken and Home Dam Reservoir. There are public access roads to the reservoirs and lake.

The first park district organized in North Dakota was in Grand Forks in 1905, at which time the first Park Board was elected. The city parks now in existence cover 230 acres of land and include a golf course, swimming pool, picnic and game areas. An extensive recreation program is carried out year-round.

Moorhead is in the midst of a planned program of expanding park and recreation areas for a growing city. Land has been acquired for new parks, a swimming pool has been constructed and a baseball park has been completed.

In Fergus Falls there are several park areas with picnic and playground equipment. The city also has a well developed picnic and swimming beach area three miles south of Fergus Falls at Pebble Lake. There is also a municipal golf course and skeet shoot. This particular area is used not only by local citizens but by many North Dakotans as is evidenced by car licenses. There are also public beaches at Ottertail and Battle Lake. There are public access points on many of the lakes in Minnesota. The State Conservation Department has provided these areas for fishermen and hunters.

Most of the larger towns have developed municipal park systems which provide recreational facilities as well as scenic areas. It is not uncommon to find small parks that have been established and maintained by communities, townships or organizations such as 4-H clubs.

2. What are the park and water recreation assets in your basin?

There are no national park and water recreation areas in the Red River Basin. There are four state parks. The Turtle River State Park, 22 miles west of Grand Forks is the only state park in the North Dakota side of the basin. It is usable for campers and picnickers. Trailers are permitted and overnight cabins are available. A noteworthy example in the North Dakota part of the basin of local-state cooperation is the Golden Lake Restoration Project in Steele County which diverts water from nearby Beaver Creek to restore the level of Golden Lake so it can be used as a recreation and fish and wildlife propagation area. Citizens of the area set up a non-profit corporation and each community was assigned a quota of funds to raise, which were used mainly for right of way costs and recreational facilities. The State Water Conservation Commission paid part of the Beaver Dam construction cost. The State Game and Fish Department, with matching funds thru its Federal Aid Division, financed the balance of the cost.

In Minnesota there are three state parks in the basin area. They are Lake Bronson, near the Canadian border, Old Mill near Thief River Falls and Buffalo River east of Moorhead. All are listed as developed sites without modern facilities.

There are approximately 36 public hunting grounds and management areas and eight state refuges and public hunting grounds. Along the eastern edge of the basin there are many lakes which are populated with cottages and resorts. Fishing and tourist trade play an important role in the economy of this section of Minnesota.

In the North Dakota basin there are approximately 17 state game management areas. These frequently adjoin public hunting grounds. Fishing and other forms of water recreation are becoming more available with the developing of reservoirs and freshening of alkali lakes. There are many small parks, waysides and historical sites in both states. These are usually maintained by local organizations.

3. Do plans for reservoir construction include provisions for recreation: access roads; feet above flood crest to acquired; use of surrounding lands and water surface to assist in maintaining waterfowl; restoration of wildlife habitat; fishways?

Reservoir construction in the Red River Basin has had provision for recreation. This is true on areas where the U. S. Fish and Wildlife Service, state game and fish departments and local people contribute toward costs and benefits as well as planning stage cooperation.

4. How many acres in the basin are in national forests? What is the investment? How many visitors annually to forest areas? How many acres in state forests? Investment? Number of visitors? Is other use being sought? Would this adversely affect national or state forests?

There are no national or state forests in the Red River Basin. However, there is an extensive tree planting program encouraged by North Dakota and Minnesota Conservation Departments for wildlife habitat development.

5. What federal agencies are concerned?

U. S. Department of Interior
Fish and Wildlife Service
Bureau of Reclamation
U. S. Department of Agriculture
Soil Conservation Service
U. S. Corps of Engineers
U. S. Department of Health, Education and Welfare
International Joint Commission with Canada
National Wildlife Institute

State agencies concerned

North Dakota Game and Fish Department
State Water Conservation Commission
Minnesota Division of Waters
Division of Game and Fish
Watershed Districts
Soil Conservation Districts
County Commissioner Boards
Local civic and community groups

I. Multiple-Purpose Projects

1. How many multi-purpose projects directly affect your locality? What are they? How many completed projects are there in your basin? Under construction? Authorized but not constructed? Proposed? Where located? What purposes are they designed to accomplish?

There are five completed multiple-purpose projects in the Red River Basin, all of which were built by the Corps of Engineers. They are the following: Baldhill Dam and Homme Dam in North Dakota; the Orwell Dam, Red Lakes structures and the Lake Traverse structures in Minnesota. They are designed to regulate the flow of the Red River in order to provide water for municipal and industrial use, to control floods, and to help provide water for pollution abatement. Recreational facilities, wildlife habitat, game refuges and fishing areas are also provided at the various units. There are no new projects under construction nor any project authorized but not constructed. There is a multiple-purpose project proposed on the Pembina River near Walhalla by the North Dakota Water Conservation Commission. An additional difficulty lies in the need for an agreement with Canada since the project proposes diverting water from the Souris River in Canada to the Pembina River.

III. What is the Administrative organization in your River Basin?

A. Local
How many local agencies are engaged in various aspects of water administration?

PURPOSE	Flood Protection	Irrigation	Water Supply	Pollution Control	Recreation, Fish and Wildlife	Watershed Treatment	Drainage	Organize Districts	Basic Data	Power
MINNESOTA										
Watershed Districts	x				x	x	x			
Soil Conservation Districts	x				x	x				
Drainage Conservancy Districts	x						x			
Drainage & Flood Control Dist.	x						x			
Municipalities	x		x	x		x				x
Board of County Commissioners					x		x			
District Courts							x	x		
Extension Service		x			x	x	x			
NORTH DAKOTA										
Garrison Diversion Conservancy District		x	x	x	x		x			x
Irrigation Districts		x					x			
Soil Conservation Districts					x	x				
Water Conservation and Flood Control Districts	x		x		x	x	x			
Drainage Districts							x			
Municipal Water and Sewer Utilities			x	x						
Extension Service	x	x	x	x	x	x	x			
Board of County Commissioners County Drainage Board							x			

B. State

How many state departments are concerned?

PURPOSE	Flood Protection	Irrigation	Water Supply	Pollution Control	Recreation, Fish and Wildlife	Watershed Treatment	Drainage	Organize Districts	Basic Data	Power
MINNESOTA										
Department of Conservation Division of Forestry						x				
Division of Waters	x	x			x	x	x		x	
Division of Game and Fish				x	x					
Department of Health			x	x						
Water Pollution Control Commission				x						
State Soil Conservation Committee						x		x		
State Water Resources Board						x	x			
State Mapping Advisory Board									x	
Iron Range Resources and Rehabilitation Commission					x				x	
NORTH DAKOTA										
Water Conservation Commission	x	x	x	x	x	x	x	x	x	x
Health Department Division of Water Supply and Pollution Control			x	x						
Game and Fish Department				x	x					
Soil Conservation Committee						x				
State Geologist		x							x	

C. Federal

UNITED STATES GOVERNMENT EXECUTIVE BRANCH
WATER RESOURCE DEVELOPMENT

	Municipal and Industrial	Irrigation	Flood Control	Pollution Control	Navigation	Drainage	Power	Recreation Fish and Wildlife	Watershed Treatment
Department of the Army Corps of Engineers- Civil Functions	x	x	x	x	x	x	x	x	
Department of the Interior									
Bureau of Reclamation	x	x	x	x	x	x	x	x	x
Bureau of Indian Affairs	x	x	x			x	x		x
Bureau of Land Management	x	x	x		x	x	x		x
Geological Survey	x	x	x		x	x	x		x
Department of Agriculture Soil Conservation Service	x	x	x			x		x	x
Department of Health, Education and Welfare Public Health Service	x			x				x	
Department of State International Boundary and Water Commission	x	x	x	x			x		

1. What form of organization for multiple-purpose river development exists in your basin: An Interagency River Basin Committee; an interstate Commission; an Authority? How do these forms of organization fit your basin?

   The only form for multiple-purpose river development in the Red River Basin is an Interstate compact, the Tri-State Waters Commission, which is no longer active.

2. Do you live in a river basin that has established in it a federal-state Interagency River Basin Committee? What is the relationship to the federal Interagency Committee on Water Resources?

   There is no Interagency River Basin Committee in the Red River Basin. The Missouri River Basin Interagency Committee is an example of this type of agency. It is composed of the governors of the participating states and representatives of the Departments of Health, Education and Welfare; Agriculture; Commerce; Army; Interior; Labor and the Federal Power Commission.

3. Is there a serviceable instrument for bringing about joint action by a group of states in meeting common problems of a regional nature? Has it developed comprehensive plans for water conservation, including fish and wildlife and recreation? Is there a need for more state initiative?

   The first comprehensive study of the water resources and needs of the Red Basin was completed in 1936 by an Interstate Committee. Even now it is the most complete study and many of its recommendations have been carried out.

CHAPTER IV - WHAT ARE THE MAJOR CONFLICTS AMONG USERS?

1. Are there conflicts between upstream and downstream interests?

Because the Red River leaves the U. S. at the Canadian border and flows thru Canada to Lake Winnipeg, what is done upstream in North Dakota and Minnesota affects Canadian interests downstream. There are at present no differences or conflicts concerning the Red River before the International Joint Commission*. The Corps of Engineers, which has been the major construction agency on the Red in the U. S. is required to submit its proposals to the IJC for review and approval. Generally speaking, storage reservoirs, channel clearing and levees built by the Corps on the Red in the U. S. primarily for flood control purposes have not adversely affected the downstream reaches of the river in Canada, and the more even flow resulting has probably benefited rather than hurt Canadian downstream areas.

2. Over location of storage reservoirs?

There are few storage reservoir sites in the Red River Basin nor are these sites considered valuable in their natural state. The two largest reservoirs are Orwell Dam on the Ottertail River and Baldhill Dam on the Sheyenne River, both tributaries of the Red River. A multiple-purpose reservoir of similar size is being considered on the Pembina River, another tributary of the Red River in North Dakota near the Canadian border. Surveys have been and are being made by the N. D. State Water Conservation Commission and the Corps of Engineers. If this should include diversion of water in Canada , it must be approved by the International Joint Commision. Small storage reservoirs are being built on tributaries of the Red River under the Small Watersheds Act (PL566) as part of a watershed control program to help prevent damaging floods and conserve soil. It is believed that in general the improvements created by larger reservoirs and smaller watershed reservoirs have not adversely affected tax returns to the counties concerned.

3. Over hydroelectric power?

Since only 5% of the power produced in the Red River Basin is hydroelectric and potential sites are limited, it seems doubtful there will be conflict over using coal or hydro power produced in the Basin or over storage reservoir uses such as irrigation, flood control, pollution abatement, or recreation, fish and wildlife which might compete in terms of the amount of water to be stored and rates of release. Already power companies, municipal utilities and cooperatives are receiving hydro power transmitted from Bureau of Reclamation facilities at Garrison power is likely to increase as it becomes available, but so is their use of lignite (coal) of which there are vast deposits in N.D.

There is no conflict between irrigation and hydro power in the regulation of Red River Basin waters because neither exists except to a small degree. The conflict, if any, will come as a result of further development of Garrison Reservoir for hydroelectric power and irrigation. Studies done by the Missouri Basin Inter-Agency Committee point out that there will be sufficient water, and the reservoir can be regulated in such a manner as to substantially satisfy both power and irrigation interests, as well as the other purposes for which the dam and other main stem Missouri dams were built.

4. Over Irrigation?

Very little water for irrigation, supplementary or otherwise, is taken from the Red or its tributaries at the present time in either state. Downstream users have not

* For explanation of International Joint Commission see Chapter V,

complained that upstream irrigators are depriving them of water nor has competition developed with other uses of water such as municipal supply, pollution abatement, recreation, fish and wild life. North Dakota law provides that the first person applying to the State Engineer and Water Coservation Commission for a beneficial use such as irrigation obtains a priority to use water as outlined in his approved water right, and the Commission has been encouraging individuals, municipalities and industries, etc., to file for water right. Some people in N.D. feel that granting water rights in this way will eventually mean all water will be in private, municipal or industrial hands and little or none left for public uses. However, the storage reservoirs, small and large are creating lakes in the Red River Basin where there were none before and practically all have provision for recreation facilities and fish and wildlife habitat and propagation. In Minnesota the Division of Waters of the Department of Conservation issues permits for irrigation upon receipt of an application from a farmer, but farmers are unaware of the law and more farms are irrigated than there are permits.

5. Between fish-wildlife-recreation users and other developments? Flood control and other use?

So far as has been determined there are no conflicts between recreation interests and the need to regulate Orwell and Baldhill Dams for purposes of flood control, pollution abatement and municipal supply, and it is expected the same will be true of the smaller storage reservoirs built under the Small Watersheds Act. When reservoirs are used for flood control and pollution abatement their levels of necessity fluctuate but apparently the difference in levels is not sufficient to hamper unduly boating, swimming, fishing and the building of lake cottages. Neither has this procedure seemed deleterious to fish life, and the muddy bottoms and considerable plant life in reservoirs produce larger fish more quickly than is true in rocky, sandy bottomed natural lakes. These reservoirs are stocked with fish by the state game and fish authorities.

In the Red River Basin there are serious conflicts between farmers desiring drainage and flood control to protect or increase their productive acres and fish-wildlife-recreation interests. Both the states and the U.S. Soil Conservation Service cooperate with local units such as counties and special districts in providing drainage facilities. They also cooperate with the Corps of Engineers for flood control practices which encourage drainage. In the extremely flat Red River Valley (the lake bottom of glacial Lake Agassiz) natural drainage is poor, and for many years open drains have been built to clear valuable agricultural land of standing water which would otherwise render the land infertile.

In the Red Lakes area in northwestern Minnesota the Corps of Engineers at the request of farmland owners among others provided flood control, channel clearing and other structures for drainage for agricultural purposes which resulted in the draining of lakes and wetlands and fluctuating levels on Red Lakes, adversely affecting the value of these areas for the production of wild rice, fish and game on which local Indians depended for sustenance.

There is conflict in the Mauvais Coulee area of the Devils Lake Basin over proposals of the N.D. State Water Conservation Commission and the Corps of Engineers to provide drainage of many privately owned acres of land that are frequently flooded. These two agencies and the landowners concerned believe the land should be protected for agricultural purposes. Fish and wildlife supporters fear some of the last remaining top natural duck breeding areas in N.D. will be destroyed. Their argument is why provide government financial support to put more acres in production of crops that are already in surplus? Each farmer, however, is no doubt concerned with increasing productivity on his farm as one of the few means he sees to keep himself in business in an era of falling prices and uncertain government crop support. It is suggested the new small and large

storage reservoirs will provide wildlife habitat, since all federal projects are now required to include provision for this in their project plans. Wildlife enthusiasts counter that ducks breed at the edges of small pools surrounded by much vegetation and not on large surfaces of water whose levels fluctuate.

6. Over pollution control?

Both states are proceeding as rapidly as possible with the improvement and construction of sewage treatment facilities with the help of federal aid under the Federal Pollution Control Act (PL660). The two states participate actively in the Interstate Sanitation Committee which set up standards for municipal and industrial pollution abatement, and federal aid funds have proved a tremendous stimulant to encouraging municipalities to meet these standards. Most industrial pollution is handled thru municipal facilities. One exception would be the sugar beet factory in Moorhead, Minn. which provides lagoon treatment for its wastes and then dumps these treated wastes into the Red River when the Corps of Engineers notifies them that river conditions are suitable.

The problem of lake pollution has been of growing concern to cottage and resort owners on Minnestoa lakes on the south eastern edge of the Red River Basin. A number of these lakes are bordered by farmlands. One of the possible explanations for the amount of weed growth in these lakes is the addition of commercial fertilizers to the surrounding farm lands which is in turn leaching out chemicals into the lakes.

7. Are there conflicts with other basins affecting the Red River Basin?

A number of groups and individuals in N. D. are working hard to achieve diversion of water from Garrison Reservoir into the Souris and thence to the Red for purposes of irrigation and increased municipal and industrial supply. People in Missouri, and Iowa object to any diversion to the Red which would flow thence into Canada but not to diversion if return flows all go back into the James River and thence to the Missouri. In general people in S.D. have supported Garrison Division although on newspaper in eastern South Dakota editoralized in opposition in the fall 1958.

8. Between local entities in the construction of projects?

There have been conflicts between adjacent cities across state lines over whether one or both should cooperate in flood control projects and who would be responsible for what. Both Grand Forks and Fargo sought flood protection thru Corps of Engineers projects. East Grand Forks and Moorhead decided not to participate and Grand Forks and Fargo went ahead with the plans proposed for their protection and constructed by the Corps. In the case of Fargo, Fargo had to give Moorhead legal asurance that Fargo would compensate Moorhead property owners for any damages occuring to them which would be caused by the operation of the flood protection works. This required enabling legislation by the North Dakota legislature. The Fargo project also included being in Moorhead, Minn., and this required approval from the Minnesota authorities.

There also has been a conflict between a city and a county over the best sort of local entity to handle flood control and related water use problems. Landowners in Cass County, North Dakota, proposed that a county wide Water Conservation and Flood Control District be set up as the legal entity to represent the people in Cass County and Fargo in planning and constructing water resource projects in cooperation with state and federal agencies. Fargo officials were unwilling to go along partly because they expected the larger financial burden would fall on the city. As a result the landowners in most of Cass County outside Fargo established the Maple River Water Conservation and Flood Control District which has since initiated the Swan-Buffalo Creek small watershed project in cooperation with the Soil Conservation Service; and the City of Fargo set up its own flood control district and has since initiated the Fargo flood control project mentioned above which is being constructed by the Corps of Engineers. Interestingly enough representatives of the two federal agencies as well as the State Water Conservation Commission at the hearing to consider setting up the county wide district spoke in favor of a county wide district in contrast to the separate districts.

1. To what extent do state and local governments participate in planning, programming, financing and operating water resource facilities? To what extent do private citizens and organizations participate in water resource control and development? Is there a need for more local and state initiative? Do the local interests share in the costs of projects which benefit them?

NORTH DAKOTA

The North Dakota State Water Conservation Commission has control over all waters of the state, grants water rights, and investigates, plans, programs, constructs, and maintains water resource facilities but usually in association with local agencies, other state agencies and federal agencies. Often it shares in financing with local, state, and sometimes federal agencies but does not operate facilities. It is responsible for preserving normal drainage patterns in state highway construction. It provides basic data on surface and ground water resources in cooperation with the U. S. Geological Survey and the State Geologist and locates, with its own technicians and equipment, sources of water supplies for municipalities so requesting. It works closely with the various federal agencies bringing to their attention needed projects, reviewing and criticizing their proposed plans, and actively supporting their plans with which it is in accord.

The Division of Water Supply and Pollution Control of the State Health Department approves all plans for municipal supply and sewage disposal (jointly with the State Water Conservation Commission) before construction, inspects these facilities at least once a year if manpower permits, administers and allocates the state's share of federal aid funds for sewage disposal improvements to municipalities, actively participates with Minnesota and South Dakota agencies in the Interstate Sanitation Committee which set up standards for municipal and industrial pollution control, and encourages municipalities and industries throughout the state to meet these standards. Along with the State Water Conservation Commission it represents the state before the International Joint Commission and interstate and Canadian provincial organizations which involve North Dakota waters.

The State Game and Fish Department and State Water Conservation Commission have worked together for many years, often in cooperation with local and federal agencies, in developing projects that provide fish and wildlife conservation and recreation, the Commission generally providing engineering services and the Department ecological decisions.

The State Water Conservation Commission organizes local water districts of various sorts at the request of local people and works directly with already existing local bodies such as counties, municipalities and park districts. These districts have power to raise funds either by mill levy or special assessments or both to help finance the construction and operation of their projects, and negotiate with whatever state and federal agencies they decide can best accomplish their purposes. They are governed either by a board elected by themselves or appointed by the County Commissioners. Besides municipalities, park districts and counties these special local bodies include irrigation districts, water conservation and flood control districts and drainage districts. In addition the state legislature has established the 25 county Garrison Diversion Conservancy District, an over-all entity responsible for development of Garrison Diversion unit, and those landowners in the affected counties who wish to be included are establishing their own local irrigation districts which will deal with the Garrison Diversion Conservancy District and the U. S. Bureau of Reclamation. Municipalities and counties through their elected officials also handle their own water projects, such as the Fargo and Grand Forks Flood Control Districts which negotiated directly with the Corps of Engineers and County Drainage Districts which work directly with the State Water Conservation Commission and the Soil Conservation Service.

In North Dakota private citizens and organizations participate to a considerable extent in water resource development. For example, local landowners can organize into the kind of district provided by law which they believe best meets their needs. In other instances private citizens in an area have organized non-profit corporations to raise money to help finance local projects such as the restoration of Golden Lake in Steele County in the Red River Basin. Chambers of Commerce in the larger cities in the Red Basin have active water committees and not only keep themselves well-informed of what water projects their communities need but actively work with various city, state and federal officials to achieve these. The local Chambers of Commerce are active promoters of Garrison Diversion along with the Greater North Dakota Association, which was recently formed by the merger of the North Dakota Reclamation Association and the Missouri-Souris Projects Association. County Wildlife Federations and local rod and gun clubs work to promote the interests of fish and wildlife.

In North Dakota the state agencies concerned with water and certain specific local citizens and local and state organizations are taking much initiative in trying to develop those water resources of the state they consider important. The North Dakota Water Users Association is currently carrying on a state-wide campaign to widen and enlarge its membership. Generally speaking, however, it seems that the greater number of citizens, particularly in urban areas, are neither aware nor much interested in water uses and programs although they are increasingly using for recreation the larger storage reservoirs and smaller lakes being created in the basin.

In North Dakota local interests share in the costs of most projects which benefit them, although there is perhaps little uniformity in the proportions they share in the various programs in the state and in relation to projects in other states. For example, a North Dakota Small Watershed Project received 43% of cost from local interests, whereas in a small watershed project in Texas local interests contributed only 6%. In flood control projects under the Corps of Engineers and the Soil Conservation Service local interests provide easements and rights of way. In the proposed Garrison Diversion only those landowners who wish to be included have been included in the irrigation districts, and they will pay over a period of 50 years what they are able toward cost of construction (with power revenues from Garrison Dam making up the difference - about 17% landowners and 83% power) and will pay the entire cost of operation and maintenance. However, everybody in the 25 counties is required to pay up to 1 mill to the Garrison Diversion Conservancy District but all will benefit (although it would be difficult to measure to what extent) thru increased municipal and industrial supply and increased flow for pollution abatement, etc. Possibly the local, state and federal governments will benefit as irrigation brings increased trade and services to the area and consequent greater tax returns. For local recreation facilities, such as Golden Lake, the citizens through the Golden Lake Restoration Corporation raised $20,000 to be used partly for providing recreation facilities while the Game and Fish Department and the Water Conservation Commission assumed responsibility for fish and wildlife and construction. The Commission's funds came from state taxes appropriated to them by the legislature; the Game and Fish Department's from the sale of fishing and hunting licenses and from federal aid funds allocated to the states from federal taxes on fishing and hunting equipment. In sewage control programs the federal government provides up to $250,000 or 30% of total costs whichever is smaller, and the municipality pays the rest, often through revenue bonds which are paid off by users in service charges.

MINNESOTA

Local groups (landowners, county and township boards, municipalities, district courts) initiate requests for water resource programs in their own area for: flood control, drainage, supply, establishment of soil conservation and watershed districts. County agents, agricultural extension service, soil conservation committees, and the Water Pollution Control Board usually have to nudge local groups to an awareness of

their problems and what agency functions can assist them. However, the initiative is grass roots. The State, through Conservation Department agencies, the Soil Conservation Service, and Water Resource Board assists in planning and programming, but financing and operation are local responsibilities unless the program falls within the category of a federal cost-sharing project, such as:

Flood control - Federal funds entirely except for easements, rights of way, etc.
Watersheds qualifying under PL566 and approved by Water Resource Board - Federal cost-sharing.
Sewage treatment plants qualifying under PL660 and approved by the Water Pollution Control Board - Federal cost-sharing.
Farm improvement practices under Agricultural Stabilization Program - Federal cost-sharing.

Sportsmen, business and conservation groups work to inform and develop public opinion about water resource development, but do not control water development.

There is need for further education to acquaint local communities with the advantages to be gained through participating in state and federal programs.

In most cases local interests share in the costs of projects which benefit them. (See above)

2. Are political subdivisions of upstream states compensated for loss of tax sources through creation of reservoirs which are largely for the benefit of downstream states? What provisions are there for compensating local political units for losses or handicaps incurred in the development of water resources or use of watershed lands for regional or national benefit?

The Red River Basin with which this study is concerned lies primarily in the states of North Dakota and Minnesota with a very small portion lying in the upstream state of South Dakota. There are no reservoirs in the South Dakota portion. The only two reservoirs of any size - Orwell Dam on the Ottertail River and Baldhill Dam on the Sheyenne River are situated in Minnesota and North Dakota which would be considered downstream states. These reservoirs were built by the Corps of Engineers for purposes of storing water, flood control and pollution abatement by regulating the flow of water into the Red River which forms the boundary between Minnesota and North Dakota, thence flowing into Canada where it empties into Lake Winnipeg. Benefits from these reservoirs have accrued to the states of North Dakota and Minnesota and also to Canada because of the more even flow resulting in the rivers. Consequently in the Red River Basin political subdivisions of upstream states have not lost tax sources through the creation of reservoirs which are largely for the benefit of downstream states. Garrison Reservoir in North Dakota in the adjacent Missouri River Basin would be an example of such a loss.

The two reservoirs in the Red River Basin, however, would have regional benefit. They benefit the people who dwell on the reaches of the Ottertail and Sheyenne Rivers below the dams and on the main stem of the Red. They also provide recreational and fish and wildlife benefits to the people who live nearby as well as to people from farther away who visit them. The lands for Baldhill Dam were acquired from the landowners by the agencies constructing the dam. To our knowledge there was no provision in the construction of Baldhill for compensation to counties in which the reservoir is located for losses for removal of flooded lands from the tax rolls. It is possible that tourist facilities and economic growth nearby since these dams were built have led to an increase in taxes received by these counties. In any

event it's extremely difficult to evaluate in dollars and cents their benefit to the people who use them, as well as the increase in nearby trade and services.

In the 1959 Minnesota Legislature several changes were made in the Watershed Act of 1955. Provision is made in the Act for the assessment of upstream owners when waters from their lands are causing damage to land owners. North Dakota laws provide that one person or group of persons cannot indiscriminately drain their lands onto another person's land. The State Water Commission has had several such problems referred to it and has taken the position that drains and other means to provide flood protection should take into consideration the drainage of water to a natural water course so as not to adversely affect lower lands. If damage results from such indiscriminate practices the damaged person has recourse against those causing the flood waters to drain on his lands. In Minnesota a one-mill tax levy will be permitted against all property in the watershed district for any special project which would benefit the whole district including recreation and wildlife projects. North Dakota Water Conservation and flood control districts already have power to raise funds by mill levy and/or special assessments.

On Federal refuges in Minnesota such as Tamarac and Mud Lake, there is a percentage of sharecrop profits that is turned back to the county. In the Minnesota Wetland acquisition program there is a 25¢ turnback to the counties for each acre of stateland each year. This program has actually taken many acres off the state forfeit lists.

3. To what extent does the federal government take responsibility for the protection and enhancement of fish, wildlife, and recreation resources? Should the costs incurred be considered nonreimbursable? Should states bear some of the cost?

Congress has given the Department of Interior responsibility for administering legislation enacted to insure the perpetuation of waterfowl. The Fish and Wildlife Service of the department is responsible for formulating and administering a program for regulating kill, establishing national refuges, restoring habitat, conducting research. State Game and Fish agencies in both states purchase wildlife lands and rear fish and wildlife partly through Pittman-Robertson and Dingell-Johnson funds. (Federal aid allocated to the states from federal taxes on hunting and fishing equipment). Federal construction agencies such as the Corps of Engineers, Bureau of Reclamation and Soil Conservation Service must now include provision for recreation facilities and U. S. Fish and Wildlife Service recommendations in their projects. Under PL566 as amended the SCS can pay 50% of the cost of wildlife improvement. Federal aid to states for sewage disposal improvements (PL660) by helping to clean up streams helps protect fish, wildlife and recreation resources.

It would be extremely difficult to measure in dollars and cents the costs involved for fish, wildlife and recreation resources as well as to determine who the beneficiaries are. However it seems desirable that states and in some cases localities should bear some of the costs of recreation, fish and wildlife resources. State game and fish agencies in the states in the Red Basin already do share some of the costs through the programs they provide with funds from fishing and hunting licenses. (and in Minnesota with legislative appropriations). In North Dakota local people voluntarily raised funds to help with the restoration of Golden Lake for recreation purposes and the state through its Water Conservation Commission and Game and Fish Department contributed state and federal aid funds for the balance of the cost.

4. To what extent do international treaties affect the development of the Red River Basin?

The international character of the Red River Basin (as well as the related Souris and other basins draining both U. S. and Canada) was recognized as long ago as 1909 when the International Joint Commission was set up by the two countries to provide machinery for the prevention and settlement of disputes arising over the use of such international waters. The IJC set up the following priorities of use: 1. domestic and sanitary purposes; 2. navigation; 3. power and irrigation, which of course affect the Red River Basin, and matters affecting both countries have been and will continue to be referred to it for settlement.

Canada and the U. S. also have a treaty to protect and perpetuate useful migratory birds. This treaty takes control over migratory birds away from the states and vests it in the joint control of the U. S. and Canadian governments. The U. S. Fish and Wildlife Service is charged by the U. S. government with carrying out the treaty. The treaty clearly affects the Red River Basin which lies in what is known as the central flyway under jurisdiction of the treaty.

VI. WHAT IS THE FUTURE OF THE RED RIVER BASIN?

1. What are the main water problems needing attention in the Red River Basin?

The main water-related problems needing continuing attention in the Red River Basin are flood control, drainage, control of pollution, storage for periods of low rainfall, preservation of fish and wildlife, development of recreation facilities and increased soil conservation practices. Some of these problems are competitive, and the search for solutions has already led to conflict. For example, flood control and drainage practices can increase the amount of productive agricultural land but may decrease natural habitat of fish and wildlife and recreational facilities and thus be opposed by wildlife interests. Some of the problems are complementary. The planting of shelter-belts, a growing practice in the Basin, helps preserve soil and moisture by lessening wind erosion and provides habitat for wildlife. Storage in the two main reservoirs for periods of low rainfall has not conflicted with the need for reservoir space for flood control purposes, and it has been possible to release water as needed to maintain a minimum low flow for pollution control purposes.

Pollution control has, of necessity, involved the improvement of sewage disposal works in many of the municipalities in the Basin. Both states' health agencies are convinced that federal aid has greatly increased the speed with which necessary facilities could be constructed and believe that with continuation and improvement of the federal law the goal of satisfactory pollution control can be achieved and maintained. Industrial growth, however, has been slow although there is now a trend toward increasing the number of potato processing plants. With this growth will come the problem of controlling industrial waste disposal either by the industry itself or a neighboring municipality.

2. Is the solution of these problems a part of the planning objectives for the Red Basin?

Each agency has short and long-range planning objectives for various phases of water conservation. Perhaps the following could be considered to be basin planning objectives:

1. Interstate Sanitation Committee's and state health agencies' efforts to achieve pollution control through adoption of their recommendations by U. S. Public Health Service and continued federal aid in improvement of sewage disposal facilities.
2. Corps of Engineers flood control and drainage proposals and projects have had an overall basin survey in 1949 Report to Congress followed by a review in 1956 of what has been accomplished and what is yet to be done. These surveys are also concerned with pollution and other water problems.
3. Soil Conservation Service has a number of small watershed flood control and land management projects in the planning and construction stage.
4. State and federal efforts in fish, wildlife and recreation.

3. What might be done in the future?

Diversion of water from the Missouri at Garrison Dam through a series of reservoirs and canals to provide water to the Souris-Red Basin for irrigation, regulation of low flows, municipal and industrial supply and pollution abatement is one proposal. This is a Bureau of Reclamation project, part of the Pick-Sloan Plan (Flood Control Act of 1944) for the development of the Missouri Basin.

Its authorization must be modified by Congress to permit diversion from Garrison instead of from Fort Peck. Then Congress must appropriate money to begin construction. Costs will be spread over the 50-year construction period and will total about $500,000,000. The Garrison Diversion Project will have a significant effect on the Red River Basin. A great part of the land that will be benefitted lies in the drainage basin of the Red River of the North, including the Souris. Much of the new wealth that this project is expected to create will come from the Red Basin and as a consequence would have a tremendous impact on the Basin's economy.

It is strongly supported in North Dakota by the State Water Conservation Commission, North Dakota Water Users Association, Chambers of Commerce and affected farmers. Although Minnesota cities along the Red stand to benefit, they represent a negligible part in the overall Minnesota water picture where the current emphasis seems to be on small watershed development. This is natural in view of the many small watersheds in Minnesota. It is meeting opposition from downriver Missouri Basin states. In June 1959 the North Dakota Water Users Association was suggesting North Dakota float a bond issue to finance its own diversion from Garrison Reservoir.

The North Dakota State Water Conservation Commission believes a major problem to be the equitable division between North Dakota and Minnesota of the waters of the Red River and has proposed the Tri-States' Water Commission (an interstate compact between North Dakota, South Dakota and Minnesota) be reactivated, perhaps as a two-state compact. The Minnesota authorities have evidenced no interest as yet in this proposal. As a result the North Dakota State Water Conservation Commission has been concentrating on a policy of urging all North Dakota cities using Red River Basin water to secure water rights under North Dakota law. What affect this will have on Minnesota or future negotiations is not certain since Minnesota water laws in contrast to North Dakota's are based on riparian rather than appropriation doctrine. In North Dakota municipalities, individuals and industries can acquire rights to water they use for beneficial purposes. In Minnesota water is supposed to be shared by all along a stream's banks and delivered by upstream users undiminished and unchanged to downstream users. There are advantages and disadvantages to both water laws. Where water is in short supply, however, some solution must be found to dividing it equitably. A fundamental difference exists between Minnesota and North Dakota in that Minnesota has abundant water resources while North Dakota is often faced with scarcity.

Perhaps a Red River Basin Inter-Agency Committee would be a useful alternative if a revived interstate compact proves impossible to secure. Increasing realization of inter-governmental relationships appears to be developing faster in basins which have inter-agency committees, such as the Missouri Basin. At least this seems to be indicated in the minutes of their meetings and the reports they publish.

Another possibility would be a river basin committee such as proposed by Representative Aspinall of Colorado who has introduced a bill into Congress authorizing the President to create commissions for major river basins or regions to serve as principal agencies for coordination of federal, state and local planning for water resource development.

The most fundamental problem facing the Red River Basin, however, would seem to be a need to explore and inventory its three basic resources of people, land and water. To be sufficiently comprehensive this should be undertaken jointly by all agencies operating in the Basin, both state and federal and including some means of assuring representation of the public. There appears to be a more rapid increase in population than in the past. Whether this is a net increase and how large or just a rural loss and urban gain will be indicated by the 1960 census. In the 1950 census the cities were showing the gains. Even rural loss and urban gain pose problems of

land and water use. The large amount of extremely fertile soil has been and probably will continue to be the Basin's greatest natural resource. It has by far produced the greatest amount of wealth, and the wealth it produces has determined the economic prosperity not only of the farmers but of the urban areas. Another source of wealth is recreation from the lakes area in the southeastern part of the Basin, which has had considerable development as a resort and vacation area. Many people use this resource from outside the Basin as well as a large proportion from within the Basin. Fish and wildlife resources are considerable - in particular fish in both natural and artificial lakes and waterfowl and other game birds. Underground resources and timber resources are not extensive.

The solution for the Basin's economic problems seems primarily to revolve around the need to make the most productive use of the fertile soil and to increase the number of industrial plants processing food, fiber and livestock products. One approach which has substantial support in the North Dakota part of the Basin is the diversion of water from Garrison Reservoir on the Missouri as described above. The aim would be to have irrigated and dryland farming complement each other. In areas outside the Red Basin, such as Lower Yellowstone in western North Dakota and eastern Montana, irrigation has meant significant economic growth with vegetables, sugar beets and livestock feed being produced in irrigated areas and nearby ranchers buying feed and sending their stock to feed lots in the irrigation project for wintering. It has meant, compared to nearby areas, a significant growth in towns and trade and services provided. It must be remembered, however, it is not easy for farmers to change from accustomed ways to new ways of farming. Also it is costly, may seem to be beyond their resources to farmers who might wish to, and may require new kinds of credit arrangements.

There is in progress a regional study of the Upper Midwest, which includes the Souris-Red River Basin and also extends into the upper Missouri and western Great Lakes Basins. States included are Minnesota, North Dakota, South Dakota, Montana, western Wisconsin and upper Michigan, which comprise the Ninth Federal Reserve District. It is sponsored by the Upper Midwest Research and Development Council composed of 29 firms and organizations in the area with the help of their own funds plus additional funds from the Ford Foundation and the Committee for Economic Development. It is being conducted by the Council and the University of Minnesota and will take four years and some $500,000 to complete with portions of it and recommendations being released as they are ready. It is the first and only one of a number of regional studies now being undertaken throughout the U. S. that is concerned with a largely rural area. Its aim is to find ways to promote economic growth of the region which lags behind the rest of the country.

The study will consider the character and capabilities of the region's labor supply and will also cover mineral and other material resources, water supply, power and transportation facilities. Every activity which contributes to wealth making will be examined from the standpoint of its present position and future possibilities, and the relation of each to the others. According to J. Cameron Thomson, Council Chairman, its ultimate aim is "to provide more and better jobs for more people". President J. L. Morrill of the University of Minnesota says that by recognizing "the larger-than-state character of resources and problems" the study represents "a major breakthrough in economic thinking". Ford Foundation executives comment that it will help "avoid what has become almost standard - and unfortunate - practice: economic planning of large areas, unrelated to physical and land-use planning or urban components".

Council Chairman Thomson lists the following main reasons for making the study:

1. The economic character of the region provides an opportunity for studying two of its current and long-range economic problems - agriculture in transition and the economic potential of low-grade mineral resources.

2. The transition in farming implies a population shift. As it adopts new methods - particularly new machines - farming will engage fewer and fewer people in the region. These people released from farming must be provided with new and profitable pursuits in this region if they are not to be lost to other areas; consequently the need of a study leading to establishment of new industries, or expansion of present ones.

3. The region soon will begin to feel the influence of the St. Lawrence Seaway as it already is feeling the impact of the Missouri Basin Development. Yet it has no coherent idea of what the effect of the two will be.

Two principal products are expected from the analysis of information obtained. One is an understanding of all factors contributing to the economic welfare of the region and its people or detracting from it. Two is a forecast of the future place of the region in the economy of the U. S., taking into account shifts of population and changes in inter-regional competition, changing demands for goods and services and recommendations for action needed to accelerate sound economic growth of the region.

Two committees will represent the public interest during the study. One will be a governor's advisory committee and the other a citizen's advisory committee to include representatives of agriculture, labor, business and the professions. The Upper Midwest Research and Development Council is an outgrowth of the Resources Research Committee, which several years ago financed a $130,000 study of mineral resources of the region with emphasis on possibilities for developing North Dakota lignite deposits.

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10. Chambers of Commerce of Grand Forks, North Dakota, and Moorhead and Fergus Falls, Minnesota.

11. U. S. Bureau of the Census, 1950.

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1. League of Women Voters of Grand Forks, North Dakota River Basin Survey

2. League of Women Voters of Fargo, North Dakota River Basin Survey

3. League of Women Voters of Moorhead, Minnesota River Basin Survey

4. League of Women Voters of Fergus Falls, Minnesota River Basin Survey

5. League of Women Voters of Moorhead, Minnesota, "A Study of Moorhead - City of Progress".

6. Eleventh Biennial Report of North Dakota State Water Conservation Commission.

7. Thirty-fifth Biennial Report - Health in North Dakota - North Dakota State Department of Health.

8. A Comprehensive Program for Water Pollution Control for the Red River Basin, U. S. Public Health Service, 1953.

9. Know Your River Basin Survey of the Twin City Metropolitan Area.

10. Report - "What Has Been Done On Water Resources in the Red River Valley For the Past Fifty Years" - Olaf C. Soine

11. Letter to Mrs. H. T. Moore, Fargo, from Norman L. Peterson, Division of Water Supply and Pollution Control, Department of Health, North Dakota.

12. Letter to Mrs. G. E. Mann, Fergus Falls, from Mr. Allen L. Fisk, Assistant State Conservationist, North Dakota.

13. Letter to Mrs. G. E. Mann, Fergus Falls, from Mr. Hans Uhlig, SCS Biologist, Fergus Falls, Minnesota.

14. Interview - Mr. Fred Heisel, Health District No. 7, Minnesota.

CHAPTER III

1. League of Women Voters of North Dakota Water Resources Committee, Nov. 1958 Agencies concerned with Water Resources Development in North Dakota.

2. League of Women Voters of Minnesota, Dec. 1956 - State Department agencies and Interstate Commissions concerned with the Development, Conservation and Control of Water Resources in the State of Minnesota.

3. National Voter, January 1959. League of Women Voters publication.

4. Ninth Biennial Report of the North Dakota State Water Conservation Commission.

5. Letter from Mr. Vernon S. Cooper, Assistant Secretary, North Dakota State Water Conservation Commission.

CHAPTERS IV, V, VI

1. Eleventh Biennial Report of North Dakota State Water Conservation Commission, July 1, 1956 - June 30, 1958, Bismarck, North Dakota.

2. Thirty-fifth Biennial Report of North Dakota State Department of Health, "Health in North Dakota", July 1, 1956 - June 30, 1958, Bismarck, North Dakota.

3. Annual Report, North Dakota Game and Fish Department, July 1, 1957 - June 30, 1958, Bismarck, North Dakota.

4. 1936 Interstate Committee Report - Red River of the North.

5. Red River of the North Drainage Basin, Report to Congress by U. S. Army Corps of Engineers, House Document 185, 81st Congress, First Session, 1949.

6. St. Paul District, Corps of Engineers, Preliminary Review and Report on Flood Control and Related Problems, Red River of the North Drainage Basin, 1956.

7. Comprehensive Water Pollution Control Program for the Red River of the North Basin, U. S. Public Health Service, Publication No. 293, 1953.

8. Red River of the North Drainage Basin, League of Women Voters of Grand Forks, North Dakota, February 1959.

9. View of a River Basin, The Red River of the North, League of Women Voters of Fargo, North Dakota, April 1959.

10. Water Use and Control Programs of Moorhead, League of Women Voters of Moorhead, Minnesota; January 1959.

11. Documents on The Use and Control of The Waters of Interstate and International Streams; Compacts, Treaties and Adjudications, U. S. Department of the Interior, 1956.

12. Fourth Biennial Report of The Tri-State Waters Commission, December 1944

13. Mission Basin Inter-Agency Committee, Minutes of Meeting held October 1958, Bismarck, North Dakota, primarily relating to Garrison Diversion.

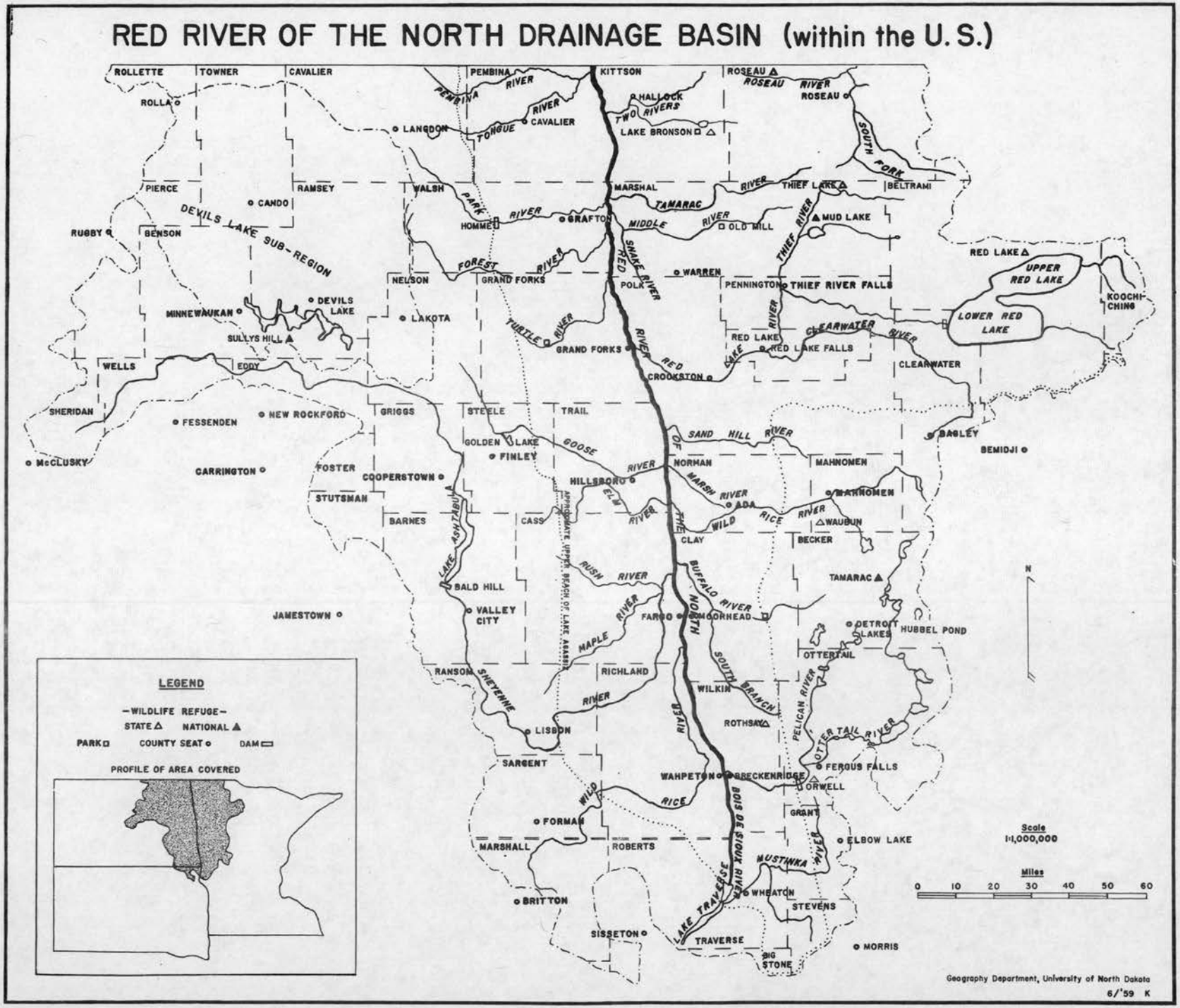
14. Conservation in America, Dorothy Childs Hogner, J. B. Lippincott Co., New York, 1958, primarily for explanation of federal aid for fish and wildlife.

15. Correspondence and interviews with federal, state and local officials and with officials of Northern States and Ottertail Power Companies.

16. The Fargo Forum - Various articles relating to water - 1956-59 - included information on small watersheds, Fargo flood control project, Garrison Diversion, Upper Midwest Research and Development Council

17. The Minneapolis Tribune - "The Changing Face of the Dakotas"

RED RIVER OF THE NORTH DRAINAGE BASIN (within the U. S.)



Geography Department, University of North Dakota
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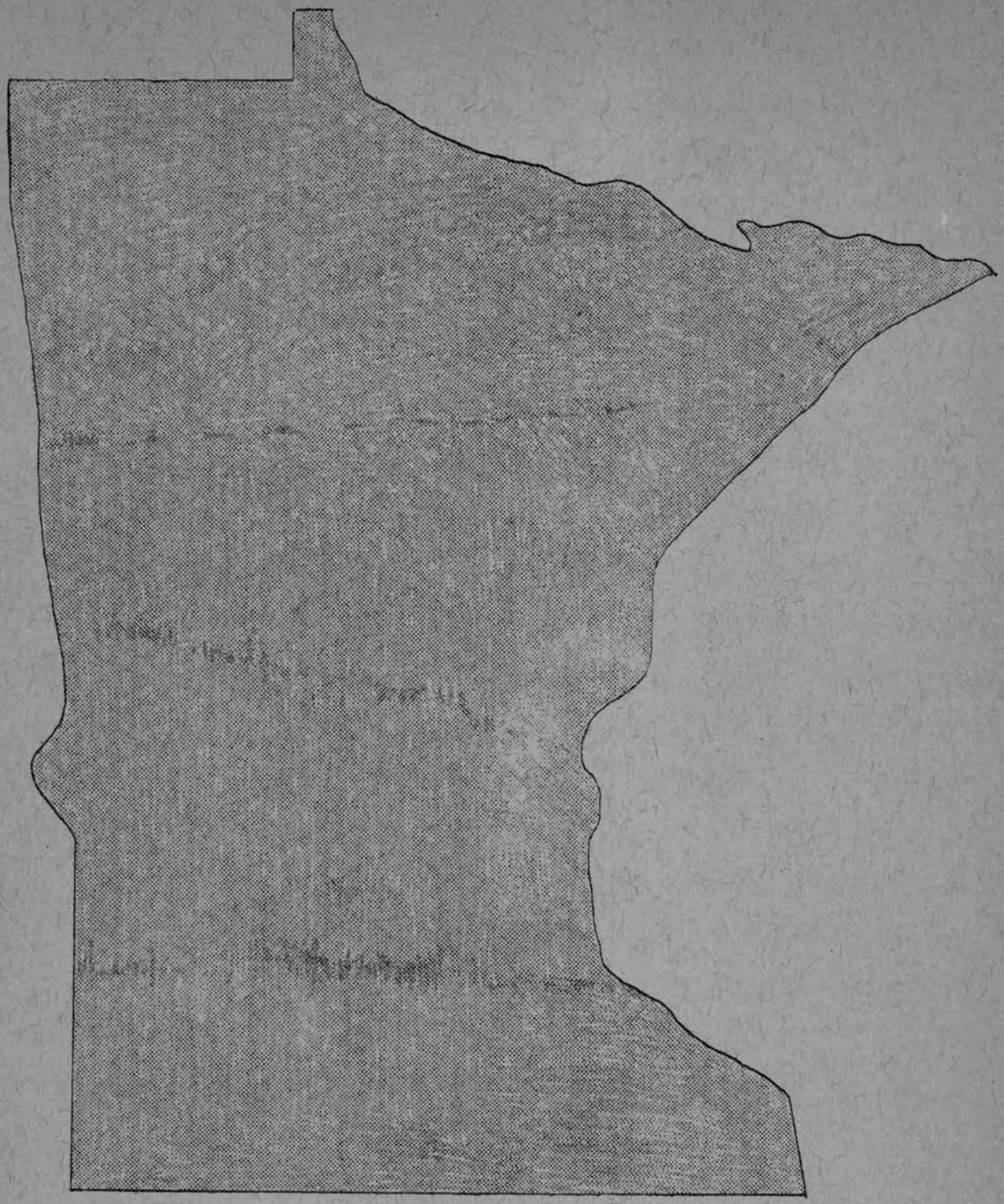

WATER RESOURCE MANAGEMENT IN MINNESOTA

PREFACE

WATER RESOURCES: Support of those national water policies and practices which promote coordinated administration, equitable financing and regional or river basin planning.

A water resources study item was first adopted by the League of Women Voters of the United States in 1956. It was reworded at the 1958 National Convention to embody the three general areas of agreement. National study publications on this item include On the Waterfront (1957), Little Drops of Water (1957), the 1959 National Board report and National Voter articles.

This Minnesota publication is intended to supplement the national study by promoting a better understanding of water resources management. Many Leaguers throughout the state have contributed to their own understanding and to this publication by examining their own local areas. Despite the time and energy put into this effort, the book cannot be considered the full study that would be done on a state Current Agenda item. Most of it is focused on the Upper Mississippi basin in Minnesota. Descriptions of some uses and management programs include the entire state. Other League studies have been printed on the basin of the Red River of the North (Fergus Falls), on the St. Louis River in the Great Lakes basin (Duluth) and the metropolitan area (Minneapolis).

League of Women Voters of Minnesota, 15th & Washington S.E., Minneapolis 14, Minn.
September 1959 090159D - 30¢

June 1960 - 7 Districts formed smaller than expected slightly over 2% of total area in the State

WATER RESOURCE MANAGEMENT IN MINNESOTA

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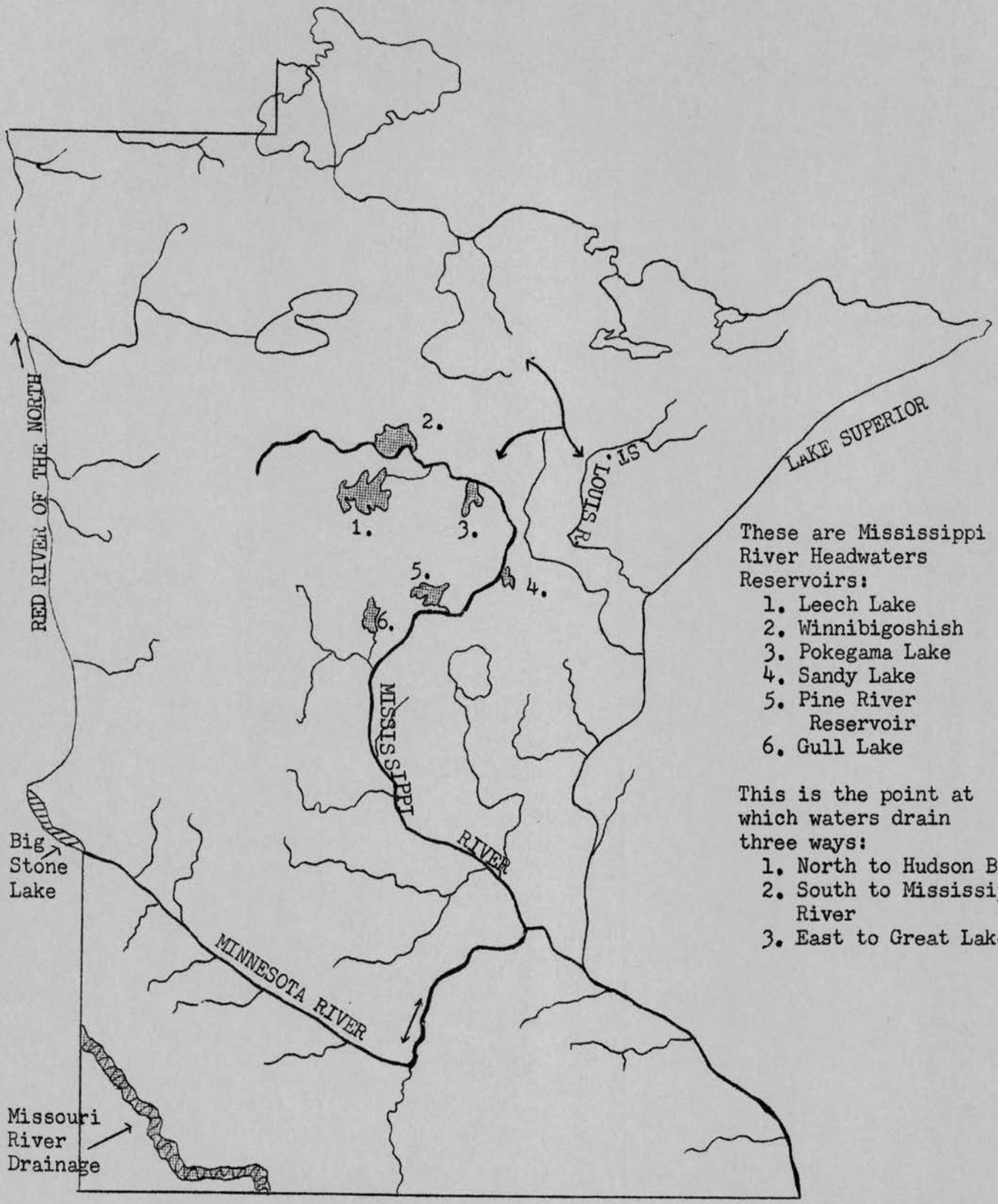
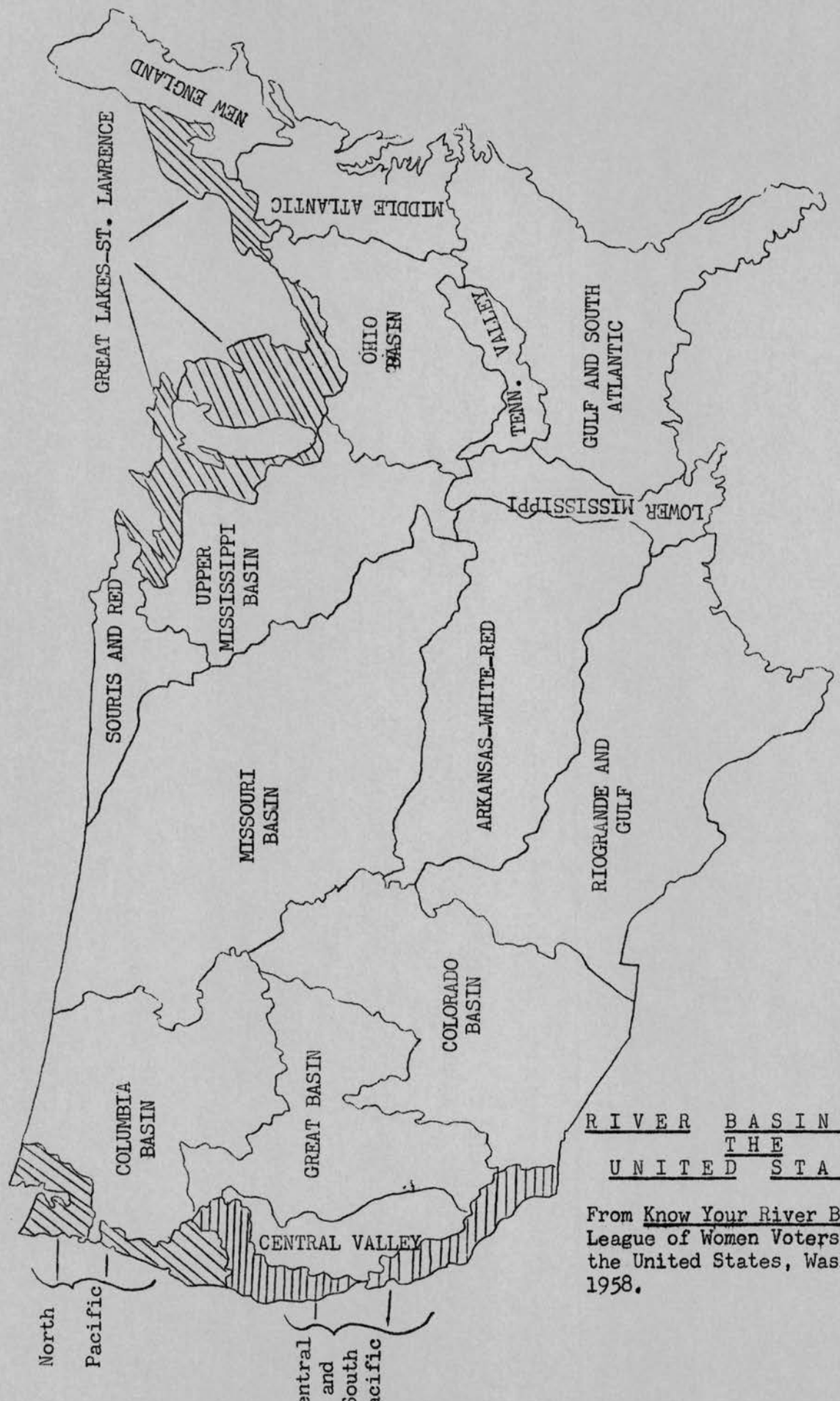


RIVER DRAINAGE IN MINNESOTA

From the Hydrologic Atlas of Minnesota, Minnesota Conservation Department, St. Paul, Minnesota, 1959



RIVER BASINS OF THE UNITED STATES

From Know Your River Basin
League of Women Voters of the United States, Washington, 1958.

WATER RESOURCE MANAGEMENT IN MINNESOTA

Introduction

As we study water resources we must keep in mind the primary facts that lead us to believe wise water resource management is vital. These facts are variously expressed in nearly every book written, speech made or pamphlet distributed on water:

> From 1900 to 1930, while the U. S. population doubled, total water use, other than for industry, increased four-fold. By 1955 it was up another 21 percent. Water needs are expected to double again by 1975, while populations increase 40 percent. (1)

> Our national water usage has increased from 40 billion gallons a day in 1900 to 262 billion gallons a day in 1955, and it is estimated it will be 453 billion gallons a day in 1975...We are now using six and one half times the amount of water we used in 1900 without any increase in the annual supply, and 25 years from now we will be in need of twice as much water as we consume at the present time. (2)

The point is clear. No matter where we live, in the "humid East" (Minnesota is one of the westernmost of the humid eastern states) or the semi-arid and arid West, there is only so much water available and a multiplying demand for it. This fact, coupled with man's dependence on water, leads us to this conclusion: Our social and economic well being rests upon our ability to manage water uses.

Familiarity with Minnesota's main river drainage patterns is the first step in examining the area's water resources. With only minor exceptions, the state does not get water from outside its own boundaries, and control and use programs in other states do not substantially affect the flow of Minnesota's waters. The Mississippi River rises here and drains half the state. Only 12 percent of the drainage area of its first major tributary, the Minnesota River, lies outside the state.

A drainage divide chops northern portions of the state into odd-shaped pieces, creating an interesting point near Hibbing where waters may run off in any of three directions -- to the Great Lakes, to Hudson Bay or to the Mississippi.

The small section of the Great Lakes-St. Lawrence basin that lies in Minnesota contains only waters that rise in the state, primarily down the St. Louis River. Waters that drain eventually to Hudson Bay are in the basin of the Red River of the North, which also rises in Minnesota and is boundary to North Dakota.

In addition, a small triangle of southwestern Minnesota is drained by the Missouri River, amounting to two percent of the mammoth basin covering part or all of 10 states.

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(1) Address by Morrie A. Bolline, U. S. Soil Conservation Service deputy state conservationist, delivered before Minnesota League of Women Voters Workshop on Conservation, Feb. 27, 1958.

(2) Virgil C. Herrick, executive secretary, Minnesota Water Resources Board, A Water Policy for the Future, Conservation Volunteer, Nov.-Dec. 1957.

A few additional facts, especially pertinent to the Upper Mississippi basin in Minnesota, are useful keys in understanding water questions in this area and in comparing them with problems in other parts of the nation:

1. Sites for large dams do not exist in Minnesota. Deep valleys with constricted exits, where dams backing huge quantities of water might be built, are not characteristic of the area. There are no large waterfalls that can create a great deal of electric power.

2. Though on the fringe of the nation's semi-arid plains, Minnesota can be considered safely humid, with its great quantity of lakes and natural water retaining formations.

3. Soil and water conditions and topography make much of Minnesota suitable for agriculture. Consequently, it is one of the nation's leading farm states.

4. Other characteristics of nature -- lakes and wetlands -- make many sections of the state an agreeable home for wildlife, especially waterfowl. Minnesota's advantages for fish and wildlife habitat are judged to be of national importance.

5. Because many types of outdoor recreation are associated with surface water and because so much surface water exists in Minnesota, it is natural that recreation is a major state industry.

The above key characteristics determine the nature of significant water conservation and control measures in the area and set the stage for the principal conflicts among users. Using these five characteristics for reference, we can summarize Minnesota's important water programs and the conflicts that arise into five categories:

1. Natural lakes, with dams at outlets, are utilized for reservoirs. Multiple uses (flood control, wildlife habitat, water supply) they may serve are usually limited to a small area by comparison to some of the nation's western water storage projects. Without any major water power source that might be harnessed in a federal project, the thorny issues of how to pay for this kind of project and how to distribute the power fairly do not exist in the Upper Mississippi basin.

2. Irrigating to reclaim for production otherwise unsuitable land is not a necessary practice in Minnesota. Thus the U. S. Department of Interior's Bureau of Reclamation, one of the "big three" federal agencies in water control projects, is not active in the state. Complementary irrigation for increased production on good farm land may become important in the future, but that is a separate problem.

3. Agricultural land use makes the Upper Mississippi basin especially suited to the "small watershed approach." Essentially, this approach controls water where it falls, before it runs off to form surface waters. The U.S. Department of Agriculture's Soil Conservation Service (another of the "big three") has long promoted this concept with programs encouraging conservation measures on individual farms. Through the years this principle has been broadened to include upstream flood control measures affecting more than one farmer. It has led to additional federal and state legislation, so that today small watershed organization, complete with local governing and taxing powers, is probably this area's brightest hope for multiple purpose water resource management.

4. State and federal fish and wildlife authorities feel a need to preserve Minnesota wetlands for waterfowl. This desire often comes in direct conflict with the farmer's need to drain land for cultivation. There is probably misunderstanding and certainly need for more scientific information about the broad effects, or lack of effects, of draining land. The conflict is complicated by the federal government assuming some of the costs of drainage, thus encouraging such projects.

5. Recreation interests naturally feel they have an economic stake in the attractive appearance of the state's lakes and would like levels to remain relatively stable. Yet, lake reservoirs for flood control purposes, for example, are not functioning well unless levels change, sometimes quite rapidly, from low before a flood to high during a flood. This kind of fluctuation can also have adverse effects on fish and wildlife.

CHAPTER ONE

WATER, LAND AND PEOPLE

Comprehensive development of water resources is the aim of most conservation-minded people. A comprehensive approach requires that character of the land and activities of the people living on it, as well as water, be considered. Plans for water use and control programs should begin with detailed analyses of population, economic and physical characteristics, along with data on water supply, in a drainage area. For purposes of this study, it is useful and practical to begin with merely capsule descriptions of the state's personality.

Land and People

"Varied" is a word often used in describing Minnesota. One geographer says the state is in "a transitional location" between East and West on the continent, and he continues:

> It has land that must be drained for agricultural purposes and land where water resources are precarious enough to justify complementary irrigation. Its land usage capability ranges from best agricultural land to much land that must stay in permanent forest cover. It has a metropolitan area with more than a million people and large stretches with thinnest population density. (3)

Another concise summary:

> In the northeast is found rugged picturesque topography, for the most part heavily timbered and sparsely populated, with the unique advantages of a true wilderness area. Mining and forestry are the basis of its economy. In the south and west the fertile soils and rolling prairies have resulted in a highly developed agricultural region. In the central lakes region, also blessed with good soils, farming is overshadowed by the outstanding recreational and scenic values of the lakes and wooded hills. (4)

This miniature picture is completed by the Twin Cities, where variety is the keynote for about half the state's three million people, employed in industries in the fields of agricultural products, chemicals, electronics, machinery, wood and paper products, transportation, finance, insurance, wholesaling and retailing.

Water -- Where It Comes From

Where is the water, and how much is there, that must be used in great quantities at home, in every industrial plant, to nurture the good farm crops, to enjoy in leisure, to preserve the ways of nature? A good answer is complicated in Minnesota (as well as in the rest of the country) by lack of complete data. Many of the record keeping, data gathering, mapping and scientific study programs are started under state and federal cooperation. But, in most cases, those working in this field believe these basic investigations need expansion.

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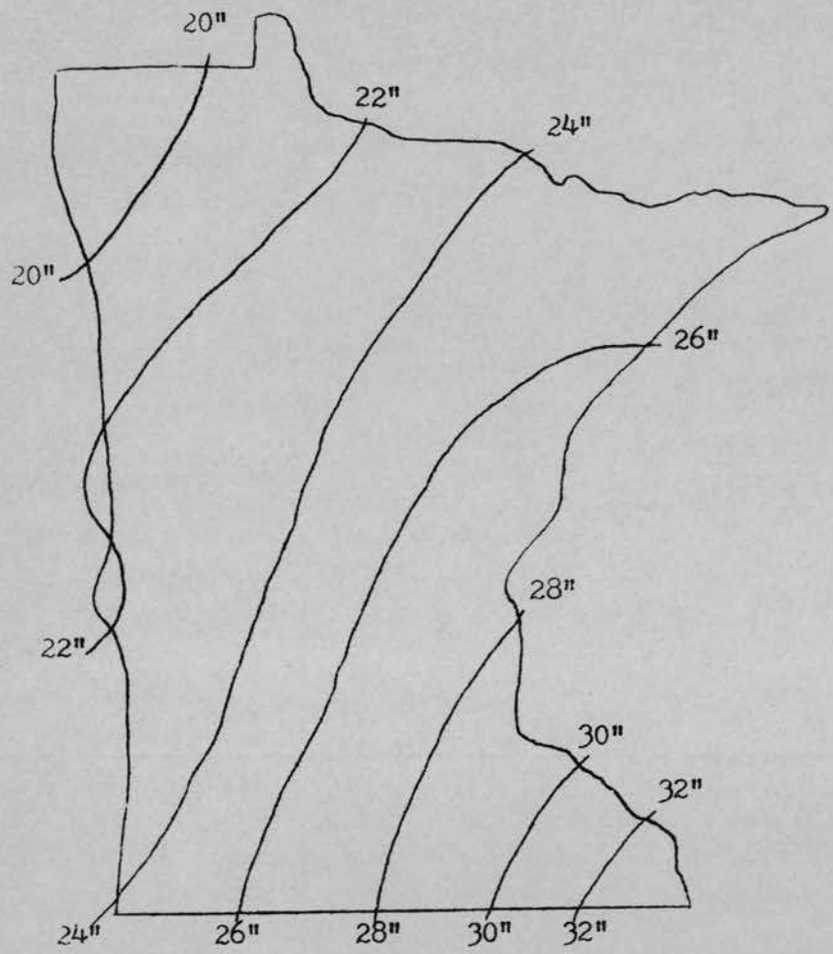
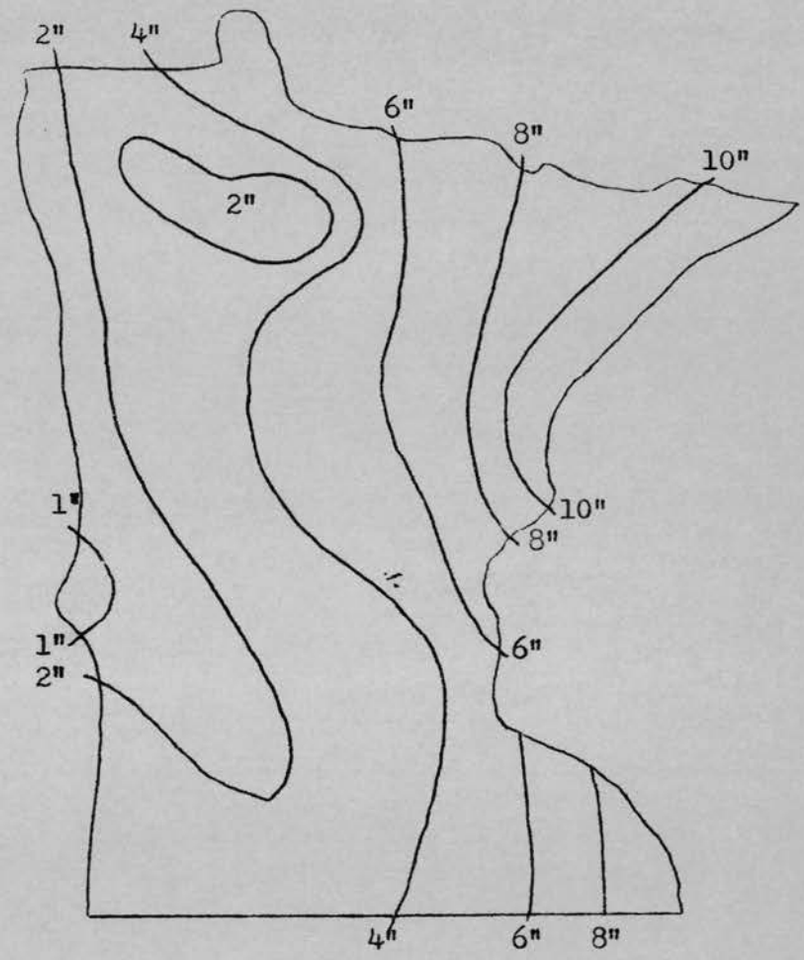
(3) Dr. Hildegard Binder Johnson, professor of geography, Macalester College, St. Paul, statement prepared especially for the Minnesota League of Women Voters, February, 1959.

(4) Department of Conservation, Division of Waters, Hydrologic Atlas of Minnesota, Bulletin No. 10, (State of Minnesota, St. Paul, April, 1959) p. 1.



LINES OF EQUAL ANNUAL PRECIPITATION



LINES OF EQUAL ANNUAL RUNOFF

From the Hydrologic Atlas of Minnesota

p 7

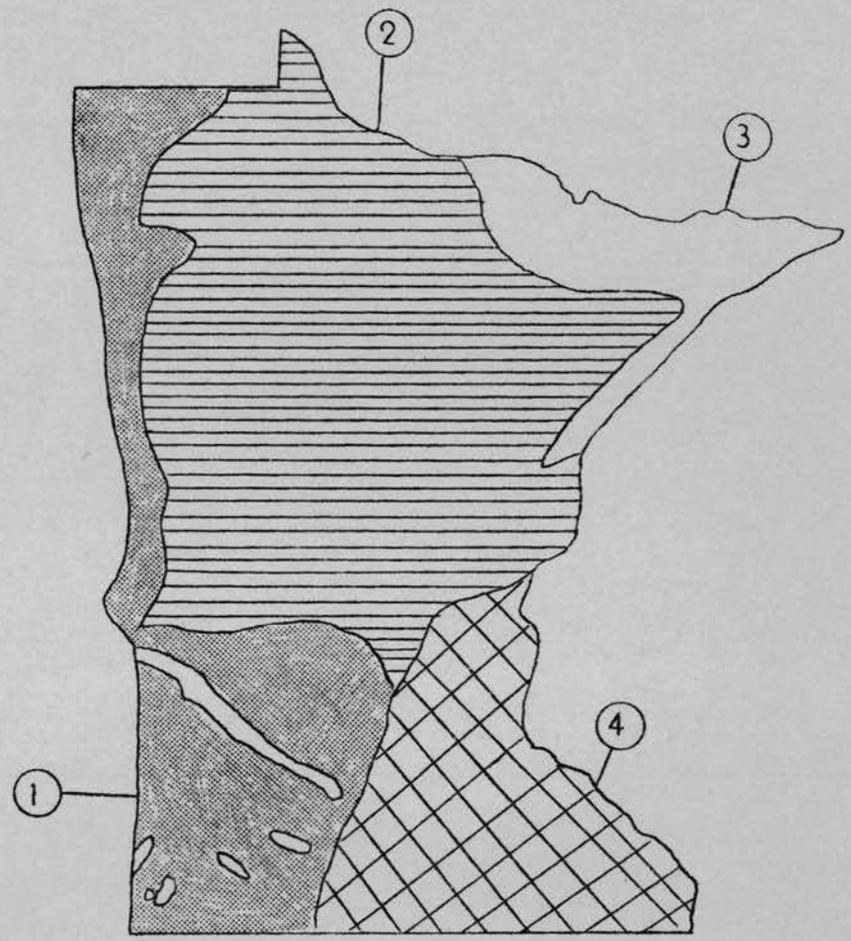
1. This area is clay with lenses of sand or gravel. This material is not a good water source. In places deposits of sand carry considerable water, but its mineral content may be high.

2. Generally underlain by thick glacial drift resting on granite and associated rocks. Not porous, furnish little water except for occasional sandy and gravelly lenses which furnish abundant supplies.

3. Underlain by glacial deposits varying in thickness, and generally sandy and gravelly. Where thick, they yield abundant water. The drift consists of granite and hard rocks which are not good sources of water.

4. Few areas in the U.S. can equal this area in available artesian water. Rocks are limestone, sandstone and shale. The sandstones are prolific sources of water which rises in the well when penetrated.

From Minneapolis Sunday Tribune, Picture Magazine, March 25, 1956.



GROUND WATER SOURCES

Detailed knowledge of the time and place and amount of precipitation and evaporation, the essential actions of the hydrologic cycle, is the starting point for planning wise water use. Rainfall, principally during summer thunderstorms, is the source of most of Minnesota's water. Mean annual precipitation (the mid-point between the extremes) in the state is 25 inches. This can be compared with 17 inches in a semi-arid state, Colorado, and with 30 inches for the nation. Like other characteristics of the state, precipitation varies widely with the low point of about 19 inches in the valley of the Red River of the North and a high of 32 inches in the southeast corner. Since this water falls mostly during the growing season, the state tends to high agricultural development.

Snow, although it accounts for only a small portion of the precipitation, affects water supplies in its manner of melting. If it melts on unfrozen ground, much moisture will enter the soil and subsoil. But if sudden spring thaws occur while the ground is frozen, the rapid runoff can cause floods.

Weather data is compiled by the U.S. Weather Bureau, which has 201 stations in Minnesota. This number -- one station for every 438 square miles -- can be compared with the national average of one station for each 230 square miles. A state agency suggests more stations would help studies of storms causing floods and aid in forecasting flood stages. (5)

Where the Water Goes

Some of the rainfall evaporates, some seeps into the ground and some runs off to form surface waters -- lakes, streams and rivers. Ground water and runoff can be measured in various ways.

Ground water is stored in underground formations which can be tapped by wells. Eventually, most of it emerges as surface water and runs off into the ocean. These waters under Minnesota provide most of the municipal and industrial water supply outside the Twin Cities and have been used so far with few shortages. (6) But some water engineers question whether it is being used faster than it is being replaced in some areas. This controversy suggests a need for more definitive research. A state Conservation Department, Division of Waters, report notes that ground water studies, formerly done only on a local basis, are being expanded as a statewide program conducted with state and federal cooperation. The same report lists 49 observation wells in 16 of the state's 87 counties, with 14 of them in the Twin Cities' counties of Hennepin and Ramsey. (7)

Minnesota's surface waters, again according to the Division, have been studied for many of their characteristics, but "there is still much to be accomplished before a working knowledge sufficient to conserve and protect available water supplies is attained." (8) Surface runoff into streams can be measured indirectly at gaging stations. In 1958, 127 stations recorded this flow in a program shared by the state and the U.S. Geological Survey. Annual runoff in different parts of the state varies widely from a scant one to 10 inches. These runoff variations indicate problems of having the desired amount of water at the proper place and time. Some of the moisture that falls is held in natural reservoirs, the lakes. Even though the state is not among the most humid, it can retain a high percentage of the water that falls in these natural storage places. A complete lake basin inventory is being made by the Division of Waters and indicates the total may reach at least 17,000.

(5) Ibid., p 5.
(6) Ibid., p 6.
(7) Ibid., pp 6-8.
(8) Ibid., p 8.

Amount and rate of runoff are determined in some degree by the physical makeup of the land. Detailed knowledge of the topography is thus another basic tool for water planning. A good topographic map can aid in proving the possibility or impossibility, physically and financially, of a proposed project. In 1958, only 30 percent of Minnesota was "satisfactorily mapped" (9) with the rest scheduled to be completed by the U.S. Geological Survey, in cooperation with the state.

CHAPTER TWO

WATER USE

in the

UPPER MISSISSIPPI RIVER BASIN

The Mississippi River drains more than half of Minnesota. (10) This can be pictured as three areas: first, that above the Twin Cities, where recreation and iron ore and forest industries predominate; second, the metropolitan area and the farm country to the south and east, where industries related to agriculture are important; and third, the sub-basin of the Minnesota River, also an agricultural area.

Supplies for Home and Industry

Municipal water supplies for Minneapolis and St. Paul are taken entirely from the Mississippi. (11) River flow is at present more than adquate and always has been, but predictions have been made that greater demand by increased populations, as well as increased individual use of water, will lead the Cities to find ways to increase the minimum flow through engineering or to look for other sources of supply. Some speculation is that in another 40 years the Cities may be piping water from Lake Superior. (12) Long range plans are not developed for either city, but water supply is one of the problems under study by the Twin Cities Metropolitan Planning Commission.

By far the majority of other municipalities, farms, individual homes and industry in the entire Mississippi River basin draw on ground water supplies through wells. (13) Few difficulties have been encountered in locating abundant supplies, but estimates of adequacy for future use vary. In the metropolitan area, one authority states one underground source, the Jordan sandstone, will not begin to be depleted for two centuries at the present rate of use. Another estimate is that depletion will occur in 45 years. (14) But neither of these statesments takes into account the trend toward increased individual water use or needs of increasing populations.

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(9) Ibid., p 21.

(10) Total land area of the state is 80,009 square miles, with 4,059 additional square miles of surface waters. Rand McNally-Standard World Atlas, (New York 1951), p 229. The Mississippi drainage area in Minnesota is 45,000 square miles. At the point it leaves the state it has also drained 20,000 square miles in Wisconsin, South Dakota and Iowa. Hydrologic Atlas, p 17.

(11) For details, see League of Women Voters of Minneapolis, Know Your River Basin Survey of the Twin Cities Metropolitan Area (Minneapolis, 1959) pp 7-11.

(12) Minneapolis Star, Some Day Your Shower May be From Lake Superior, July 9, 1959.

(13) Some municipalities that do not use ground water for domestic and industrial supply are: Minnetonka, which draws from Lake Minnetonka; Austin, from springs, St. Cloud, from the Mississippi; Akeley, from Eleventh Crow Wing Lake; Granite Falls, from the Mississippi. Compiled from Hydrologic Atlas.

(14) League Basin Survey, op. cit., p 8.

Waste Disposal

Waste from every source -- home, farm, industry -- must be disposed and a most popular route is along natural waterways. A problem arises as waters, which can purify themselves to some extent as they flow, become overloaded. Too much waste depletes oxygen, causing fish and plants to die. An example of a heavily overloaded stretch of the Mississippi River is from the Twin Cities to Hastings, where the rate of fish kill has alarmed sportsmen. According to a state legislative report, few Minnesotans live in areas where it is either desirable or safe to assume streams and rivers can be purified by the natural flow. (15)

Navigation (16)

The Mississippi River from Minneapolis south is one of the nation's commercial shipping routes, carrying back and forth products including petroleum, grain, coal, iron, steel and chemicals. The tributary, the Minnesota, is used for commercial navigation for only a short 13 miles upstream. In addition, the waterways in the Mississippi system in Minnesota are used increasingly for recreational boating.

THE MISSISSIPPI Early a transportation route, the Upper Mississippi River's importance for navigation declined after the 1880's when more economical and dependable rail transportation became dominant. But navigation has revived on the river in the past 20 years as the result of federal projects, estimated to cost in excess of 200 million dollars. Fluctuating water levels were the cause of uncertain navigation. The "canalization," approved by Congress in 1930, includes 26 locks and dams in the 652 miles from the mouth of the Missouri River at Alton, Illinois, to Minneapolis, making the river more dependable for freight transportation. Although still considered incomplete in some details, the main part of the project, constructed by the U.S. Army Corps of Engineers, has been in use since 1940. River traffic on this stretch increased from 458 million ton-miles in 1938 to 3,879 million ton-miles in 1957. Commercial harbors associated with the "canalization" are at Minneapolis, St. Paul, Winona and Lake City. Minneapolis harbor facilities are now being expanded by the Corps in a project, estimated to cost 36 million dollars, that extends the nine-foot channel 4.6 miles and includes two locks at St. Anthony Falls. The Corps also has constructed six small boat harbors for recreation, at Hastings, Red Wing, Lake City, Winona, Wabasha, and St. Paul.

THE MINNESOTA On the Minnesota River the Corps of Engineers is drawing plans for improvements for commercial navigation from the mouth to 14.7 miles upstream, a little beyond Savage. At present, a nine-foot channel on the Minnesota to Savage, 13.7 miles, is maintained by private industrial interests along the river. A Corps project since 1931 has maintained a four-foot channel along this same stretch and beyond, for a total of 25.6 miles.

Commercial Harbors	Average Annual Tonnage 1953-1957
Minnesota River	823,265
St. Paul	2,560,000 (up from 68,161 in 1935 to 3,000,000 in 1958)
Minneapolis	680,000 (up from 110,000 in 1935 to 825,000 in 1958)

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(15) See Chapter Three, Pollution section.

(16) Information in this section was compiled from U.S. Army Engineer Division, North Central, Water Resources Development by the U.S. Army Corps of Engineers in Minnesota, (Chicago, 1959).

Commercial Harbors	Average Annual Tonnage (1953-1957
Lake City	2,000
Crooked Slough, Winona	190,900

For the sake of comparison, it can be noted the Duluth-Superior harbor handles 60 to 65 million tons in a season, second only to the Port of New York. The recent increase in recreational boating is shown by the fact the Corps put 7,300 small, private craft through its locks on the Mississippi River in 1953, then moved 27,000 in 1958. (17)

Recreation, Fish and Wildlife

> "Water is the lifeblood of outdoor recreation and fish and wildlife... Over 50 percent of national forest recreation visitors use the surface bodies of water or land adjacent to them....All forms of wildlife are completely dependent on water for survival, just as man is....People are attracted to new bodies of water as flys are attracted to honey." (18)

This relation of water to recreation is so important in Minnesota that the tourist industry is usually ranked among the state's top half-dozen industries. Both state and federal governments have several programs to preserve recreation areas.

STATE PARKS Minnesota had 97,404 acres in state park land in 1957. Many parks have some special and even historical relation to water. Itasca Park is developed around the Mississippi River headwaters. William O'Brien Park on the St. Croix River was given to the state in memory of an early lumberman of that area. A proposed new park would be at the junction of the Crow Wing and Mississippi Rivers, site of an early settlement and Indian battles. Camping use of Minnesota's parks reflects the national trend, increasing by leaps and bounds and straining facilities. Fees taken for camping in 1957 increased 134 percent over 1956. (19) It is estimated total state park visits in 1957 were over two million.

FORESTS The forests, foundation of the state lumber, and wood and paper products industries, are also developed for recreational purposes. State owned forest land amounts to 4.7 million acres, with 2.2 million in state forests that have been developed in some measure for recreation purposes. These state forests are concentrated in the Mississippi headwaters and lakes region and the northeast section of the state. The two national forests in the state are Superior in the Great Lakes drainage area and Chippewa in the Mississippi headwaters region. In Chippewa there are 500 lakes and 700 miles of streams and rivers. In 1958, recreation visits to Chippewa numbered more than half a million, an increase of 800 percent over 1948.

FISH AND WILDLIFE REFUGES An estimate by the Department of Interior Fish and Wildlife Service, published in 1956, suggests Minnesota has over a million acres of land that is "habitat of highest water fowl use in present condition, the largest areas of which should be included in either federal or state waterfowl management programs." (20) The state Department of Conservation, Game and Fish

(17) Remarks by Col. Desloge Brown, district engineer, U.S. Army Engineer District, St. Paul, before Minnesota LWV Workshop on Conservation, Feb. 27, 1958.
(18) Address by Edward P. Cliff, assistant chief, Forest Service, U.S. Dept. of Agriculture, delivered before Soil Conservation Society of America, Asilomar, California, Aug. 29, 1957.
(19) Minnesota Conservation Department, 1956-1958 Biennial Report, p 24.
(20) Samuel P. Shaw and C. Gordon Fredine, Wetlands of the United States, (U.S. Government Printing Office, 1956) p 16.

Division, is engaged in a program of purchasing "wetland" areas for waterfowl habitat with a goal of 250,000 acres in 68 counties. Federal projects in the Upper Mississippi River basin include the Upper Mississippi River Wild Life and Fish Refuge -- intermittent tracts along 284 miles of the river from Wabasha, Minnesota, to Rock Island, Illinois. The lands, in four states, total 197,444 acres with 32,667 in Minnesota. Another federal refuge in the Mississippi basin of Minnesota is at Rice Lake and includes 15,500 acres.

Power

Hydroelectric power, developed privately, is important in the Mississippi basin, but the greater economy of steam power makes the latter method more predominent today. In the entire state in 1958, there were 64 steam electric generating plants and 52 hydroelectric generating plants. (21) Largest hydroelectric plants are on the St. Louis River, not part of the Mississippi drainage. In the Mississippi basin there is no great fall of waters where tremendous quantities of power can be generated.

Steam power operations must be close to a good water supply which is used for cooling and condensing. Both types of generation return the water to the stream flow, clean and undiminished.

The area's first nuclear power generating plant at Elk River also uses water for cooling and condensing and returns it to the Mississippi. It is believed that radioactivity carried by this water can be kept below Atomic Energy Commission standards. (22)

Irrigation

Complementary irrigation to increase agricultural production is expanding in Minnesota. It is possible that irrigation in some areas could expand to the point of competing with other water uses. (23) Although the state exerts some control over this private use, the law is not well known and farmers frequently fail to apply for permits. (24)

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(21) Hydrologic Atlas, p 15.
(22) Ibid.
(23) Ibid.
(24) League Basin Survey, op. cit., p 20.

CHAPTER THREE

BETTER USE THROUGH CONTROL AND CONSERVATION

> There are a number of things which can be done to modify and direct the course of water as it flows over the land or underground. Changes in vegetative cover can affect the amount of precipitation which reaches the land surface; cultivation of the soil and the works of man...may alter the amount of water which percolates into and through the soil. Water may be impounded behind dams, diverted into new courses, or speeded on its way to the ocean by the improvement of channels. (25)

Ideally, the things that are done to modify and direct water courses should be aimed toward better use of the water resource. In the following sections, some methods and programs for managing water in Minnesota are explored.

Headwaters Reservoirs

Conflicts between basin-wide interests and local demands are illustrated by operation of the Mississippi headwaters reservoirs. A Corps of Engineers project with beginnings dating back to 1878, its primary purpose was to control water flow for navigation, with effects below the Twin Cities and outside the state. With navigation on that stretch of the river now aided by 26 locks and dams from St. Louis to the cities, the reservoirs are now serving multiple functions -- flood control, water supply, aiding in wildlife and wild rice production. Critics believe the reservoirs' operation is not adjusted well enough to these local demands. The Corps policy still stresses the need for navigation control under emergency conditions.

In the heart of the state's lake resort area, the six reservoirs are actually natural lakes with control dams (see map of major rivers and lakes). Most of the storage is contained in Leech and Winnibigoshish Lakes. Pokegama's water is released for navigation, taking about 10 days to reach the Twin Cities. It is then replenished from Winnibigoshish, that water taking about 14 days to travel intervening swamps.

A Minnesota legislative interim commission (1957-1959 biennium) found augmented operation of the reservoirs for water supply, power, irrigation, dilution of sewage, and for adjusting levels for recreation and wildlife conservation reduced available capacity for navigation by almost three-fourths. The group questioned the Corps' object of operating the reservoirs at full capacity for navigation while at the same time needing empty reservoirs for flood control. Also noted was the conflict among local desires: Conservationists see a need for certain lake levels for maximum production while resort owners prefer other levels to maintain the appearance of their property.

Occasional disregard of local requirements was charged by the commission. It cited the example of when "the unnecessarily abrupt stoppage of water from Leech dam in March 1958 resulted in extensive damage to fish." (26)

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(25) Hydrologic Atlas, p 9.

(26) Legislative Interim Commission to Study Upper Mississippi Reservoirs, Report, (State of Minnesota, 1959) p 20.

Some measure of state control was the recommendation of the legislative group. The commission also concluded, "More complete and reliable data should be obtained on various aspects of the problem, particularly on the relative economic importance of the various interests affected by the reservoirs." (27) This conclusion, asking more study, suggests that the final word cannot be said on what is the most economical, fair and coordinated way to operate the reservoirs and the 90 lakes that drain into them. The question is heavily dependent on how to evaluate benefits of recreation and wildlife preservation. Organizations which support the commission's recommendation for state control include the Minnesota Game Protective League, Isaac Walton League, Minnesota Conservation Federation and other sportsmen's groups.

Flood Control

Flood control is actually of two types, and both are important in the Upper Mississippi basin. There are the direct methods for protection against major floods -- damming for water detention in reservoirs, improving river channels for greater capacity, and flood walls and levees to confine flood flows. Such "main stem" or "downstream" works are constructed by the Corps of Engineers. Indirect flood control is accomplished by land treatment methods which utilize the principle of holding water where it falls. Thus, "upstream" flood control is one of the purposes of soil conservation programs, forest management and fish and wildlife habitat projects.

Large scale flooding is not considered frequent on the Mississippi River above the Twin Cities. Lakes and marshes provide natural reservoirs. Notable exception is the Aitkin area where about 30,000 acres, mostly farm land, are subject to damaging floods. The Corps' only completed flood control structure on the Mississippi, a diversion channel, protects Aitkin.

Below the junction of the Mississippi and Minnesota Rivers, damaging floods occur more frequently. Flood plains at St. Paul and South St. Paul and at Winona are occupied by residential and industrial developments. Corps protection works have been started or authorized at those cities, costing an estimated $7,600,000 at St. Paul and South St. Paul and $1,800,000 at Winona. These proposed works are flood walls and levees. Another authorized flood wall and levee project is on a minor tributary in the state's southeastern extreme -- the Root River at Rushford.

The Minnesota River, flowing across a wide, flat plain, is a flood menace to much valuable farm land and a number of communities. Above Mankato, tributaries from the south fall rapidly through gorges, each river capable of producing sudden, high and devastating flash floods often greater than the flow of the main stem. Mankato and North Mankato are especially vulnerable because the Minnesota River there has been joined by the Blue Earth River, which, in turn, was joined in rapid succession by its own tributaries and streams.

Flood control works along the Minnesota River include three important projects. A dam and channel at Big Stone Lake, the Minnesota's headwaters on the state boundary, diverts the Whetstone River into the lake for flood storage. The works are also used to maintain a better range of water levels on the lake. Built with both state and federal (Works Project Administration during the 1930's) money, the reservoir is now operated by the state Conservation Department. Lac Qui Parle dam and reservoir, including Marsh Lake reservoir (also WPA built, operated by the state for 10 years, now operated by the Corps), controls the flow of the Chippewa River.

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(27) Ibid., p 21.

The Chippewa is diverted into Lac Qui Parle through a channel known as Watson Sag. These reservoirs are also used for recreation. A Corps levee and flood wall project, to cost an estimated two-million-plus dollars, is underway farther down the river to protect Mankato and North Mankato.

According to the state Division of Waters, the Big Stone-Whetstone project never was considered completed and requires further channel improvement. The Division's opinion is that Big Stone-Whetstone, along with the Corps Lac Qui Parle project, "when completed and satisfactorily coordinated will completely control floods of a 15-year frequency in the Minnesota Valley for some distance below Montevideo, will substantially reduce extreme floods, and also will provide water from storage for minimum flows required by several communities downstream for municipal water supplies." The Division also states that the Big Stone's flood storage possibilities have never been fully realized because local interests oppose water level fluctuations.(28) After recent local complaints about silt and debris collecting in the lake, the Corps is investigating revision of the project and its effect along the river. (29)

ZONING Flood plain zoning is a method of restricting the use of flood plains. Its object is to eliminate the need for expensive flood protection structures. Some authorities believe mapping adequate to define these plains is not available in Minnesota. Far from a new idea such zoning was used by the French in the 18th Century along some of the Mississippi River.

Soil Conservation

As an agricultural state, Minnesota is particularly concerned with the federal soil conservation program. There are about 80 soil conservation districts in the state, most of them organized on a county basis but some including parts of one or more counties. The Soil Conservation Service, U.S. Department of Agriculture, seeks to work out plans for better farming practices with individual farmers. Methods to increase capacity of the soil to produce crops, reduce siltation of streams and lakes, increase infiltration of water into the soil and conserve water where it is needed, as promoted by the Service, include contour plowing, strip cropping, forestation, planting grassed waterways and construction of check dams and farm ponds. These practices reduce flood damage to agricultural land and, in some degree, control stream flood flows. The Soil Conservation Service has been authorized by the federal Watershed Protection and Flood Prevention Act (Public Law 566) to emphasize conservation and flood control measures in the entire area of a small watershed. (See Chapter Five)

Forest Management

Purposes of forest management and soil conservation are similar and related. A U.S. Forest Service official summarizes:

> There is a great deal of sound evidence that well managed forest lands in good condition are particularly effective in performing the following functions:
>
> 1. Preventing or reducing flood producing overland flows.
> 2. Protecting the soil from erosion.
> 3. Reducing sediment load in streams.
> 4. Producing water of good quality.
> 5. Reducing the hazard of spring floods by retarding snow melt.
> 6. Prolonging stream flow during dry periods.

(28) Hydrologic Atlas, p 19; also section on Big Stone Lake Watershed Unit II.
(29) See Footnote 16.

7. Storing water in the soil for beneficial use by the forest cover.
8. Providing deep percolation, which feeds permanent springs and streams and replenishes the water table. (30)

Minnesota's virgin forest may once have amounted to 31.5 million acres. A U.S. Forest Service survey in 1953 lists the state's remaining forests at 19.3 million acres, about 37 percent of the total land area. This drastic reduction is the result of intensive lumbering which ended about 1920, of a series of disastrous fires between 1894 and 1918, and of agricultural clearings.

Forest management is complicated by divided ownership dating from Minnesota's early statehood, when some unsold federal lands were turned over to the state and counties. Here is the present ownership in acres:

National Forests	2,195,000
Other federal lands	860,000
State lands	3,484,000
County and municipal	3,619,000
Large private forest tracts	3,059,000
Farm forests and woodlands	4,881,000

Much of the state owned forest land is in small parcels that do not easily lend themselves to coordinated management. The state Conservation Department's Division of Forestry operates forest programs through ranger districts. (31) County owned forest lands, usually in the past not managed at all, are now subject to cutting regulations and planned management in some cases. Farm forests are often managed through soil conservation programs, stimulated by the cooperative efforts of the federal Soil Conservation Service, state Conservation Department's Division of Forestry and the U.S. Forest Service. In addition, tree planting under the federal soil bank program will probably have an impact on Minnesota. It is known that over-cutting takes place on some of the small private forest lands. The Division of Forestry has a program to advise, free, owners of less than 1,000 acres. The two-million-plus acres of federal forest lands is administered to preserve and restore their functions in preventing floods, in preserving water quality and regulating stream flow, although the Forest Service notes there is much yet to be done.

Fish and Wildlife Preservation

Fish and game managers often charge that soil conservation and other water management programs are not planned with enough consideration given to preserving wildlife. Specifically, in Minnesota, recreationists have been alarmed about the loss of wetlands (32) which are vital to waterfowl conservation. A major cause of this loss is agricultural drainage: Farmers often feel wetlands need to be drained so they may be put into production. There ismuch difference of opinion concerning long range effects of drainage, particularly its influence on ground water levels. Nevertheless, it is clear that waterfowl will stay away from Minnesota if their damp, albeit attractive to them, homes are gone.

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(30) Speech by Warren T. Murphy, director, Division of Flood Prevention and River Basin Programs, U.S. Forest Service, before Minnesota Watershed Congress, Minneapolis, September, 1958.

(31) Conservation Department Biennial Report, op. cit., p 7.

(32) Wetlands have been defined as lowlands covered with shallow and sometimes temporary or intermittent waters. Other common names are marshes, swamps, bogs, wet meadows, potholes, sloughs, river overflow lands.

To preserve some of the remaining wetlands, the state Conservation Department Division of Game and Fish has undertaken a program of purchasing these lands all over the state, with a goal of 250,000 acres. By the end of 1958, more than 50,000 acres had been bought or optioned at a total cost of $1,400,000. (33) Some control and coordination in drainage questions on behalf of wildlife are exercised by the state and federal conservation agencies. On the state level, the Division of Waters has advisory power on county and judicial drainage ditch proposals. Federally, a 1946 "Coordination Act" requires that "every water use project for power, flood control, navigation and drainage, planned by the Corps of Engineers, Soil Conservation Service, and for power development by industry and companies under the Federal Power Commission license" be reviewed by the U.S. Fish and Wildlife Service. (34)

Pollution Control

Water must be clean to serve many of its useful purposes. Yet one of its common uses -- as a waste disposal channel -- can make it unclean when the waste is in quantity. With the amount of waste that must be disposed today making waters too polluted for them to clean themselves, the only solution is to treat sewage before its disposal.

State legislators studying pollution problems found sewage treatment methods can remove 85 to 90 percent of organic or suspended materials and 99 percent of the bacteria. (35) Two types of treatment are generally employed by municipal plants. Primary treatment removes most solids by screening and sedimentation processes. Secondary treatment may be necessary to reduce organic and bacterial content by oxidation and chemicals. The amount of treatment needed in any one case is determined by a number of factors, including the type of sewage to be treated, the relationship between the volume of sewage and the flow of the water course, and the other ways in which the water course is used. In some instances, primary treatment is sufficient. Minnesota has no system of standards or classifications for describing the pollution levels in rivers and streams, a pollution control used in some states. The usefulness of setting these standards is questioned by some in the pollution abatement field. Investigation of the method was urged by the legislative study group.

It is impossible to compile an up-to-date accounting of what communities have what kind of sewage treatment. Plans, sometimes spurred by the hope of federal aid, are coming into the state Water Pollution Control Commission at a rapid rate. From 1950 to 1957, 117 communities had constructed new or improved old disposal plants. At the Control Commission's May 1959 meeting alone, 99 sets of plans for municipal and industrial sewage disposal projects were considered. According to the Commission engineer, all the state's cities above 3,000 population are at least in the planning stage of cleaning up pollution. (36) A big step in pollution abatement has been local approval of a secondary treatment plant at Red Wing, last major city on the Minnesota side of the Mississippi River to have treated sewage, in January 1959. It is estimated to cost $2,235,000.

Another aspect of the pollution question is disposal of industrial waste when it is not carried by a municipal system. The state legislators noted "state reports show many of the industries and the type of treatment employed, but...no evaluation as to adequacy has been published." (37)

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(33) Conservation Department, Biennial Report, op.cit., p 13.
(34) U.S. Fish and Wildlife Service, Statement of River Basin Activities, Region III, (Minneapolis, 1955).
(35) Water Pollution Study Commission, Report, (State of Minnesota, 1959) p 32.
(36) Harvey T. Rogers, quoted in Minneapolis Star, Every City Above 3,000 Cleaning Up Pollution, July 22, 1959.
(37) Water Pollution Study Commission, op.cit., p 14.

Industries with wastes requiring separate treatment or without municipal systems available can be found up and down the Mississippi in Minnesota -- milk, paper, vegetable canning and meat packing plants, oil refineries, ore processing and metal plating works. One of the recommendations of the legislative group was that the state be empowered to review industrial disposal facility plans before construction. Although permits are now required to operate these facilities, they may be applied for during or after construction.

Ground water pollution is a subject about which very little is known, and ground waters are not under the jurisdiction of state pollution legislation. Combination of a private well and cesspool on residential property may result in unsafe well water. A recent case is the metropolitan Twin Cities suburbs, where state Health Department tests show sewage products are seeping into some well waters in dangerous quantities. Extended pollution legislation to cover ground waters was another of the legislators' recommendations.

Atomic waste disposal may present a whole new set of problems in water pollution. The nuclear power plant at Elk River is to deposit low-level atomic wastes into the Mississippi River above the Twin Cities. Some studies at other atomic plants indicate this disposal is not harmful, but the legislative interim study found other reports warning such disposal "is always undertaken at some slight hazard to the health of populations using those waters, and that such disposal is not a really satisfactory solution." (38)

CHAPTER FOUR

WHO PAYS THE BILLS

Responsibility for meeting the cost of water management lies with both government and private interests. Nearly all water resource management programs must begin with an idea at the local level. What are called "Corps projects" actually begin with local petitions to the federal level -- the Congress. Soil conservation programs begin with the individual farmer. Pollution control measures start at the municipal level. The small watershed approach, which ideally combines all efforts toward water control, also is initiated by petition from local groups. Notable exceptions to local initiation are recreation and fish and wildlife programs.

Who it is that assumes the costs of carrying out the local ideas, and by how much, is complicated and involved. Most water-related programs are paid for at least in small part with federal money. Some, such as the flood control and navigation projects constructed by the Corps of Engineers, are virtually entirely federally financed. The following descriptions only touch on some of the cost-sharing arrangements important in Minnesota.

Local Responsibilities and Costs

Local initiative (from landowners, county and township boards, municipalities and district courts, for example) is especially important in organizing small watershed districts under the state Watershed District Act. (See Chapter Five.) A district is financed in several ways. First, a tax not to exceed one mill per dollar of assessed valuation, or $20,000, whichever is less, may be levied on all taxable property in the district. Second, the district has authority to sell bonds. Third, it can levy special assessments on property benefited by a project.

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(38) Ibid., p 22.

And, fourth, under the federal Watershed Protection and Flood Control Act, the district may qualify for funds to entirely cover flood prevention construction and partially offset costs for irrigation, drainage, fish and wildlife development and other agricultural management. The Secretary of Agriculture determines the local share on the basis of benefits derived.

State Responsibilities and Costs

The state, through the Department of Conservation, Pollution Control Commission, Soil Conservation Committee and Water Resources Board, assists in planning watershed districts in these ways:

Water Resources Board organizes the Districts.
Soil Conservation Committee approves applications for federal aid.
University of Minnesota agricultural extension service advises, through soil conservation field men, county agents, extension foresters.
Conservation Department advises on engineering under the Division of Waters, on tree planting under the Division of Forestry, on wildlife habitat under the Division of Game and Fish.
Water Pollution Control Commission advises on pollution problems.
Attorney General deals with legal problems.

The state wildlife program under the Division of Game and Fish is extensive, supported by a Division fund of nearly five million dollars for 1959. The wetlands purchase program is financed by license receipts and federal aid. Other plans of the Division call for purchasing land for free public access to lakes, expansion of game refuges and public hunting grounds and acquisition of fish spawning areas.

With no national parks located in Minnesota, the state Conservation Department must finance and provide this type of large scale recreation facility. Minnesota ranks 29th in the nation in state park fiscal programs with the 1958 appropriation reaching $500,000.

State aid provided municipalities by the Pollution Control Commission is in the form of basic data and information on technical problems. The commission has no construction program.

Federal Responsibilities and Costs

The steps of the Corps of Engineers' formula for calculating whether a project is economically justified have been described by Col. Desloge Brown, St. Paul district engineer (39):

1. Determine the type of improvement or structure necessary and estimate the cost.
2. Determine the annual payments necessary to amortize this cost over the 50 years considered to be its economic life, and pay the interest on the unamortized balance. Added to this is any cost for operation and mmaintenance. The total is the annual cost of the project.

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(39) Remarks at League workshop, op.cit.

3. Compute the annual benefits; for example, for a flood control project, dollar damages caused by each past flood are averaged with consideration given the probable frequency of occurrence of successively higher river stages, to determine the average annual flood damage. Reasonable allowance for normal future growth is taken into account. Flood control benefits are the portion of these damages which will be prevented by the proposed improvement.

4. There may be additional benefits, such as increased property values as a result of higher use of land no longer subject to flooding. There may be, in the case of reservoirs, water supply and recreation or fish and wildlife benefits.

5. Total average annual dollar benefits are compared with the annual costs to arrive at what is called "benefits-to-cost ratio." Unless this ratio is greater than one, that is the benefits are greater than the costs, the project would not be recommended by the Corps and in all probability would not be authorized by Congress.

Corps requirements for local financial cooperation and participation are:

1. Local interests must provide all lands and right-of-ways required for the structures.

2. They must agree to maintain and operate the structure after completion.

3. They must agree to protect the federal government from any claims or liability as a result of construction.

4. They must finance any alterations to roads, bridges or public utilities required by the construction.

5. In certain cases, they must make a cash contribution where there are land enhancement or recreation benefits from the project. Generally speaking, local interests must pay 50 percent of the percentage of the cost of the project which can be attributed to land enhancement or recreational benefits.

Three federal aid programs of significance to water development in Minnesota concern watershed district organization, pollution abatement and farm improvement practices.

Watershed districts qualifying under the Watershed and Flood Prevention Act (Public Law 566) receive funds for planning services, technical assistance, construction of flood prevention structures and a share of the cost of structures applicable to the agricultural phases. On occasion, there is a choice for local interests between undertaking programs under sponsorship of the U.S. Department of Agriculture's Soil Conservation Service or under the Corps of Engineers. During 1958, Minnesota municipalities received $929,000 in federal aid to share costs of sewage treatment plants under the Water Pollution Control Act. (40) Farm improvement practices are financed in part under the Department of Agriculture's Agricultural Stablization Program (the "farm program"). During 1958 $6,200,000 in these funds were spent in Minnesota.

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(40) See League of Women Voters of United States, The National Voter, July, 1958 "The Waters are Still Muddy."

CHAPTER FIVE

PROBLEMS IN GOVERNMENT: TODAY AND THE FUTURE

It is clear that the Upper Mississippi River is not being managed as a basin. Reason for the lack of impetus within Minnesota toward whole-hearted basin treatment probably lies in the fact that the state is a headwaters region. Problems of use and conservation are not inherited from outside the area; they begin right in the state. Even so, the difficulties of coordinating water management efforts, long recognized in other parts of the nation, are also apparent in Minnesota. A clearer picture of these problems can be gained from a quick summary of the principal agencies -- local, state and federal -- active in the basin.

Local

Patterns of local government are, of course, not uniform throughout the state. Every municipal board or council is concerned in some way with water management, at least with water supply and sewage disposal. Municipal departments administering such programs sometimes include engineering and health departments. In addition, some communities have planning commissions that may be concerned with planning for these facilities. At the county level, county boards of commissioners have responsibilities for drainage ditches and county owned woodlands. A county health officer is sometimes employed. Water related units which are sometimes organized overlapping municipal and county lines include soil conservation districts, a few drainage and conservancy districts (forerunners of watershed districts) and a few watershed districts. (41)

State (42)

WATER RESOURCES BOARD An independent board of five members appointed by the governor, created in 1955 to determine and apply a state water policy in certain legal proceedings and, upon petition, to establish watershed districts.

WATER POLLUTION CONTROL COMMISSION An independent commission, created in 1945, consisting of the state commissioners of conservation and agriculture, secretary and executive officer of the state Live Stock Sanitary Board, the secretary and executive officer of the state Board of Health and three members appointed by the governor. The commission administers and enforces all state water pollution laws.

SOIL CONSERVATION COMMITTEE An independent agency composed of the dean of the University of Minnesota's Institute of Agriculture, the Agricultural Extension Service director, commissioner of the state Department of Agriculture, commissioner of state Conservation Department, the U.S. Soil Conservation Service's state conservationist and four farmers appointed by the governor. It administers and coordinates soil conservation districts.

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(41) Watershed districts established during 1957-1958: High Island (Renville, Sibley and McLeod counties); Two Rivers (Kittson and Roseau counties); Joe River (Kittson county); Stockton-Rollingstone-Minnesota City (Winona county). Minnesota Water Resources Board, Report to the Legislature and Governor, (State of Minnesota, 1959) p 6.

(42) See League of Women Voters of Minnesota, You Are the Government, Revised Edition, (H.M. Smyth Co., Inc., St. Paul, 1958).

DEPARTMENT OF CONSERVATION Four divisions -- Game and Fish, Forestry, Parks and Waters -- have various conservation responsibilities, some of which have been noted in previous chapters. The Division of Waters is responsible for general administration over public waters and provides engineering service for the Water Resources Board. In the spring of 1959 the Waters Division published a preliminary survey of the state's water resources and proposed boundaries for 39 small watershed units that might be used as a guide by the Water Resources Board in establishing watershed districts.

Federal (43)

One of the "big three" national water management agencies -- the Bureau of Reclamation of the Department of Interior -- is not active in Minnesota because a need for large scale reclamation programs is not characteristic of this humid area. Agencies particularly active in the Upper Mississippi basin are:

DEPARTMENT OF DEFENSE
Army Corps of Engineers

DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Forest Service
Agencies administering "farm program" aid

DEPARTMENT OF INTERIOR
Fish and Wildlife Service

Drainage Area Planning

The common sense of managing water resources by natural drainage areas -- basins or watersheds-- has been recognized in Minnesota and carried out to some extent in legislative action. The key law is the Watershed District Act of 1955, which supplements the federal Watershed Protection and Flood Control Act. (44)

A watershed district is a political subdivision of the state. It is a local organization for coordinating all water problems of the watershed. It is a legal and financial authority for initiating projects. A district may be established for flood control, stream improvement, drainage, irrigation, water and soil, conservation and pollution control. Watershed planning may also be concerned with problems of water supply, forestry, fish and wildlife and recreation.

The Water Resources Board may establish a district after a hearing petitioned by one of these three groups within the proposed district: the county commissioners of one of the counties, officials of three or more municipalities, or 25 percent of the resident freeholders. The district is governed by a board of managers, appointed at first by the Water Resources Board from nominees suggested by the petition, and later by county commissioners of the district. The district board is assisted by an advisory board which it appoints and which should consist, if possible, of one county commissioner, one municipal officer, one soil conservation district officer, a member of a farm organization and a member of a sportsmen's group.

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(43) See League of Women Voters of United States, On the Waterfront, (Washington, 1957) p 7.
(44) Ibid., p 15.

An overall plan to guide projects and improvements is developed by the managers and presented to the Water Resources Board, which holds a public hearing within the district before making its decision on the plan. Any individual project within the watershed district must be consistent with the approved overall plan. These projects must be initiated by petition to the managers from one of these groups: a board of county commissioners; an affected municipality; 25 percent of the resident freeholders; or owners of 25 percent of the affected property. Before hearings are called on each project, a survey is made to determine costs and benefits.

Another recognition of the importance of drainage management is found in the 1957-1959 state legislative water pollution study report: "Experience ... has proved that regional planning for water use and control is both more effective and more economical than attempting to solve the pollution problems of each community separately." (45) This principle was embodied in the group's recommendation that, "Sanitary regions be established to coincide as nearly as possible with the several major drainage basins of the state." (46) This recommendation, although it does recognize the drainage factor, has caused critical comment from another state agency interested in organization along drainage lines. The Water Resources Board, in its 1959 report, opposes sanitary regions and suggests that watershed districts be invested with full power to deal with all pollution problems. The board notes, "Creation of two special districts, each having authority to assess property within the watershed and each having separate managers, would be unwise." (47)

State Policies

Achieving coordinated and fair water management is complicated by inconsistent and unclear policies within the state. Minnesota has come far with its two 1955 acts creating the Water Resources Board and watershed districts. But the Water Resources Board notes many remaining difficulties: (48)

> The board feels its authority needs expansion in three ways. First, that it may initiate studies on water policy questions rather than taking them up merely on petition or appeal. Second, that its findings and recommendations should be mandatory rather than advisory. And thirdly, that it should be able to make recommendations on all proposed federal projects, thus, for example, serving as a referee in agricultural-wildlife production disputes before these cause complete rejection of a project.
>
> State water laws, usually written with a single purpose in mind, need recodification. The board states, "Little or no consideration is given to the effect the law might have on other aspects of water management." Prinicipal examples are inconsistent and unclear definitions of public waters and conflicting objections of drainage and wetlands acquisition statutues.
>
> No state agency is primarily responsible for promoting the watershed district concept, and "educating people as to its advantage." The board believes some method of state technical and financial assistance in planning these districts could be worked out, as in other states.
>
> State enabling legislation to allow a community to adopt flood plain zoning is needed. Laws governing appropriation and management of ground water need strengthening in a number of ways.

(45) Water Pollution Study Commission, op.cit., p 24.
(46) Ibid., p 7.
(47) Water Resources Board, op.cit., pp 1-2.
(48) Compiled from Water Resources Board Report, op.cit.

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Prepared by Leagues in the Twin Cities Metropolitan Area
Chairman: Mrs. W. E. Balcom - Wa 6-3247

KNOW YOUR RIVER BASIN SURVEY OF THE TWIN CITIES METROPOLITAN AREA

INTRODUCTION

1. MATERIAL - This material has been gathered by the water resource people of the thirty Leagues in this Area. We have had to cut it to the bone, and regret being unable to reproduce some of the many fine maps, charts, etc. that accompanied the written material. Use of this material with the TWIN CITIES METROPOLITAN PLANNING COMMISSION report, Dec. 1958, called "THE CHALLENGE OF METROPOLITAN GROWTH" is very desirable, as that report deals with the same general topics as this one, and in addition provides excellent charts and maps which emphasize the facts.

   Sources of information are numbered and listed at the end; the numbers indicated at the top of the topic will indicate the source.

   This material follows the outline of the KNOW YOUR RIVER BASIN SURVEY sent out by the National League of Women Voters. It will be necessary to use the survey outline in presenting the material, as the questions will not be repeated here, in order to conserve space. You will also need a map showing the Metropolitan Area.

2. PRESENTATION - We suggest that three or four persons work together in presenting the material; one to read the question, another to give the answer, a third to give supplementary material, a fourth with a pointer to use the map!

3. AREA - This survey will include all of Hennepin, Anoka, Ramsey, Washington and Dakota counties; this also is the area covered by the above mentioned TWIN CITIES METROPOLITAN PLANNING COMMISSION report. This division was decided upon for these reasons:

   a. To conserve woman power; many of you know that a separate survey of the complete Upper Mississippi Basin (in this state) is in progress by the water resource people of this larger area. In order to do this, it was necessary to recruit many Leaguers from the metropolitan area to fill in the gaps in the Mississippi Basin where there are no local Leagues. When that survey is completed, this Metropolitan survey will be incorporated in the Upper Mississippi River Basin survey.

   b. To emphasize the geographical, cultural and economic unity of this area; also to point out that problems regarding water do not stop with the boundary lines of any unit of government.

4. OTHER OPINIONS - Some of the questions in Chapter IV and Chapter VI are matters of opinion, subject to different viewpoints; so we felt it was necessary to secure these from persons in the water resource field. Where this has been done, we have credited the views of a person to that person.

CHAPTER I

A. PHYSICAL CHARACTERISTICS
(Sources 1, 2, 3, 4 & 23)

Rivers as boundaries of counties - Locate on map: Crow River, Mississippi, Minnesota, St. Croix and Cannon Rivers; also the Vermillion running through Dakota County, joining the Mississippi River at Hastings, and the Rum joining the Mississippi at Anoka.

County	Terrain	Soil Types	Fertility	Natural Vegetation
Anoka	Mostly flat Small part western area, rolling	Windblown fine sand outwash gravel, mixed sand & clay	Low Fair Good	Wire grass in marshes, scrub oak, basswood, maple, elm
Dakota	Hilly to rolling, several flat areas	Clayey soil, top 1/3 Middle 1/3, outwash gravel & pebbly sand Bottom west, clay loam Bottom 1/3 east, stoney loam	Good Fair Good High inherent fertility	Open oak-aspen groves and tall grass prairie
Hennepin	Rolling and hilly, numerous bogs & marshy depressions	Clayey to stoney loam, Gravelly hills	Fair to good Fertility in S. & S.E., high	Basswood, sugar maple, elm, oak
Ramsey	Rolling to hilly	North, fine wind blown sand; rest clayey to stoney loam	Low Fair to good	Oak - aspen groves
Washington	Small NW area, flat; largely rolling to hilly	Mostly clayey soil; sandy strip near river, NE; Stoney to gravelly loam, ridges and knolls	Good Low High	Oak - aspen groves

NOTE 1. Because this area was recently glaciated, many types and variations of terrain and soils occur within each of the general classifications illustrated. See map opposite p. 10, "The Challenge of Metropolitan Growth".

NOTE 2. All along the route of the Mississippi, at the mouth of the Rum, along parts of the St. Croix, and on the north bluff of the Minnesota, on the south bank near Shakopee; also in the valleys of the Vermillion and Cannon Rivers is the outwash gravel, or pebbly sand. Rock outcropping also occurs on the Mississippi from Minneapolis down, from Shakopee to St. Paul, on the St. Croix from Afton to Hastings, and in the area immediately around Hastings. This is usually accompanied by good fertility of soil.

Land erosion might be more of a problem if the area weren't so build up; as it is, most erosion is stream bank erosion, erosion from highway cuts, gully erosions. There is a good deal of silt carried by the Minnesota River which is deposited in the area, but which has come from further upriver. Erosion is spread over most of Vermillion Watershed.

Locate major lakes in Area on maps - Minnetonka, White Bear, St. Paul Reservoir lakes, Forest Lake, Big Marine, Coon Lake, etc.

Seasonal extremes of temperatures (averages)

Jan.	10.2	April	46.3	July	75.0	Oct.	47.8
Feb.	20.3	May	56.6	Aug.	69.2	Nov.	32.3
Mar.	30.6	June	66.8	Sept.	59.3	Dec.	24.9

Precipitation averages at: (yearly amounts)

Farmington, Dakota County	36.07 inches	St. Paul, Ramsey County	28.31 in.
Stillwater, Washington County	32.50 "	Minneapolis, Hennepin County	27.85 "

Sections nearest major rivers tend to be the most humid. It takes 10 inches of snow to equal 1 inch of rain. Regarding distribution of precipitation, Farmington is somewhat typical; 33.52 of their total of 36.07 inches was received during the 7 months from May through November. Seasonal variations from year to year may be great - extremes are 22.45 inches above normal in 1848 to 17.3 inches below normal in 1910. In 1958 precipitation was 8.31 inches below normal. Underground water is discussed in the next chapter.

B. POPULATION CHARACTERISTICS
(Sources 1 & 10)

(For a complete and detailed analysis see Twin City Planning Committee Report)

1. Population in thousands

1930 - 882
1940 - 967
1950 - 1,151
1958 - 1,458
1980 - 2,000, an increase of 600,000 persons

Present ('58) Distribution*

County			Centers of Density
Dakota	Urban	47,000	
	Rural	20,000	
Hennepin	Urban	812,000	Minneapolis
	Rural	18,000	
Anoka	Urban	52,000	
	Rural	9,000	
Ramsey	Urban	422,000	St. Paul
	Rural	8,000	
Washington	Urban	16,000	
	Rural	26,000	

*Estimated by Twin City Metropolitan Planning Committee

Observations:

The Central Cities: relatively stable populations with little room for substantial growth inside their existing limits.

The Inner Suburban Zone: communities close to the central cities, which have grown rapidly since 1950; a slowdown in population expansion is beginning in parts of this zone, as land for large subdivisions nears exhaustion.

The Outer Suburban Zone: the rural urban fringe, scene of numerous free standing housing developments over the past decade, a considerable increase in residential building since the mid-1950's: this zone will likely bear the brunt of population growth over the next 15-20 years.

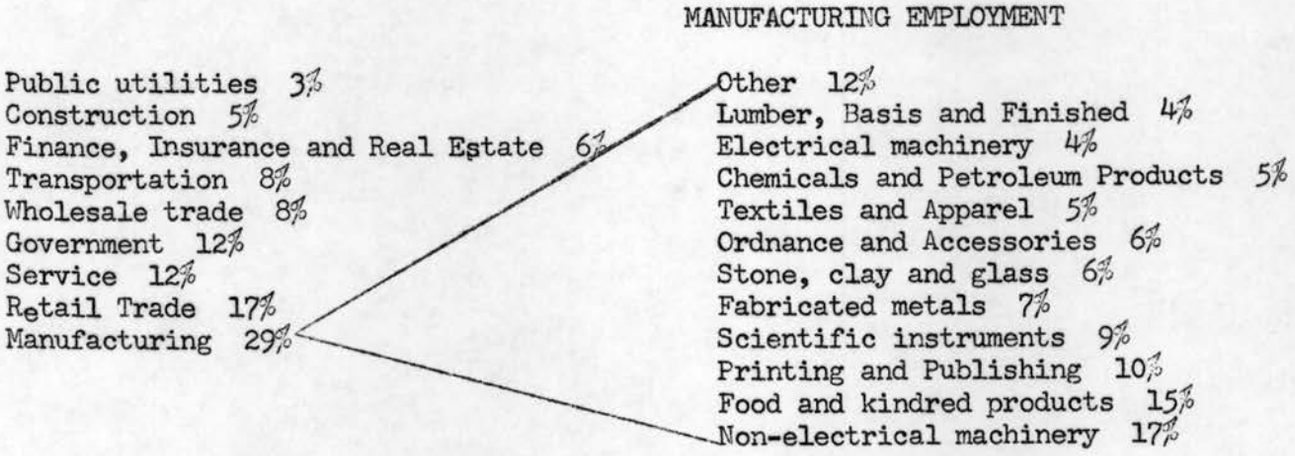
The Rural-Small Town Zone: still largely agricultural in nature; future highway, industrial, recreational and institutional developments could serve to greatly accelerate population expansion.

C. ECONOMIC CHARACTERISTICS
(Sources 1, 5, 6, 7, 8, 9, 10)

1. The area is: a major transportation center; one of the nation's 10 largest wholesaling centers; an important financial and insurance center; the 15th largest U. S. manufacturing area; the 13th largest retail market in the nation; and the "front office" for many public and private agencies. This diversification is a major strength of area.

2. Manufacturing provides the greatest source of income, with a percentage of 41.4%, wholesale distribution 39.6%. (This was from a report of income taken from taxable payrolls.)

EMPLOYMENT - 5 county area



Yes, economic wealth is growing moderately, (compared to national standards) indicated by the steady growth of building and employment in the last twenty years. The west coast area is growing faster, but this area is average for the middle west and east. There are not many new industries locating here at the present time, so primarily the expansion is from within; existing firms are diversifying and making new products.

Factors affecting economic health:

1. The decline in the area's share of the national expenditure for new plants and equipment from 0.8% to 0.5% of the nations's total. This is cause for legitimate concern, for experience indicates that a decrease in share of plants and equipment may ultimately be followed by relative employment losses.
2. This area has a large pool of skilled labor.
3. Minneapolis dominates as a wholesale center.
4. There is a large supply of good quality processing water for industry.
5. Some major firms sublet contracts to smaller highly specialized firms, encouraging the growth of the smaller firms.
6. The state tax structure needs overhauling and a more equitable system introduced. (This presently is a major concern of the State Legislature.)
7. The average number of days of absenteeism is 4 days in Minnesota, compared to a 14 day average in the U. S.
8. Transportation facilities are good, and improvement may be expected by reason of the Upper Harbor completion and improved terminal facilities; also improvement to the channel of the lower Minnesota River will extend transportation facilities.

9. The average annual increase in number of jobs needed is 19,000. The last five years has shown a serious lag in the number of jobs available; the total state lag in number of jobs is estimated at 72,000 since 1947. Our high quality labor force inevitably will turn elsewhere if it cannot find jobs at home.
10. The growth of the Metropolitan Area is about the same rate as the nation as a whole; yet the growth of the region which it serves (Nebraska, the Dakotas, Iowa and Minnesota) is falling considerably short of the nation as a whole. This affects MARKETS, POLITICAL STRENGTH, AGE OF POPULATION (younger and more productive workers tend to leave the area).
11. Regional Research plans have very recently been announced (Tribune 1/16/59) by the Minneapolis Area and St. Paul Chambers of Commerce, Minneapolis Gas Co., Northern States Power, and Northern Natural Gas Co. of Omaha. This is designed to stimulate the area's industrial economy.

SUPPLY - also see Chapter II

Dr. George Schwartz, U. of Minn. Dept. of Geology, believes there is an abundant supply of water in Minnesota, our major problem being one of distribution.

POWER - Adequate. See Chapter II, Power

Northern States Power has grown with the area's population and increasing demands. Some of the outlying districts, Anoka, Farmington, etc. are supplied by coops, these are also adequate.

BETTER UTILIZATION OF RESOURCES NEEDED?

The basic question here is one of land use. Competing interests, all of them legitimate and desirable, competing for sites for location of new industry, desirable homesites, recreational facilities, highways, etc. For other suggestions, see Chapter IV on Conflicts. The section above on Factors affecting Economic Health also pertains to this area.

3. In the manufacturing field, we are not using the products of the forested areas to a sufficient degree. Commissioner Selke, of the Department of Conservation, states "We must develop new outlets for forest products and establish new wood using industries."

A recommendation to require change from the present state law regarding pollution of the waters of the state was made by the Water Pollution Study Commission reporting to the 1959 Legislature, and is as follows: "That specifications of sewage treatment facilities be submitted to the Water Pollution Control Commission and approved before construction of industrial facilities is begun."

Transportation of bulk commodities on the Mississippi and Minnesota Rivers has not reached its potential.

In the Metropolitan area, there is a contrast between concentration of economic activities on one hand, and fragmentation of the land into numerous political units on the other. This functions to produce inequalities in non-residential tax base.

Recreational facilities for employees is a major concern of business or industry entering an area. Naturally, this is an area where what we have must be kept, and added to, in the light of 600,000 more people in 20 years.

D. COMMUNITY ORGANIZATION*

Obviously all the groups interested in some phase of water resources cannot be listed; it is equally obvious that there is NO group interested in the entire subject, with its many ramifications, except the League of Women Voters.

Business Groups	Primary Interest
Mpls. Area Chamber of Commerce	To bring in new business, and the wise use of natural resources
Junior Chamber of Commerce	Same
St. Paul Chamber of Commerce	Developers of Valley Industrial Park, on lower Minnesota River
Mpls. Area Development Corporation	
Bankers' organizations	Water is vital to economic health of area
Power companies	River transportation, water essential for producing steam, also for cooling purposes
Upper Mississippi Waterway Ass'n.	River transportation
Mississippi Valley Ass'n.	River transportation and promotion of stronger region, economically
Shippers' Ass'n.	Averting polluted supply
Health Authorities and Insurance Companies	
Well diggers organization	Well digging
Lower Minnesota Improvement Ass'n.	Navigation to New Ulm

Conservation Groups	Primary Interest (some phase of conservation)
Keep Minnesota Green	Conservation Education & tree farming
Minnesota Game Protective League	Fish and Game
Minnesota Conservation Federation	Pollution, state legislation fish & game
Isaak Walton League of Minnesota	" " " " " "
Clear Air-Clear Water Unlimited	Protection of air and water from pollution
Natural History Society of Minn.	Preservation of habitat for wildlife
Save our Wetlands	Preservation of nesting areas for waterfowl
Minnesota Emergency Conservation Commission	Stronger legislation regarding pollution, protection of supply, others in conservation area.
Minneapolis Star-Tribune	Believes in conservation of soil and water

*Sources included in IC

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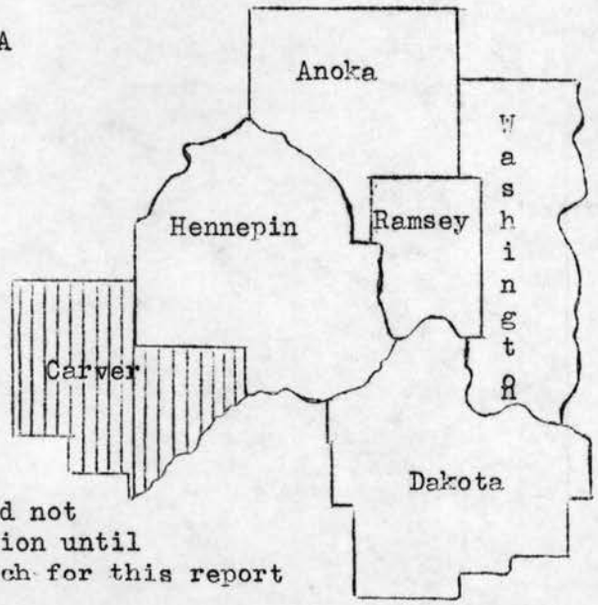
METROPOLITAN AREA



Carver county did not join the Commission until after the research for this report was completed.

CHAPTER II

A. WATER SUPPLY OF THE METROPOLITAN AREA
(Sources 11,12)

1. SOURCES OF SUPPLY

The Twin Cities Metropolitan Area is fortunate, perhaps even "unique" in having two abundant sources of water: the Mississippi River and the Jordan Basin. The St. Paul and Minneapolis municipal water systems obtain their water from the Mississippi River, Minneapolis directly, and St. Paul through a series of lakes. The public supply of Minneapolis is pumped from the Mississippi at the Fridley pumping station No. 5, north of the city; the water is treated at the Fridley water softening plant and then divided. Part of the water is delivered to the Columbia Heights Filtration Plant where it is filtered and sterilized, and then supplied to the city by gravity from the reservoir. The other part of the water is pumped by low service pumps to the Fridley Filtration Plant, treated and then pumped directly into the mains from the reservoir. The original installation was financed by general revenue bonds.

Water for the St. Paul municipal water system is pumped from the Mississippi River at Fridley to the Vadnais storage reservoir through Charles and Pleasant Lakes. Water storage in the Vadnais impounding system may be augmented by pumping from the Centerville Lake system, a series of lakes lying north of the Vadnais system. Overflow from Otter Lake and Bald Eagle Lake may be taken by gravity into the Vadnais system as a reserve source. Held in reserve are two artesian well fields, one along the shores of Centerville Lake, the other at the McCarron Station. The St. Paul system was financed by bond issue.

The U.S. Geological Survey, Bulletin 274, published in 1953, states: "The surface-water supply of the Twin Cities area is sufficient to supply all forseeable industrial and domestic needs. Under the most adverse conditions on record (the drouth of the '30's) the maximum combined water demand of Minneapolis and St. Paul was less than one-half of the flow of the Mississippi River above the Minnesota River."

All other municipal water systems in the five county metropolitan area and most industrial plants and large businesses within the Twin Cities obtain their water from wells (ground water). It is necessary to know a little about the geology of this region to understand the remarkable formation of the basin.

The general structure of rocks beneath the Twin Cities is that of a shallow basin. Beneath varying thicknesses of glacial drift lie alternate layers of relatively non-porous confining rock such as limestone and layers of porous water-bearing rock such as sandstone. Most farm and home wells tap the glacial drift layer. The St. Peter sandstone, the layer below the glacial drift, supplies limited water. A formation called the Shakopee-Oneota separates the St. Peter sandstone from the Jordan sandstone, the most important aquifer in the area, as it is completely saturated with water. 95% of large wells in the Twin Cities extend into this 100 foot layer which is about 400 feet below the ground at its center, a mile or so east of the loop in Minneapolis. It's outcrop area (where the sandstone comes to the surface of the land) extends from St. Bonifacious on the west to the St. Croix River on the east and from Forest Lake to Hampton on a north-south line.

The water temperature is 48°, ideal for cooling purposes; the water hardness is twice that of the Mississippi River, but still soft enough for commercial purposes. The water is under pressure (artesian water), so that it may rise as much as 200 feet in a 400 foot well. The pressure results from the relatively non-porous layers of rock above and below the Jordan sandstone, and the sloping contours of the layers.

The Hinckley sandstone layer, about 1000 feet down, has a small yield, but is softer than Mississippi River water and is used by launderies and certain other industries.

These aquifers are replenished largely by rain and snow falling on the outcrop areas, and by some percolation through cracks and fissures of the confining layers.

"There is no point in worrying about exhausting our underground water supply," said Dr. George A. Thiel, head of the Department of Geology at the University of Minnesota, in "Minneapolis Industrial Oasis", a publication of the Minneapolis Area Chamber of Commerce. Although the water level is receding at the rate of 1 foot a year, he does not regard this as alarming because the ground water level is about 200 feet above the Jordan sandstone, and at the present rate it will be two centuries before we start depleting the Jordan.

However, in the same article, Adolph Meyer, noted hydrological engineer, expressed a different viewpoint. He said, "We must not waste our ground water. I think there should be a limit to the amount of such water to be used in industrial cooling and in air conditioning... We need to study the problems of recharging our underground water supply."

Quoting the Geological Survey,#274, again we find: "At the current average daily rate of withdrawal of ground water, the quantity stored in the aquifer and without recharge would be enough to supply the ground-water use for the entire area for about 45 years." These opposing judgments illustrate the need for further research on our ground-water resources.

Southdale offers a unique example of industrial water conservation. The water used for summer air-conditioning is returned to an underground drift reservoir, and pumped back, still warm for winter heating. This water gives up its heat and is returned cold to a deep rock layer reservoir, ready to pump up again for the following summer. Only the small amount of water from washrooms, kitchens, etc., is discharged into the sewer.

2. FUTURE PLANS

The water supply of the Twin Cities Metropolitan Area is probably adequate to serve the needs of the area for many years to come. The major problem centers on providing the treatment and distribution facilities that will deliver adequate amounts of proper quality water to required locations for an expanding population. Another 600,000 people will require new water systems with a capacity larger than that of Minneapolis! (from Twin Cities Metropolitan Planning Commission Report)

Although the Geological Survey #274 indicates the surface-water supply is more than adequate, and ground water abundant, St. Paul has been forced to restrict the use of water through sprinkling bans during the past several summers. The lack of water has been blamed on the inadequacies of the distribution system, but a recent article in the St. Paul Dispatch (Jan. 16, 1959) expressed concern over the supply of raw water because of the drouth which marked 1958 and has continued thus far this year. Precipitation was only 2/3 of normal in 1958. St. Paul's water department has begun studies aimed at increasing the supply of raw water, and has engaged consultants to study the Mississippi River conditions at Fridley because of low water stages. The possibility of building a dam there to create a storage reservoir has been suggested. Other sources of raw water are being investigated, particularly the St. Croix River, 12 miles east of St. Paul.

Leonard N. Thompson, general manager of the St. Paul Water Department, said in a Dispatch article January 21, 1959, that "with existing facilities, St. Paul could

get along the coming summer for a couple of months even if the weather should remain extremely dry." "We are concerned about doing something immediately to insure plenty of water, but we are also looking ahead to a long range program which would guarantee the elimination of future worries," he said.

A $21,500,000 bond issue in three stages to improve and expand the St. Paul water supply is now about half completed. It provides for a pipe line from Fridley, improvements at Fridley pumping station and expansion of filtration plants; supply line into Highland Park, overhead tank and ground level reservoir in Highland, 90-inch conduit from Lake Vadnais to the filter plant, rehabilitation of 30 million gallon Dale Street storage reservoir.

The Minneapolis Water Department has no immediate plans for expansion; long range plans are only in the thinking state. Work is going ahead on improving the system, but this does not include expanding facilities.

There is a considerable amount of activity in water plans for smaller communities surrounding Minneapolis and St. Paul. Recently three municipalities, St. Bonifacious, Brooklyn Center and Osseo, have completed new water supply systems. New Hope passed a $325,000 bond issue in the November election to start installation of a municipal water system. Maple Plain passed a $12,000 bond issue to expand its water facilities by drilling a new well.

Of the dozen or so housing developments with private community water systems, seven have been completed in the last year. These water systems have been put in by the contractors who built the housing developments. There are three ways that these systems are administered: 1) The developer himself may manage the system; 2) The developer might turn over the system to the local municipal government (a developer in Coon Rapids has given the water system to the village); 3) The people in the development might own the system cooperatively (Mendota Heights bought the water development from the contractor and elected their own officials).

Water service in the Twin Cities is entirely paid for by the consumers. Costs of water mains in the case of a new street opening up are paid for by the property owner...this is called a frontage tax. St. Paul's plans for expansion are being paid for by bond issues, which will be retired from revenue in the form of increased water rates.

Cost of water to the consumer in the metropolitan area is low when compared with other sections of the country.

3. AGENCIES HAVING WATER SUPPLY RESPONSIBILITIES

The Minnesota Department of Health. One function of the Minnesota Department of Health is to insure the sanitary safety of the water supply. Annual investigations of public water systems are conducted and reports issued to municipal officials who are then responsible for making changes if they are recommended. The supply system is examined for physical or operational defects, which might cause contamination of the water supply, and a bacterial examination is made. The system is then rated by the Department of Health, with a score of 100 indicating complete compliance with the sanitation safety standards of the Minnesota Department of Health. A score of 85 or above is approved with score below 85 indicating the need for immediate action on the part of municipal officials.

Plans and specifications for new water supply systems and additions to existing facilities must be submitted to the Department of Health for review, and approved. One of the major accomplishments of the Department is the development of a set of standards relating to the construction, location, and operation of water systems. These standards are published in the "Manual of Water Supply Sanitation".

The Minnesota Department of Health deals only with public water supply systems, and has no control over the wells of individual home owners. The need for county boards of health to supervise farm and domestic wells seems to be indicated.

The certification of water works operators, another function of the Health Department, has been in effect for the past ten years, and is given in conjunction with the waterworks operators school in March of each year - at the Center for Continuation Study at the University of Minnesota. The certification program is voluntary and is sponsored jointly by the Minnesota Department of Health, the University of Minnesota, The League of Minnesota Municipalities, and the North Central section of the American Water Works Association. In March 1958, 130 water works operators attended the session. Certification is given at different levels depending upon the complexities of the water system.

The Minnesota Department of Agriculture keeps "tab" on the water that is used in food processing industries, using the rating standards of the Minnesota Department of Health.

Municipalities have the power to adopt ordinances regulating the construction and location of wells.

Division of Waters, Minnesota Department of Conservation, has administrative authority over the use and allocation of public water of the state, and issues permits for the appropriation of ground and surface water.

Water Resources Board (Minnesota) upon petition establishes watershed districts for conservation purposes, and holds hearings on questions of state water policy.

The Geological Survey (U.S. Department of Interior) a basic data collection agency that cooperates with individual states on a 50-50 cost basis; in Minnesota, it works with the Division of Waters, Conservation Department; often they will use information from the Corps of Engineers also. Bulletin 274, referred to previously, contains information on geological formations, climatological data, chemical quality, flood frequencies, etc.

Soil Conservation Service - U.S. Department of Agriculture - activities are indirectly related to water supply, as they deal with conservation of both soil and water.

The Federal Housing Administration and the Veterans Administration have to pass on water systems serving homes financed under their programs.

The Corps of Engineers controls the flow of the Mississippi River - See Chapter IV, CONFLICTS.

TABLE

PUBLIC WATER SUPPLIES OF THE METROPOLITAN AREA

MUNICIPALITY	SOURCE	TREATMENT
Anoka	wells	iron removed
Bayport	wells	fluoridation
Brooklyn Center	wells	none
Circle Pines	wells	fluoridation, water softening
Columbia Heights	Mississippi R.	disinfection, complete treatment, softening
Coon Rapids	wells	none
Edina	wells	disinfection, fluoridation
Excelsior	wells	iron removal, softening
Farmington	wells	none
Forest Lake	wells	chlorination, addition of polyphosphate
Golden Valley	Mississippi R.	disinfection, complete treatment, softening
Hampton	wells	none
Hastings	wells	none polyphosphate
Hopkins	wells	chlorination, iron removed, addition of /
Lakeville	wells	complete disinfection
Lauderdale	Mississippi R.	disinfection, complete treatment, softening
Long Lake	wells	none
Loretto	wells	none
Mahtomedi	wells	none
Maple Plain	wells	none
Minneapolis	Mississippi R.	disinfection, complete treatment, softening
Minnetonka Beach	wells	iron removal, softening
Mound	wells	none
Morningside.	Mississippi R.	disinfection, complete treatment, softening
New Brighton	wells	none
New Trier	wells	none
North St. Paul	wells	none
Osseo	wells	none
Robbinsdale	wells	complete disinfection, addition of polypho-
Rosemount	wells	none sphate
St. Bonifacious	wells	none
St. Louis Park	wells	chlorination, addition of polyphosphate, aera-
St. Paul	Mississippi R. lakes, wells in reserve	disinfection, complete treatment tion fluoridation
St. Paul Park	wells	none
Stillwater	wells	chlorination, ammoniation
South St. Paul	wells	chlorination, addition of polyphosphate
South Inver Grove	wells	none
Tanners Lake	wells	none
Thompson Grove	wells	none
Valley View Hills	wells	none
Wayzata	wells	chlorination
West St. Paul	part of St.Paul system	disinfection, complete treatment, fluoridation
White Bear Lake	wells	none
Woodbury Heights	wells	none

B. POLLUTION ABATEMENT
(Sources 1,14,15,16,17,18,19,20,21,22)

1. Approximately 28% of the population of this Area is not presently served by public sanitary sewers. With existing public sewer facilities already overloaded, the prospect of adding 600,000 more people to the Area intensifies the need for vigorous and early action to solve this pressing problem. Because of increasing urban densities in many areas, the use of cesspools, septic tanks and outhouses is no longer satisfactory, particularly where public health is endangered by possible contamination of private and public water supplies.

   The Minneapolis-St. Paul Sanitary District is presently more than halfway through a five year program of research and planning aimed at determining the logical future size of the Sanitary District and the best method of expanding collection and disposal facilities to serve the expanded Area. (See map p. 21, "The Challenge of Metropolitan Growth").

2. (a) Lake Minnetonka has a pollution problem that has been increasing in recent years. The problem is most acute on the western end of the lake, in the area of Mound, Island Park, Spring Park, and Tonka Bay. None of these municipalities has municipal sewage disposal, and all drainage in the area goes eventually into the lake.

   The design of disposal systems in an area such as this is complex, because of the problems of affluent draining directly into the lake, and, in some cases, the large number of small summer homes crowded closely together. Wayzata and Excelsior are the only Lake Minnetonka municipalities that have municipal sewage disposal plants.

   The residents are aware and alarmed about the situation. Some action has been taken by municipalities to control individual cases of pollution, with some success. There is action being taken toward the formation of a Lake Minnetonka Watershed District to handle the pollution problem. (The state law must be altered to allow this). This is very controversial at this time. There is a great deal of opposition to this action, as many people feel very strongly that the disadvantages of the watershed district in this area outweigh the advantages. However, there is general agreement that some united action will have to be taken, probably through the League of Lake Minnetonka Municipalities. (Report on Minnetonka by Carol Slothower, Wayzata).

   (b) The annual report for 1957 by the state Health Department of the investigation of St. Louis Park City water <u>supply</u> reported a high rating (93%) in pollution-free water. Neither the state nor any other body has jurisdiction over private wells or a program for testing private water supplies. It is recommended that owners of private wells have samples of water tested by a laboratory, prices ranging from $4 to $20.

   <u>Cess Pools</u>. The state Pollution Control Commission is giving much consideration to problems involving the overflow of cess pools, etc. but their jurisdiction is limited to rivers, lakes, sewage, etc. The overflow of private cess-pools would come under a Public Health nuisance and would be under nuisance laws and local jurisdiction. The Mayor of St. Louis Park has appointed a committee to study the needs for a local health program, also a youth fitness program. This committee has just begun a study. According to Mr. Kilpatrick, (Assistant Director of Environmental Sanitation for Minnesota) resident of St. Louis Park and a member of the mayor's committee, it would be very desirable that St. Louis Park have its own Health Department. In that case, nuisances and health problems could be taken care of by the local health department.

Sewage Disposal. St. Louis Park belongs to the Minneapolis-St. Paul Sanitary Sewage Disposal system. Residences connected with the sewer are charged a yearly rental fee. Plans are now being formulated which will extend sewer mains to the southwest corner of St. Louis Park, the only area not now served by sewer lines.

Industrial Pollution. Corrosive industrial wastes have to be treated before they can be disposed of in the sanitary sewer system. However, untreated wastes under present law can be dumped or disposed of on the property of the industry as long as wastes do not spread into adjacent areas. Industry should and can process wastes into usable products or haul them away. Legislation is being introduced in the state legislature which would control underground pollution. No problems are expected with new industries in St. Louis Park but there remains the problem of industrial pollution which has occurred because of practices in previous years.

Much confusion and inadequate information surrounds the issue of industrial wastes in St. Louis Park. Several years ago residents complained about the flavor of drinking water in the area of the Creosote Plant. The drainage of the plant was inspected and it was found to drain into a pond which was self-contained and did not overflow. As a result, the authorities maintained no problem existed and no control was necessary. However, the railroad in the area had to abandon a well at one time and the city dug a well in this area years ago also had to abandon it because of creosote taste in the water. At present this plant pours its wastes onto the ground in grease traps. The grease is then reclaimed, the other wastes seep into the ground.

Another industry involved with the problem of waste products is a lithium plant, although the city water superintendent says their waste water does not contain any harmful substances. Under contemplated storm sewer drainage plans, the swamp near the lithium plant would be dredged and the water would flow into Cedar Lake in Minneapolis. (Report by M. Kaufmann, St. Louis Park).

(c) Stillwater - The Stillwater City Council has voted acceptance of a $250,000 grant to be used in building a proposed $1,000,000 sewage disposal plant. (St. Paul Pioneer Press 12/31/58).

(d) Arden Hills formally asked its neighbor, Roseville, for permission to hook on to the latter's sanitary sewer system. The Roseville Council, finishing up a multi-million dollar sewer project, indicated its approval of the request, but referred the matter to St. Paul for the last word. (Pioneer Press, 1/14/59).

(e) South St. Paul - both the Mississippi and the Vermillion Rivers are badly polluted. The St. Croix River pollution problem is not as acute as the population is either small or scattered.

According to the Minnesota Water Pollution Control Commission, there is no standard of pollution set by state law. However, one cannot safely use these streams for drinking or swimming, nor even eat the fish taken from this particular area - especially from the Twin Cities to Hastings. There is a very critical situation in the Mississippi River from St. Paul to Hastings, according to Game Warden Kenneth LaBoone, and the Hastings Gazette,(Jan. 22, 1959). Warden LaBoone said flatly "the river is at the saturation point where pollution is concerned." John B. Moyle, Supervisor of the Section of Research and Planning, Game and Fish Division, Minnesota Department of Conservation, states: "We feel that the present conditions in the river and the fish kill are probably caused by the pollution load of sewage effluent, the effects of which have been aggravated by low stream flow and thick ice. Until there is further treatment

of Twin City sewage wastes there is no practical solution to low oxygen condition in the river when stream flows are down." The dissolved oxygen content (according to Twin City Sanitary District) in the river was 0.4 ppm (part per million) on January 20, 1959, which is considerably below the point necessary to maintain fish life. The U.S. Corps of Engineers reports that the river flow at the Robert Street Bridge has been below 2,000 cfs (cubic feet per second) for 11 days during January, and was 1900 cfs on January 22, (date of this report). Not only do these conditions affect the recreational and commercial fishing interests, but they also represent a very serious and critical threat to residential and industrial development in this area.

The principal sources of pollution are: Municipal Sewage, petroleum refineries, metal plating chemical industries, tanneries, gravel washing, malting companies, vegetable oil processing, rendering plants, canneries, milk plants, and grain washing. Human wastes from cottages and cabins along the river, animal wastes, silt, soil erosion, resulting from agricultural practices, garbage and rubbish disposal in the waters, fish houses, bathing beaches, motor driven pleasure and commercial crafts, and from storm sewers located inside buildings.

The sewage plant of the Minneapolis-St. Paul Sanitary District treats an estimated population equivalent of 1,600,000; but reduces the strength of this sewage by only 35%. South St. Paul, although it has a secondary treatment plant, is over-taxed at least 10%; Hastings has a primary treatment plant which at the present time is adequate and will probably have a secondary plant as soon as the Twin Cities enlarge and expand their plant. Stillwater, Hudson, Prescott, on the St. Croix, have no plants; but they are in the planning stage and have accepted Federal grants. Red Wing will install both the primary and secondary treatment plant. Lakeville, on the Vermillion River, needs to enlarge its present plant. Farmington, also on the Vermillion, has a primary plant now in the construction stage. The Hastings State Hospital on the Vermillion River has an excellent primary and secondary plant.

STATUS of FACILITIES (from report of Water Pollution Study Commission)

Basin	None	Improvement Required New Plant Needed	Add to or Enlarge	Total Municipal.-
St. Croix	8	6	1	15
Lower Miss.	30	11	26	67
Vermillion	2	0	1	3
	40	17	28	85

EXTENT of TREATMENT of WASTES by INDUSTRIES: from Health Dept. (chart, 1/16/59)

Type of process or waste	Treatment or Control Facilities	Effluent discharged
Petroleum refining	Pit disposal of spent caustic, API, oil separator, oxidation lagoon	Mississippi River
Metal Plating	None	Backwater of Miss.
Gravel washing	Settling basin	Baldwin Lake to Mississippi River
Chemical	pH adjustment and neutralization basin	Mississippi River
Chemical	surge control	St.Paul Ammonia Products, Inc.force main to Miss.R.

Type of process or Waste	Treatment or Control Facilities	Effluent discharged to
Petroleum Refining	Pit disposal of spent caustic, chemical neutralization and stripping, API oil separator, biological filter with recirculation, activated sludge plant, oxidation lagoon	Mississippi River
Chemical	Short term settling and skimming unit	Mississippi River
Tannery	Rotary screen	Trout Creek to Hay Creek to Mississippi River
Malting	Coarse screen	Slough to Miss.R.
Vegetable oil processing	Oil skimming tank	Mississippi River
Rendering	Septic tank and leaching pit	Soil
Vegetable canning	Fine screen	St. Croix River
Milk Plant	None at present, city facilities under construction designed to include these wastes	Vermillion River

If industry is located in a part of the Metropolitan Area that is served by the Twin City Sanitary District, their wastes are treated through the Twin City Sanitary District plant. If located in a suburban or rural area, a permit is issued to them by the Water Pollution Control Commission. As for adequacy of state laws, and the enforcement of these laws, there is room for doubt and difference of opinion. The Water Pollution Study Commission makes a good many recommendations to the Legislature as to what should be contained in the state laws. The lack of money and manpower for the State Department of Health is a decidedly limiting factor in the enforcement of present laws. The control of Water Pollution is greatly hampered by inadequate appropriations. (This report by Vera Pierson, South St. Paul League).

In addition to the state Agencies already mentioned, the Department of Agriculture, and the not heretofore mentioned federal agencies of Fish and Wildlife Service, Department of Interior, the Soil Conservation Service of the Department of Agriculture, and the Department of Health, Education and Welfare are concerned in some degree with problems of pollution.

On the preceding page we mentioned Stillwater as having accepted a federal grant. However, the Federal Water Pollution Control Act is better suited for use by smaller municipalities with the projects providing for single governmental units. The appropriation under this act for grant funds to aid municipalities has been considerably less than the amounts applied for by the communities of the state. The amount appropriated by the Federal Government for 1958 was sufficient to satisfy the applications for only 8 of the 46 communities that applied. The proportion of aid applied for and received was about the same in 1957. This aid is administered through the Water Pollution Control Commission on the basis of need and priority.

NOTE: The report and recommendations of the Water Pollution Study Commission that were submitted to the 1959 Legislature are of extreme importance. The following excerpts are of great interest:

> "However, this increase in industrial requirements and population in the state has been so great, that it is doubtful whether the present rate of sewage disposal facilities is doing more than to keep pace with this growth. It would seem advisable to initiate a program which would not only accelerate the building of new plants but which coordinate more effectively all efforts within the state to correct pollution programs."

Also:

> "It can be expected that the deposit of low-level atomic wastes in the Mississippi River will be carefully controlled, and the waters of the river constantly monitored to determine whether excessive concentrations of radioactive substances accumulate at any points."..... past studies "give reasonable assurance that wastes discharged from the Elk River Plant will not result in the contamination of River Waters... The problem of safe disposal of Elk River wastes into the Mississippi is made the more urgent by the proximity of the plant to the intake pipes of the Minneapolis water supply (about 30 miles). The danger may never be great, but the mere possibility of contamination of the water supply of a major city makes it imperative that discharge of atomic wastes into the Mississippi River be carefully controlled."

C FLOOD CONTROL
(Sources 1,24,25,26,27,28,29,30,31,32,33,34)

1 & 2 combined by area.
COON CREEK, ANOKA County, is a direct tributary of the Mississippi, and averages one flood a year. It rises in east central Anoka, flows westerly 10 miles, turns abruptly near Anoka, to flow south and east. Its watershed covers an area of 55,276 acres. Major recent floods occurred in 1942, 43, 48, 51 and 57. Along the main Coon Creek, where the flood plain was delineated, approximately 1,496 acres are flooded annually. The 1957 flood, considered to be a 50 year occurrence, inundated 2,879 acres. Present land use for the entire watershed is general cropland; the number of acres devoted to each purpose is as follows: 19,213 - vegetable, 2,450 - pasture, 6,542 - woodland, 8,381 - wildlife, 400 - idle, 5,527 lakes, 600 homesites and urban area. Part of Coon Rapids is in the watershed, other towns are Andover, Crooked Lake, Constance, Soderville, Lake Netta, Ham Lake and Johnsville.

Cropland along Coon Creek suffers severe damage from surface flooding and flooding of on-farm drainage outland systems. Floodwater damage to roads and bridges is estimated to be $16,895, annually, of which $9,003 is in the flood plain along the main creek. Other agricultural damage in the flood plain is estimated to be $800 annually, which consists of damage to farm roads, bridges, fences, livestock, farm machinery and stored crops. This agricultural damage affects business and industries concerned with the processing of farm goods.

Excessive rainfalls, melting snows contribute to the flooding in this area; while most of Coon Creek and most of its tributaries have been straightened, the present system of county drainage ditches lacks the capacity to handle flood flows and causes flooding of the area. The Anoka County Board of Commissioners and the Anoka County Soil Conservation District are seeking to establish a Coon Creek Watershed District. This will enable the county to plan land treatment and install flood prevention structural measures on a watershed basis. A Coon Creek Watershed work

plan has been completed which involves structural changes consisting of 27.1 miles of channel improvement for flood prevention and drainage. Types of land treatment to be installed during the project period will consist of wind strip cropping, cover crops, rotation grazing and other soil conservation practices to retard flooding and soil erosion.

NOTE: A Geological Survey map compiled in 1911 and 1912 shows area which Coon Creek drains as marshland.

The work plan proposed estimates that the total cost on a five year basis for improvements at $1,104,922. The PL 566 (Federal) share of this is $225,685 and the rest to be provided by local interests is $879,237. In addition, the local sponsoring organization will acquire without cost to the Federal government, such land easements or rights of way as will be needed in connection with the works of improvement, this estimated at $284,151. The costs of land treatment will be borne by owners and operators of the land. However, some of these costs can be reimbursed to the people through the Agricultural Conservation Program. The above given figure, $1,104,922, is the overall cost estimate for flood control. This includes improvements for agricultural water management (drainage).

CROW RIVER, NW Hennepin County boundary, flows into the Mississippi at Dayton, flooded in 1957, but does not flood frequently. It causes some damage to farms and farm communities, but the damage has been slight. The Nine Mile Creek Watershed area which begins at Hopkins, flows through Edina, and empties into the Minnesota at Bloomington, causes some urban basements to flood, and may in the future become a problem, if preventive measures are not taken. It also flooded in 1957. Mr. Earl Ainsworth, Hennepin County Commissioner, and other interested parties are attempting to create and stimulate interest in a Nine Mile Creek Watershed District to help with flood problems and related water difficulties. This is apparently still in the planning stage. Most of the flooding in urban areas seems to be caused by inadequate storm sewers, and is of the nuisance value type. Particularly in the suburbs, the existing storm sewer systems are not providing complete protection.

Minnehaha Creek, drainage outlet of Lake Minnetonka, flooded in 1957, causing stream bank erosion. However, flooding does not seem to be a major problem for Hennepin County.

Minnesota River low lands (flood plain) Considerable flooding in this area, largely an unoccupied area. (Dakota County)

Confluence of Minnesota and Mississippi - you'll need a map.
The Hennepin side of the Minnesota-Mississippi is bordered by high bluffs, hence doesn't have the flood problems of the other two counties.

Floods are caused by the peak flows of the Minnesota River combining with high flows of the Mississippi - usually in the spring as a result of melting winter snows, affected only to a minor extent by spring rains. The 1951 and 1952 floods were both results of these conditions. Peak flows causing damage have occurred in 1881, 1897, 1908, 1916, 1951, 1952. Data of the Corps of Engineers leads them to believe that a flood stage would probably be equaled or exceeded on the average of once in four years, and that the flow of the magnitude of the 1952 flood would probably be equaled or exceeded on an average of once in 80 years. Areas flooded follow:
Lilydale, (Dakota County) a small section, population 175 (1958), which could solve its own problem by local protective works or by evacuation of the flood plain. Local interested citizens of this area informed the Corps they would not evacuate the plain, so at present the flood control problem at Lilydale is still unsolved.
EXPLANATION: The Ramsey County-Dakota County boundary line is east-west along Annapolis St., with the exception of one small jog north; thus there is a small portion of St. Paul south of the Mississippi River which St. Paulites refer to as "west side". It is not WEST ST. PAUL, which is in Dakota County, as is So. St. Paul.

Continuing around the bulge (Ramsey County) is a low strip along the river. The flood plain of the St. Paul - So. St. Paul reach includes areas totaling approximately 5,400 acres, about evenly divided between occupied and unoccupied lands. The urban areas which are hardest hit by floods are St. Paul (directly across the river from downtown St. Paul), the upper levee section, St. Paul, and So. St. Paul, further east and south.

The St. Paul area is an old section of the city with block after block of deteriorating homes. By 1962, city officials and civic groups hope, the houses will be gone, the river chained, and a spanking new industrial district open for business. It is called the Riverview Redevelopment area, and is by far the largest in the city, with 186 acres of residences earmarked for clearing.

The Corps of Engineers already has received a $200,000 appropriation for preliminary planning of a St. Paul-So. St. Paul floodwall, which will protect the Riverview Area. A request for $163,000 to complete planning is in the current budget submitted to congress. "The floodwall will be ready for the 1962 spring flood season if funds continue to be allocated," said Col. Desloge Brown. He said the levee-floodwall pumping station system would keep the area safe from crests much higher than in 1952, the worst flood of a century.

Upper levee section, St. Paul: Damage has been done to this section, which is composed of numerous small residences, a steam power generating station, a bulk oil storage area, 2 grain elevators, and a paint manufacturing plant. Further down the river, on the same side, opposite the airport, is an area which is inundated or damaged by flooding. This area includes a large sand, gravel and concrete plant, the St. Paul Municipal Barge Terminal, railroad yards, and the Minneapolis-St. Paul Sanitary Sewage Treatment plant. Levee protection was considered by the Corps for the Twin City disposal plant, but costs were too great under the benefit-cost ratio. The sanitary district itself, is currently studying local protective measures for flood control.

Another St. Paul flood control project, aside from the Corps, is the construction of Shepard Road. A portion of this road from the vicinity of the Robert St. Bridge, upstream to the upper levee, is being constructed to an elevation about 2 feet above the 1952 flood level. This road when completed will extend to high ground beyond the upper levee and will give flood protection to the entire district enclosed. Interior drainage (sewer systems) facilities for this area are being planned and constructed by the city in connection with this road. The costs of Shepard Road, with interior drainage facilities, is estimated by the Street and Highway Engineering Coordinator, Mr. Shepard, to be approximately $3,000,000.

The flood protection projects at St. Paul proposed by the Corps will cost an estimated $3,779,500, of which $3,137,800 would be borne by the federal government and $741,700 by local interests. In addition, local interests would maintain and operate improvements at an estimated annual cost of $9,850. This will also correct a critical seepage problem.

The South St. Paul area includes stockyards, meatpacking plants, and the sewage disposal plant. Beside damage to those just mentioned, homes and other commercial property were damaged. The average annual loss here is approximately $143,650. The most serious problem at So. St. Paul is that of interior drainage, according to the Corps of Engineers. The Corps is presently working on improving the existing flood control works at So. St. Paul by raising and extending the flood barrier and providing for the installation and operation of expanded facilities for interior drainage. (This is included in the $200,000 appropriation mentioned before in connection with St. Paul.) An estimated federal first cost is $2,567,700. Local interest must provide all lands, easements and rights of way necessary for the

construction. They must also hold and save the U.S. free from damages due to construction works, maintain and operate improvements, make at own expense all necessary changes to utilities, highways and bridges, and make in cash or equivalent construction work, a contribution equal to 1.89% of the first costs of the flood project. At price levels quoted by the Corps in its report, this contribution would be $49,500. They would also have to meet the requirements and costs stated for the project at So. St. Paul consisting of cash contribution or construction equivalent of $525,200.

Farm areas in Dakota County experience some damage to crops every year or two, and considerable damage in five years. According to Mr. Frederic Tripp, Work Unit Conservationist, flooding of agricultural land in this county is caused by poor land use in the watershed, and the lack of good soil conservation practices on the farm. This results in rapid run-off of water and silting in streams below. Farmers are being encouraged to reduce run-off by use of contour strips and terraces. Mr. Tripp's office is also helping farmers with ditching and tiling. Internal water taken out of the soil by both of these practices is done over a long period of time, so that when heavy rains occur, the soil will absorb more water.

The confluence of the St. Croix and the Mississippi Rivers is at Prescott, Wisconsin Washington County, Minnesota, is bounded on the east side by the St. Croix, and partially on the west side by the Mississippi. Floods are not a major problem, and any flooding on either river is related to that of the other. Damage to farms is negligible to moderate. Control consists primarily of good soil conservation practices (prevention) and maintainance of existing flood prevention measures. Streamflow along the shore of the St. Croix is not extremely fast because of the backwater resulting from Red Wing Dam. The cities and towns of Stillwater, Afton, St. Mary's Point and Bayport are inconvenienced, according to Mr. Clifton Halsey, Soil Conservation agent. However, as the urban areas become more densely populated this "inconvenience" might well become a major problem.

Flood plain zoning must be instituted on the local level by local governing bodies. Such zoning requires that floodways and flood plains be clearly defined on maps, so that there can be no misunderstanding of the area subject to regulation. A flood plain zoning program has not been set up in any of the five counties studied or even in the entire state of Minnesota, except where park developments may be taking place, and even this zoning has been done on a minor scale.

However, as the state and particularly the Metropolitan Area grow, more consideration should be given to this plan for reducing flood damage. It would seem especially important to consider this plan as new subdivisions develop. Once work has started on such areas the problem becomes increasingly difficult as time goes on. In such newly developed areas flood plain zoning would appear most practicable. Suburbs in the Metropolitan Area are certainly growing as more people need homes and planners might well think of flood plain zoning to discourage developments before the vicious circle of "encroaching on the flood plain, instituting works to prevent flooding and then recommending often that people evacuate the flood plain." Often however, zoning areas so that residential developments are not on the flood plain results in encouraging industrial development. Flood damage to poorly located industries can have a more far reaching effect on communities' economy than damage to homes. It would appear that the most important consideration in flood plain zoning would be the protection of all community activities, business, industry, transportation, utilities and recreation.

Generally, in Minnesota, according to Col. Desloge Brown, Corps of Engineers, the necessary hydraulic and topographic information has not been available for setting up a program of flood plain zoning. As the interest in this kind of zoning grows and information becomes available, flood plain zoning will becmme more practicable for Minnesota, including the Metropolitan Area. The Colonel feels that flood plain zoning appears to be a very desirable means of preventing or reducing flood damage.

Upstream reservoirs. There is no provision in the Metropolitan Area at least, for upstream reservoirs in flood control. At.St. Paul-So. St. Paul, reservoir storage to insure any appreciable reduction in flood crest flows would not be conomically feasible. Industrial developments and growth of communities in potential reservoir sites has further reduced the likelihood of their development as flood storage basins.

3. Flood Control Functions:
CORPS of ENGINEERS: See preceding pages; other projects in the Metropolitan Area are a study of Rum River Basin (partly in Anoka Co.) flood problems, the completion of the Upper Harbor, Minneapolis; Minnesota River channel improvement and dredging--$2,900,000; planning funds are available.

SOIL CONSERVATION SERVICE: The emphasis here is on prevention of floods through use of proper land treatment measures. This program attempts to solve land and water problems peculiar to each farm or watershed. See the Coon Creek Watershed at the beginning of this Chapter. SCS Districts are organized on a County basis.

MINN. WATER RESOURCES BOARD: This Board has authority over the establishment of watershed districts under the Minn. Watershed District Act and has additional responsibilities in the administration of the act. Since a watershed district organization has the power to deal with ALL water problems - flood control, drainage, pollution, etc. this Board is involved in flood control along with related water problems.

DIVISION OF WATERS, Dept. of Conservation (Minn.) Provides engineering services for Water Resource Board, in the establishing of a Watershed District.

TWIN CITIES METROPOLITAN PLANNING COMMISSION: This agency was established by the 1957 legislature for the purpose of providing ADVISORY service for the area. Included in the Commission's stury for this year is the storm drainage and flood problem. This study, when completed, may assist further in the definition of the nature of the problem and suggest the kind of solutions that may be required. An agency such as this will probably investigate flood plain zoning in the Metropolitan Area and other related preventive measures to decrease damage due to flooding.

D IRRIGATION
(Source 35)

1. Federal irrigation projects are unknown in Minnesota, but there is some irrigation by private individuals using privately owned well systems. Truck farmers in the Twin City Metropolitan Area are the chief users of water for irrigation.

2. The Division of Waters of the Minnesota Department of Conservation issues permits for irrigation upon the receipt of an application from a farmer. "The farmer must indicate clearly the number of acres to be irrigated and the inches of water to be placed thereon. A map showing the wells or water source, and the lands to be irrigated must be included." This law is not well known to the general public so that a sizeable number of Minnesota farmers are apprently irrigating land without benefit of permit from the Conservation Department.

"According to the 1950 farm census, 274 individuals were irrigating 4,200 acres while the Division of Waters showed only about 1/3 as many permits being in effect during a similar period. Of the estimated 12,000 acres under irrigation today, about half is under permit."

4. Individuals granted permits are limited to six inches of water per year per acre. Permits define the maximum amount of water that can be used, but do not limit the number of wells necessary to supply this amount of water.

Right now the City of Minneapolis is engaged in a struggle over water rights for

"irrigation" with the golf club adjacent to Lake Calhoun. This club owned lakeshore property before the city established a road around the lake. When the city wished to build a road near the lake, the club ceded the city the land but retained their right to pump water from Lake Calhoun. At the present time the lake is so low the city is pumping water into it while the golf club pumps it out. The matter has not been settled, and state laws regarding irrigation are of no help, for they apply only to systems established after July 1, 1937.

5. A discussion of water rights will be included in the completed Upper Mississippi River Basin Study.

E POWER
(Source 36)

1,2,3. In the Twin City Metropolitan Area all power is supplied by Northern States Power Company. The company owns and operates both hydro and steam generating plants. Very little of the power is generated by the hydro plants because "though the state varies in altitude from 2,230 feet to 602 feet above sea level from maximum to minimum, there is no great fall in the rivers at any point. Also the stream flow of our rivers varies widely from maximum to minimum flow. These conditions are not conducive to cheap hydro generation."

Water is not divorced from the generation of electric power by steam. To quote a director of Northern States Power Company, "Steam plants require huge amounts of cooling water, by rule of thumb, 10 tons of cooling water for every ton of coal burned. This water is not actually consumed but is simply pumped from the river through the condensers and back into the river. However, this determines why you will always find plants like Black Dog, Riverside, High Bridge, etc. located where there is a good water supply. As an example, our High Bridge plant in St. Paul uses an average of 260 million gallons of water every 24 hours. This is over 5 times as much as the entire City of St. Paul requires in 24 hours.

"Other considerations in locating a steam plant are proximity to electrical load center, barge coal and natural gas availability, and cost of delivered fuel at a particular location."

The cities apparently have an ample supply of electrical power from privately owned companies, and no plans are being made by the government to develop any multi-purpose dams on the Mississippi that will affect the Metropolitan Area.

4. The cost of power to consumers in the area is regulated by the Federal Power Commission.

F NAVIGATION in METRO. AREA
(Sources 37,38)

1. A. Mississippi River - 42 miles. Minnesota River - 26 miles. St. Croix River - 28 miles.
   B. Mississippi River - 42 miles. Minnesota River - 13 miles. St. Croix River - 13 miles.
   C. Mississippi River (Washington Avenue Bridge to Hastings, Minn. Lock and Dam #2) 9 foot depth.
   Minnesota River (Mouth to Savage, Minn.) 9 foot depth.
   (Savage, Minn. to Shakopee, Minn.) 4 foot depth.
   St. Croix River (Mouth to Stillwater, Minn.) 9 foot depth.
   (Stillwater, Minn. to Taylors Falls, Wis) 3 foot depth.

   D. River transportation is low cost transportation. Steel products shipped by river in comparison with rail rates, including the river terminal charges and final delivery show a saving of $7.50 to $10.00 per ton. Low-cost coal

means lower-priced electricity, which benefits not only every industry along the river, but every merchant,, every small business, every householder.

E. NO

2.A. Gasoline and other petroleum products, coal and fuel oil, grain, sand and gravel, steel products, scrap iron and steel, oyster shells, salt, superphosphate, binder twine, sisal, molasses, flour, coal-tar.

Barge traffic in the Upper Mississippi river area rose to record levels in 1958; receipts and shipments at Minneapolis totaled 839,678 tons, compared with 773,105 tons in 1957. St. Paul's total was 3,120,095 tons, up from 2,383,883 the previous year.

3.A. Mississippi River and Tributaries - All ports - 1958 - 6,975,147 tons
B. 1935 - 188,613 1957 - 5,837,578 1958 - 6,975,147
C. 1958 - Inbound - 4,356,974 1958 - Outbound - 1,480,604
(Tonnage increased 320% between years 1935 to 1957)

4.A. Not adequate for ocean going vessels, suitable for barge traffic. The Upper River Harbor Project was begun in 1948 by the federal government and was expected to be completed by 1960. The project provides for construction of locks and dams in the Mississippi river at St. Anthony Falls and a 9-foot channel to the Soo Line bridge near Camden, together with alterations to existing bridges and utilities. The purpose of the project is to make it possible for barge traffic to reach dock and warehouse facilities located above the falls. At present Minneapolis has only a small area, below the falls, suitable for docks (River Terminal).

Congress has given approval for completion of the lower lock in 1956, but an additional request will have to be made for the upper lock. The present estimate of total cost is $33 million, of which the city furnishes over $3 million. The City's part in the upper harbor development consists of buying the necessary land and also raising bridges and changing utilities. Beginning with the year 1942, $300,000 has been set aside annually from the Permanent Improvement Fund for this purpose.

1958 saw the virtual completion of the lower lock and dam; there was an appropriation made of $1,100,000 to start the second big construction phase in 1959. The upper lock will provide a lift of about 49', enabling barge traffic to proceed 4.6 miles upstream. There have been no specific plans made as yet for enlargement of terminal facilities or for a small boat harbor. It is expected to be completed in 1963.

Minnesota River planned extension and full improvement of 9 foot depth channel to include 26 miles from mouth.

Small boats for recreational use and excursion trade - Mississippi River excursion trade from Washington Avenue Bridge at Minneapolis, Minn. to St. Paul and to Hastings Lock #2. Small boat harbor at Harriet Island.

Minnesota River from Savage to Shakopee is maintained for pleasure craft.

St. Croix River from Stillwater to Taylors Falls is maintained for pleasure craft and excursion trade.

"Recreational boating is increasing by leaps and bounds; in 1953 there were 7,000 small boats, in 1957, 28,000; 4 times as many in 4 years."Col. Brown.

5. A. Mississippi River - St. Paul Harbor, Minnesota 1949 - $229,800 Federal
$41,200 Local Interest.
Minneapolis Harbor - 1932 - $192,841 Federal
St. Anthony Falls Extension - expected to be $33,000,000
Hastings Harbor - $77,000 Federal - Non-Federal, $9,000

Minnesota River — Total cost to June 30, 1956 - $240,985, which includes $139,671 contributed by local interests for dredging 9 foot depth and $88,584 for maintainance.

St. Croix River — Cost of Small Boat harbor at Hudson, Wis. $116,000.- Federal and $12,000-local

B. Some of them.

C. Commercial traffic increased each year at a lower cost to every one. New industries have moved into the district, providing more jobs and therefore wages: they stimulate housing and trade, and through this the economy of the community is greatly stimulated. Greatly increased use of rivers for recreational boating.

6. All Agencies. Department of Business Development, Department of Conservation, Corps of Engineers, U. S. Army, Port Authority of St. Paul, Minnesota Water Resources Board.

G WATERSHED MANAGEMENT
(Sources 12,40,41)

1. The five counties with which we are here concerned are drained by the Mississippi River primarily, by the Minnesota where it enters the main stem, and to a lesser extent by the St. Croix. Smaller tributaries, the Crow, Rum, and Vermillion Rivers, plus Minnehaha, Bassett, Shingle, Coon, Rice and Nine-Mile Creeks form sub-watersheds. Lake Minnetonka is drained by Minnehaha Creek into the Mississippi. Small watersheds within the metropolitan area fall into two classes: (1) agricultural, of which Coon Creek, Anoka Co., is an example. (See Ch. II, C.) (2) urban, Minnetonka and Nine-Mile Creek are examples. These three are the only watersheds in the Metropolitan area which have petitioned for a district. One other, the lower Minnesota area, was improperly organized and declared invalid; the proponents are planning reorganization under the amended Act of 1957.

2. The principal problems of the Metropolitan Area are flood control, pollution abatement, municipal water supply, navigation and recreation. Soil and bank erosion, gullying, drainage and wild life, (The greatest overall problem is land use. (MPC report), need attention.

3. Farms under soil and water conservation practices:

Hennepin	Anoka	Ramsey	Washington	Dakota
493	1142	20	2060	518

These soil conservation practices need to be established or improved:

1. Tree planting
2. Improved crop rotations
3. Strip cropping
4. Contour plowing
5. Terracing
6. Diversions
7. Waterway development
8. Drainage

The number of farm ponds in this area is negligible, since this is not generally

one of the indicated solutions to the particular problems here.

Idle or marginal acres planted to trees and wildlife protection:

	Hennepin	Ramsey	Anoka	Washington	Dakota
Trees	190	2007	994	2397	figures not avail.
Wild-life	520	no breakdown	2760	4077	" " "

There are very few tree farms in this area, and at this time we have not been able to obtain the statistics as to the acreage of woodland with improved management plans.

4. The following agencies are concerned to varying degrees:

Soil Conservation Service	Water Resources Board
Forest Service	Division of Waters
Agricultural Extension Service	Division of Game & Fish
County Agent	

Local Soil Conservation Districts are most concerned with problems at hand.

Lake Minnetonka Area, is an example of an urban area as a Watershed District; it contains comparatively little agricultural land. Fifteen municipalities touch on Lake Minnetonka, and a total of 23 municipalities would be wholly or partly included in the watershed district.

The biggest problem of this watershed at the present time is that of lake pollution by untreated sewage. There are, of course, secondary problems of erosion, flood control, lake level control, recreation, drainage, and fish and wildlife. The Minnesota Watershed District Act has not, up to this time, been used in this type of situation as a pollution control measure, and the matter is very controversial among residents of the area. Many people feel that this is not the proper organization to solve these problems in this case.

The petition that has been sent to the State Water Resources Board is to be acted upon by them only if and when the legislature amends the Watershed District Act to give a measure of local control in choosing the Board of Managers, rather than having them chosen by the County Commissioners, four-fifths of whom are elected from metropolitan Minneapolis.

H RECREATION

(Sources 42 thru 52)
(See also pp.24 and map opposite TCMPC report)

1 and 2.

. The St. Paul Park System is a comprehensive and intensively developed park system consisting of 51 neighborhood playgrounds with a total of 257.59 acres; 68 smaller park areas with a total of 55.29 acres; 16 parkways and boulevards covering 36.14 miles; 12 major parks with a total of 1,569.93 acres. (For the sake of brevity we will list only the more unusual attractions, and those concerned with water.)

NAME & SIZE	SPECIFIC RECREATIONAL FEATURES	ACQUIRED
Battle Creek, (65.31 A)	Natural woodland, historical site, winter skiing. NOTE: Possibility, through cooperation with Ramsey Co. Park System, of this being extended into rural Ramsey by 240 A.)	1922
Cherokee Heights(67.63 A)	Overlooks Mississippi R. and Minnesota Valley, affords magnificent view of city	1903
Como Park (448.40 A)	Zoo (free). Greenhouse. "Gates Ajar" (floral display). Paddle boats and bicycles for hire. Bird Sanctuary	1873
Harriet Island (41A)	Small boat ramp located on Mississippi River, affords scenic view	1929
Highland Park (316 A)	Swimming pool, usual park facilities	1925
Mounds Park (79.02 A)	Authentic Indian Burial Mounds	1892
Phalen Park (493.5 A)	Bathing beach, canoes, boats (for hire) usual park facilities	1894

Other St. Paul Parks with usual park facilities are: Langford Park, Linwood Park, Newell Park, Rice Park, Smith Park, Hidden Falls Park. There are some city playgrounds that can be more fully developed. Plans are being made to obtain the necessary funds through assessing citizens in the immediate area. The St. Paul Park System would like to acquire the Crosby Farm located from Lexington Avenue south to Mississippi River as a potential city or county recreation area.

The Minneapolis Park System is one of the most ideal in the United States. It has grown steadily over more than a half century. Today it comprises 55 neighborhood parks, playgrounds and athletic fields totaling 729.25 acres; 63 smaller park areas totaling 25.13 acres; 11 parkways and boulevards covering 864.56 acres; 3 creeks, (Bassett's - 3.2 miles -- Minnehaha - 7.7 miles -- Shingle - 2.3 miles) and 15 major parks, lakes and recreation areas total 3,508.56 acres.

NAME & SIZE	SPECIFIC RECREATIONAL FACILITIES	ACQUIRED
Calhoun Lake Park (534.17A)	Fishing, swimming, boats, aquatennial events	1883
Lake Harriet (402.07 A)	fishing, wilderness areas, sail boats, several swimming beaches, band concerts	1898
Lake of the Isles (199.68A)	boats, canoes, fishing, hockey rink	1886
Lake Nokomis*(407.68 A)	fishing, several swimming beaches, boats	1907
Lyndale Park (61.26 A)	bird sanctuary, municipal rose gardens	1891
Minnehaha St. Park(144.55A)	bird sanctuary, skiing, Minnehaha Falls	1889
Theodore Wirth Pk.**(739.A)	bird sanctuary,wild flower garden, skiing, swimming, scene of Aquatennial events	1890

* It appears that part of this Park may be taken for the proposed InterState Highway.
**Expect to improve beach and ski areas.

Other Minneapolis Parks with usual park facilities are: Bassett Creek Valley, Columbia Park, Diamond Lake Park, Francis A. Gross Golf Course, Hiawatha Park, Meadowbrook Golf Course, North Mississippi Park, Pearl Lake, Shingle Creek Valley.

Minneapolis has what is considered to be the ideal amount of park land - an average of 10 acres of park land for every one thousand inhabitants.

Municipal park areas in Metropolitan district other than St. Paul and Minneapolis.

COUNTY	INCORPORATED COMMUNITY	POPULATION 1958	ACREAGE OF PK.LAND '55	PARKS 1955	ACREAGE OF PK.LAND '58	PARKS 1958
Anoka	Col. Heights	14,000	60	6		
Dakota	So. St. Paul	21,000	80	10		
Hennepin	Hopkins	10,000			29.1	7
	Robbinsdale	16,000			16.5	7
	St. Louis Park	40,000			129.0	28
	Wayzata	2,800			5.0	3
	Bloomington	41,000			204.9	22
	Champlin	1,100			5.0	3
	Crystal	19,500			38.8	9
	Deephaven	2,500			8.0	9
	Edina	24,000			578.7	22
	Golden Valley	12,400			48.1	11
	Long Lake	800			6.0	2
	Loretto	200			5.0	1
	Morningside	2,000			5.5	1
	Mound	2,800			1.0	1
	New Hope	2,400			3.0	4
	Osseo	1,700			5.0	1
Ramsey	New Brighton	4,800	2.0	1		
	No. St. Paul	7,000	17.0	6		
Washington	Bayport	3,000	30.0	4		

South St. Paul has a good community bathing beach, Edina has a municipal swimming pool and St. Louis Park has a swimming pool in the Senior High School that is open to the community.

The Ramsey County Park System:

NAME	FEATURES	ACREAGE
Island Lake Park	Baseball park	63.
Schmidt Park (on La[illegible]ohanna)	boats, (fishing) swimming	34.79
Wakefield Lake	swimming	18.
Ramsey County Beach [illegible]cCarrons)	boats (fishing) swimming	11.20
Breezy Point (Lake Owasso)	boats (fishing) swimming	6.36

Others in the Ramsey County Park System are Beaver Lake, Joy Park (on Silver Lake), Keller, (Gervais) Phalen Chain of Lakes, Snail Lake, Keller Golf Course, Golf Course #2, Ramsey County Fair Grounds.

The Ramsey County Park Commissioner is planning to purchase at the least 22 acres on the east shore of Lake Josephine for use as a bathing beach. (See note on Battle Creek, St. Paul System)

The Hennepin County Park Reserve District was established in 1958; in compliance with the law, a written plan was developed and approved. Many assets for an excellent park district exist: several important creek valleys, numerous lakes, woodlands, swamplands and three circumferential rivers -- the Crow, the Mississippi and the Minnesota. The plan calls for acquisition of areas in which lakes and streams and combinations of large woodlands, meadows and interesting topography are found. Some areas which have immediate usefullness and areas which are especially adapted to reforestration and reclamation are to be given priority in the acquisition plans. The

district hopes to set aside ten acres of recreation land for each 1000 population, also another ten acres in the form of large forest areas, state parks or game preserves for every 1000 inhabitants.

A projection to the year 2000 found that Hennepin County will have a population of from 1,000,000 to 1,250,000 and the goal should be 10-12 thousand acres. This goal assumes that each of the incorporated villages, towns, and cities in the county will provide for themselves an almost equal amount of acreage for their own local recreation needs.

A brief summary: "The general shape of the proposed Hennepin County Park System is one of preserving stream valleys, the acquisition of certain lake shores and woodland areas in three general regions: Elm Creek, Nine-Mile and Purgatory Creeks, and Lake Independence regions, with some lesser holdings along the rivers and at Lake Minnetonka, all without a connecting parkway system."

Maple Hill County Park at Lake Independence has been under the supervision of the Minneapolis Park Board since 1956 when the land and funds for its operation were donated by the Baker Foundation. It has now been turned over to the Hennepin County Park Reserve District. The park, now in its third year of operation consists of approximately 200 acres of lake shore, forested lands and other park facilities. It has been used for day camping, overnight camping, picnicking, swimming and boating. It has proved to be too small to accommodate all who wish to use it, and it has been suggested that it be enlarged by 1000 acres.

OTHER METROPOLITAN COUNTIES - In response to inquiries, a Dakota County representative wrote to say that they have no park system set up; he did appear concerned about it and suggested that they had many areas which could be developed for park purposes. He mentioned the Vermillion River, Chub Creek, the Byllesby reservoir of the Cannon River. Neither, as far as we can gather, has Anoka County set up a park system. We have not heard regarding Washington County.

3. Lakes used as reservoirs in the St. Paul Water system are the only occurence of this type of reservoir in the Metropolitan Area. An outstanding feature of this system beyond its utility and main purpose of supplying water is the beauty and recreation it offers. No water recreation but shore fishing is allowed. The Water Department has been aided and advised by the State University and has planted over 600,000 trees for the beautification and protection of the many thousands of acres in the watershed. Visitors have been provided a scenic drive, and two beautiful parks.

A bird feeding program during the winter months was established as an experiment in insect pest control to protect the trees. Since this was inaugurated, the winter bird population has increased 10 times and consumes large quantities of insect eggs. (3/4 of their diet consists of insect pests and their eggs - something to remember as we evaluate the effects of the Mosquito Abatement program). Ground feeding birds eat large quantities of weed seeds. The summer bird population has not been greatly increased by this program.

4. William O'Brien State Park: there are no national forests or parks in the St. Paul-Minneapolis Metropolitan Area, and only one state park in the area. It is located two miles north of Marine-on-the-St. Croix in Washington County. The park area of 180 acres of beautifully wooded rolling countryside has nearly a mile of frontage on the St. Croix River. The area is reminiscent of the early logging days on the St. Croix River and was given its name in memory of an early lumberman by his daughter who donated it to the state in 1945. Under the terms of the gift the area can be used only as a state park.

It is ideal for hiking, has picnic grounds and access to stream fishing and canoeing. Within the last biennium the Minnesota Division of State Parks has put in

$35,000 worth of capital improvements consisting of a road, a residence and toilets. There are plans under way for a camp ground sanitation building. The park has a year-round caretaker whose salary is $3600. During the summer months an additional crew is needed for maintainance at the cost of approximately $3600. During the year of 1957 there were 28,357 visitors to the park; in 1958, there were 44,661 visitors.

Other state parks in this area are needed.

5. U.S. Fish and Wildlife Service is active in the Metropolitan Area, and recently were called in on a consultation basis on a proposed drainage ditch in the Coon Creek Watershed in Anoka County. (See Ch. II,C)

Their advice was: (1) Complete protection of Carlos Avery Game Refuge and Public Hunting Grounds and its chief water source, Coon Lake. (2) Complete protection of Meandered Lake within the watershed. (3) Preservation of the desired percentage of natural habitat for upland game (pheasants, grouse) and big game (deer, etc.) (4) Preservation of a number of existing water areas for water fowl and aquatic fur bearers. Apparently their advice will be followed.

If complete drainage of the Coon Creek Watershed had been carried out 19,000 acres of wildlife habitat in the watershed would have been ruined and the wetlands within the Carlos Avery Game Refuge which is contiguous to this watershed, would have been adversely affected.

The U.S. Fish nd Wildlife Service has and does work on projects with the U.S. Corps of Engineers in the levee projects for flood control near St. Paul. However, the affected habitat in that area is negligible.

Division of Forestry, Minnesota Department of Conservation, Upon request of private woodland owners, this state agency provides advice on management and tree planting. Private woodland areas in southern and western Hennepin County and in Washington County have been enhanced in this way. They have recently set up a fire protection project with a tower within the 9,000 acres of forest land in the Coon Creek Watershed. Future plans for this particular water shed are being worked out cooperatively with the Soil Conservation Service of the U. S. Department of Agriculture, the Fish and Game Division of the Minnesota Department of Conservation and the Division of Forestry.

Bureau of Game, Division of Game and Fish (Minnesota Department of Conservation.) The Bureau of Game is at present engaged in a program to save Minnesota wetlands. This is an attempt to preserve the natural habitat of waterfowl, upland game, and aquatic furbearers. The monies for the 'Save Minnesota Wetlands' program are derived from: (1) Voluntary contributions of private citizens. To date $17,500 has been raised this way. (2) A surcharge of one dollar on Minnesota hunting licenses. (3) Pittman-Robertson Funds, federal aid funds obtained from federal excise taxes on hunting equipment and ammunition. The program has spent $582,000 on acquisition of wetlands. 90% of these lands are under active management of the wetlands program to preserve and to rehabilitate habitat.

In Anoka County the Bureau of Game has established and manages the Carlos Avery Game Refuge and Public Hunting Grounds. Within the game refuge all phases of game management are practiced --- habitat development, water level manipulation, rough fish control, fencing, supervision of controlled grazing, game propagation and planting, acquisition and leasing of land for public hunting, feeding of game, scientific control of individual predators, fire control. Note:that cooperation with the State Division of Lands and Minerals, State Division of Waters, State Division of Forestry, Bureau of Fisheries, U.S. Soil Conservation Service and Districts, U.S. Fish and Wildlife Service, U.S. Department of Agriculture, U.S.

Forest Service, the Corps of Engineers of the U.S. Army, the Minnesota Department of Health, Minnesota Water Pollution Control Board, Minnesota Water Resources Board, the University of Minnesota, other educational institutions, and conservation agencies of other states and Canadian provinces is required in carrying out this program of wild life management.

The 'Save Minnesota Wetlands' program has worked in cooperation with the U.S. Corps of Engineers in some of their projects involving Mississippi River navigation and flood control. The program has also worked cooperatively with the U.S. Fish and Wildlife Service.

There is conflict between this program and a state statute permitting the digging of county and judicial ditches. A county ditch is a drainage ditch within one county which is dug at the request of landowners and with the consent of the county officials to drain adjacent farmland. A judicial ditch is a drainage ditch which extends into two or more counties.

The Soil Conservation Service of the U. S. Department of Agriculture cooperates with the local land owners in the planning and in the financing of these drainage ditches. In the past the Minnesota wetlands program of the Bureau of Game has been assessed for "benefits" of one or more of these ditch projects, which are really harmful to their interests. (More on conflicts in Chapter IV).

Bureau of Fisheries, Division of Game and Fish, (Minnesota Department of Conservation). This Bureau has the following general program throughout the state, including the Metropolitan Area: (1) Stocking of lakes; (here they provide information for the Minnesota Department of Health, Water Pollution Control Board in regard to the condition of water, in those lakes) (2) Lake population surveys; (3) Rough fish control (a program of removal of excessive carp, buffalo and bullheads. This encourages multiplication of more desirable species); (4) Acquisition of bog areas adjacent to lakes, which are used as spawning places for pike (They are flooded and drained under the direction of the Bureau); (5) Rescue of fish from lakes that have become too shallow to support them; routine oxygen tests are carried out by the Bureau (Another means of reducing population in inadequate lakes is allowing promiscuous fishing when conditions indicate this); (6) Lake reclamation projects (this involves removing all fish from a lake and restocking with healthy and more desirable species of fish. Such a lake reclamation project has been carried out recently at Ham Lake in Anoka County).

Minnesota law requires that there be public access to all lakes which the Bureau of Fisheries stock, improves, or manages. This problem of access is becoming increasingly acute. The Division of Game and Fish is seeking to acquire public accesses as fast as possible, and has brought 56 areas under its management during the past biennium; additional funds are needed to meet this.

At the present time the Bureau of Fisheries is working in cooperation with the Minneapolis Park Board on plans to pump water into the bird sanctuary adjacent to Lake Harriet for use of spawning pike. Their District #1 Headquarters is located at Indian Mounds in St. Paul. At present headquarters is doing experimental work with lake trout.

I. MULTIPLE - PURPOSE PROJECTS
(See Ch. III, Section C, for only one in state.)

CHAPTER III

ADMINISTRATIVE ORGANIZATION IN METROPOLITAN AREA

A LOCAL
(Sources 11,14,40,55,56)

Municipal water supply systems - 34 at present and 2 more projected.
Local water supply - 1 system in Maplewood, privately owned.
Utilities commissions independent of city or village council - 2
Industrial water supply systems - 407 in Minneapolis, 513 in St. Paul - for which permits are issued by the City Engineer, These systems are used by downtown stores, hotels, theatres, etc., principally for air conditioning.
64% of population of metropolitan area is served by the Minneapolis and St. Paul water systems.
20% by individual wells.
16% by other community water systems, generally deep wells.
Conservancy districts and Judicial Drainage districts.
City health departments or health officers - 8
County health officer - 1
Township or village without health ordinances - 4
County without health ordinances - 1
Townships or villages with health ordinances - 12
There are 4 soil conservation districts in this area, and 3 watershed districts have petitioned the Water Resources Board for establishment. 3 Water Users Associations in this area.

Other agencies engaged in various aspects of water administration:
Greater Minnetonka Council
League of Minnetonka Municipalities
Minneapolis River Terminal
Minneapolis - St. Paul Sanitary District
Bridge Division - Minneapolis Engineering Dept.
Bridge Division - County Engineering Dept.
Port Authority, St. Paul

The Twin City Metropolitan Planning Commission research and advisory body, not administrative.

B STATE
(Sources 15,24,37,40,41,53,54)

1. Department of Conservation:
a. Division of Waters - General administration over public waters; cooperation with federal agencies in survey programs; issuance of permits for water use; checking hydraulic features of plans for public drainage systems; providing engineering services for the Department, and the Water Resources Board.
b. Division of Game & Fish - Duties given in Chapter II - H
c. Division of Forestry - Duties given in Chapter II - H

Department of Health - Provides engineering and staff services for Water Pollution Control Commission; Section of Environmental Sanitation, Section of Education

Water Resources Board - Determines and applies a state water policy in certain legal proceedings, and upon petition establishes watershed districts for conservation purposes.

2. Water Pollution Control Commission - Responsible for the control of pollution in streams and lakes.

State Soil Conservation Committee - Promotes soil and water conservation activities and drainage projects, acting through Soil Conservation Districts, formed on a county basis.

Upper Mississippi & St. Croix Rivers Improvement Commission - Promotes development of navigation.

Governmental Subdivisions - District Courts, Boards of County Commissioners, Township Boards, Drainage and Conservancy Districts, Soil Conservation Districts, and Municipalities with related but not coordinated powers in matters of drainage, flood control and water use.

Interstate Commissions such as Great Lakes-St. Lawrence Tidewater Project, Iron Range Resources and Rehabilitation, South Dakota-Minnesota Boundary Waters and Tri-State Waters Commissions, International Joint Commission with Canada, all may have economic effect in the Metropolitan Area but are not directly connected with the administrative organization of this area.

3. There are 14 state agencies concerned with water resources, plus the governmental subdivisions listed above. Theoretically, administrative responsibility for water programs rests with the Division of Waters under the Dept. of Conservation, and the Water Resources Board. However to quote from the 1955 Report of the Legislative Commission of Water Conservation, Drainage and Flood Control: "Minnesota has many water problems and obviously too many agencies dealing with them. It is apparent that there is at present no adequate state authority to coordinate governmental effort in matters of water and no clear cut policy for dealing with these problems at any level....There is need for greater cooperation between the state and its subdivisions in order to find solutions for water problems that are recurring with increasing frequency."

C FEDERAL
(Sources 37,40,53,58)

Since we are dealing in this report with the Metropolitan Area, questions 1-4 are not applicable. A very small area in the southwest corner of Minnesota lies within the Missouri Basin which gives Minnesota representation on the Missouri River States Committee. Other interstate commissions are listed in III-B.

There is one multipurpose river development in the northern part of the state which affects this area; the Headwater Reservoirs project completed in 1937 to augment flows in the Mississippi River for navigation purposes. The reservoirs are at Lake Winnebigoshish, Leech Lake, Pokegama, Sandy Lake, Gull Lake and Pine River, on the Mississippi River or tributaries. Although authorized primarily for navigation, the reservoirs are operated (by the Corps of Engineers).... to reduce flood stages in the vicinity of Aitkin, and the regulated outflow from the reservoirs contributes materially to water supply, pollution abatement and industrial development from Grand Rapids to the Twin Cities.

Soil Conservation Service (SCS under Dept. of Agriculture)
This agency has an office in each of our counties, with the exception of Ramsey, and is staffed with trained technicians for the purpose of giving local farmers technical services. They cooperate with other agencies, as shown in Chapter II C and H.

Agricultural Conservation Program Service (ACPS, under Dept. of Agriculture)
This agency administers the Agricultural Conservation Program (ACP) nationally for the Secretary of Agriculture. Its purpose is to encourage farmers to invest in doing now the conservation work that is in the public interest by sharing with them the costs of carrying out selected measures for the conservation of soil and water resources.

The ACP is administered at the state level by a group composed of the State Agricultural Stabilization and Conservation Committee (ASC), the SCS State Conservation Committee, and the Forest Service representative. This group allocates funds among the counties, helps County Committees (composed of the county ASC Committee, SCS technician and the FS representative) to fulfill their ACP duties, and reviews ACP actions at the county level. The State Committee reports to the ACPS and, in turn, passes back to the County Committees the national program policies. It also has certain specific duties in the operation of the program.

Farmers Home Administration (under Dept. of Agriculture)
This agency makes loans for soil and water conservation on farm lands by establishment of improved permanent pasture, reforestation or other erosion preventatives, as well as technical advice and assistance to borrowers relative to conservation of water resources.

Weather Bureau (under Dept. of Commerce)
This is a research, data collecting and analysis agency; it forecasts river stages and issues flood warnings, and is an important service.

Public Health Service (under Dept. of Health Education and Welfare)
This agency aids water pollution control and prevention programs. Under Pollution Act 660 (Federal cost sharing) it inspects sewage treatment plant projects that have been certified by the State Pollution Control Agency as having priority. Research on new methods of controlling pollution is another important service.

Fish and Wildlife Service (under Dept. of Interior)
Investigates the probable effects on fish and wildlife of dams and other water control structures, and makes the data available to interested agencies. It also submits recommendations for modification of construction and operational plans in order to prevent damage to or enhance fish and wildlife resources, and does considerable research. In 1955 they published a study on Minnesota as to the Permanent Water Significant to Wildlife. This was done on a County basis so covered our Metropolitan Area.

Geological Survey (under Dept. of Interior)
This is a basic research, advisory, and data collection agency. (Ch. II A) At the present time it is involved in a ground water investigation in Hennepin County, a study of the stages and discharges of Lake Minnetonka, as well as remapping Minnetonka and other quadrangles in the six county area. These are topographic maps. It also maintains gauging stations on the Minnesota River at Carver and on the Mississippi at Anoka and St. Paul.

Corps of Engineers (U.S. Army, Dept. of Defense)
This agency has general responsibility for flood control, navigation, improvement of rivers and harbors. See Ch. II, Sections C & F and Ch. III, Section C.
They have surveys underway covering the Mississippi as to the following: Pigs Eye Lake Harbor-advisability of improvement for commercial harbor; government responsibility, if any, for the maintenance and preservation of St. Anthony Falls; advisability of deepening channel to 12 feet, advisability of additional commercial and recreational harbors. They also made a survey considering the feasibility of improvement of channels in Lake Minnetonka for navigation, but came out with an unfavorable report.

Federal Home and Housing Agency signed a contract with the St. Paul Housing and Redevelopment Authority in July 1958 for a $600,000 temporary loan and capital grant to raze houses and fill land above the flood level along the Mississippi which would then be resold to industry (Riverview project, Ch. II C).

United States Atomic Energy Commission and Rural Electrification Administration gave financial aid to the Rural Cooperative Power Administration for the establishment of the Elk River Atomic Power Plant. (They broke ground in August 1958).

Federal Housing and Home Finance has a request from Golden Valley for $23,000 for conducting a water survey. (August)

Bureau of Public Roads has been working with the Hennepin County Park Board on the Great River Road along the Mississippi. This would be financed on a matching federal and state fund.

D FEDERAL-STATE-LOCAL RELATIONSHIPS
(Sources 24,41)

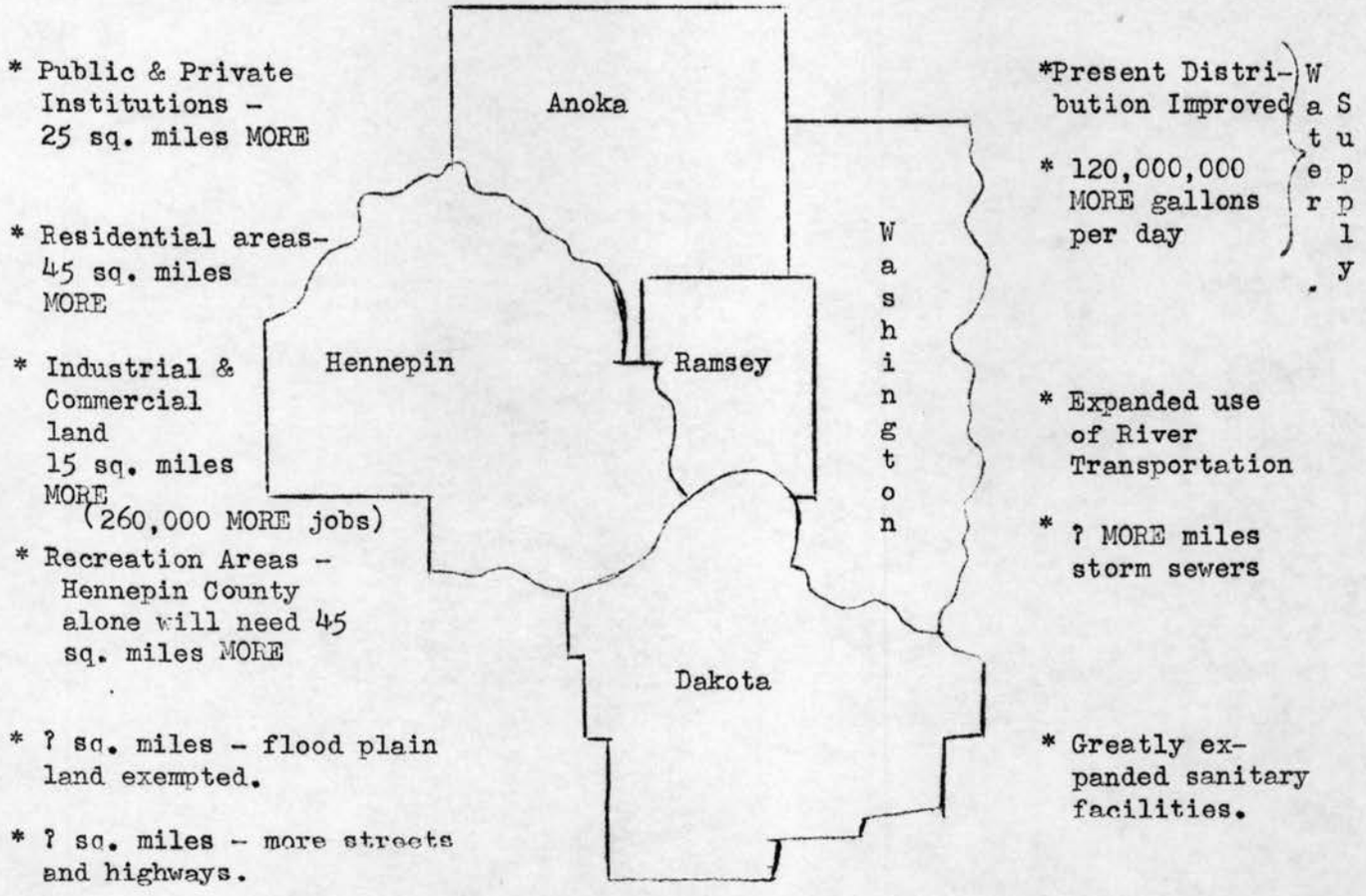
1. a & b. Agencies in their separate fields, operate conscientiously and effectively. Their relationships are good insofar as possible considering the diversity of state and federal policies which are sometimes diametrically opposed in their programs and objectives. Mr. Daley, chairman of the Water Resources Board says, "At all levels there are always found dedicated interests; agencies who will, and must, front for their own cause - for the purposes for which they exist." Agencies on all three levels go out of their way to cooperate with local groups; pressure groups naturally tend to push their own interests.
c. Yes, for the most part, but legislation to strengthen the Water Resources Board could make it a more effective policy-making and coordination agency.
d. No.
e. The Division of Waters is now working on a survey of the 39 watersheds of the state which will assist in overall planning. Assembling this data will be of great value to other agencies, both state and federal, in supplying information for coordinating their projects. The Twin Cities Metropolitan Area Planning Commission with its factual survey of present conditions and forecast of future needs, if heeded, can be a potent influence for orderly growth.

Other new developments that could be helpful lie in the field of constructive legislation. (See Ch. VI)

* *

By 1975 this Area will have:

SAME AMOUNT OF LAND AND WATER - 600,000 MORE PEOPLE



CHAPTER IV

MAJOR CONFLICTS AMONG USES
(Sources 8,15,38,64,Letters)

"Our primary conflicts do not concern consumption of water. Conflicts concern management of our water." Virgil C. Herrick, Executive Secretary of the Minnesota Water Resources Board.

1 and 4. Colonel Desloge Brown, U.S. Corps of Engineers writes: "Since the problems of the Twin City area are involved with water control measures upstream, it is difficult to separate problems affecting the Twin City area from those pertaining to the larger area."

Referring to the Mississippi River headwaters reservoirs, Colonel Brown continues: "These six reservoirs were built to store water to increase the low water flows on the Upper Mississippi River for navigation purposes. Since completion of the locks and dams on the Upper Mississippi in 1939, their importance for this purpose has decreased; however, they are still maintained and operated with funds allotted for navigation. The second purpose to which they can contribute and which is likewise a primary responsibility of the Federal Government through the Corps of Engineers is flood control. Since their importance for flood control diminishes quite rapidly in the Twin City area, you may not be concerned with it.

"The third function to be considered in their operation is one which could be quite important in the Twin City area, domestic water supply. A fourth factor involved in their regulation is the provision of the optimum habitat for fish, game and migratory waterfowl. This particular consideration can be quite complex, involving both reservoir levels and downstream flow conditions. Another factor is the desire for stable levels in the reservoir lakes themselves during the recreation season (about 15th May to 15th September) because of their increasing importance as recreation areas. As you can readily appreciate the maintenance of a stable level tends to run contrary to most of the other consideratinns. A factor allied to the fish and game aspect is wild rice culture. The value of this crop is an element in the economy of the area. Another factor and one which has been of concern in the Twin City area is augmentation of low flows for pollution abatement. Perhaps a final factor is the power which is generated from the water as it goes downstream in a number of hydro power plants which have no appreciable storage but which utilize the "run of the river flow".

"After considering the primary responsibilities of the Corps of Engineers for navigation and flood control and the almost pre-emptive use for domestic water supply, we attempt to work out a compromise between the demands of the other interests. As you can readily appriciate, it is impossible to satisfy everyone."

Comment: Tax losses and irrigatinn will be touched on later.
Another quote from Mr. Virgil Herrick: "Land owners in the lower part of the watershed are often damaged by improperly designed and maintained drainage systems in the upper part of the watershed. There has been and will probably continue to be a serious disagreement over drainage and disposal of surface waters. Certainly one of our most serious problems is the extent to which our waters should be used to remove pollution materials."

In his reply to our questions, Dr. Donald P. Duncan, School of Forestry, U of M points out (a recent development) that foresters have been assigned by the Minnesota Conservation Department to the active watershed areas in the state. Also in his department, two courses dealing with forestry in relation to watershed management are given. He speaks of the conflict of interest between the resort areas and the

need for a stable downstream flow (given in detail above). Another aspect of the problem is quoted: "A conflict between the upstream and downstream interests might be posed as the conflict between a desire for providing maximum immediate financial return on the part of the upstream land owners (even to the detriment of the land) and the need further downstream for pure water with as even a flow as possible during the season. In some cases immediate financial return to the upstream land owner needs to be sacrificed in the interests of subsequent owners of the land as well as in the interest of water users downstream. It appears to me that the upstream land owner particularly on some of his less productive land may need to be compensated from some public source for doing this sort of thing in the public interest."

2. Conflicts of land use are inextricably bound to conflicts concerning water management. Following are some illustrations:

Dr. William H. Marshall, Dept. of Entomology and Economic Zoology, U of M writes: "There are definite conflicts between agricultural drainage programs and the needs for habitats to maintain a wide variety of wildlife such as song birds, water birds, upland game and especially waterfowl production areas. Removal of small and large shallow water areas from the landscape has eliminated many prime wildlife habitats over large sections of northern Iowa and southern Minnesota. The drainage is being extended into northwestern Minnesota areas. The latter development is fast reducing duck production habitat in one of the three remaining high quality areas in the United States."

Dr. Philip W. Manson, Dept. of Agricultural Engineering, U of M states: "The primary purpose of this paper (Water and Agricultural Land) has been to summarize briefly some of the reasons why the farmers in the fertile areas of Minnesota believe that agricultural drainage is a sound conservation practice and is not detrimental to the water supply of the state. In closing, it will be reiterated that farm drainage does not remove water from the soil that is useful for crops, does not affect precipitation, does not measurably affect major floods or runoff, nor does it appreciably affect the groundwater supply of deep wells. The statements made are based on research conducted at the Minnesota Institute of Agriculture and on opinions published by a number of the foremost authorities in the country on subjects related to water."

A statement by Jim Kimball (Director of Game and Fish, Minnesota Dept. of Conservation, at the water resources meeting called by the Governor Jan. 5, 1957: "At least half of Minnesota's three million-plus people hunt and fish, and they spend $150,000,000 a year on it. Some drainage may be necessary and we have no quarrel with the farmer who drains his own land at his own expense for his own profit. But we do object to spending public money through federal subsidies to encourage farmers to drain, especially in view of present crop surpluses." Also, "Shorter working hours mean more leisure time and greater need for wholesome recreation. And so the army of sportsmen grows and increases the demand for the one commodity which we do not have in over-supply -- game and fish."

Comment: The Federal Reserve District of Chicago gave as one of the reasons for the increase of farm land prices, the attraction of government subsidies. Minnesota farmland prices went up 6% in the year ending July 1, 1958.

Comment: The tourist business is variously placed as the third or fourth regarding total financial importance to the state. This is hard to substantiate; however, 300,000 out of state fish licenses were purchased in 1957, and a total of $127,000,000 out of state money was spent by a million tourists.

Mr. J. W. Clark, Commissioner of Minnesota Dept. of Business Development writes: "The one issue of controversy which comes to this office in relation to our water resources is difference of point of view of scores of sportsmen's clubs,

and the like who urge insistently that our rivers and lakes be kept in their natural state for the enjoyment of humanity and the protection of our wild life. Opposed to their point of view are those industries and municipal governments who are equally insistent that our waters can serve further functions through industrial application and a means of supplying a municipal water supply and for the removal of effluent from sewage disposal plants.

"There is much to be said for both sides. There is a realization that something in the way of compromise must be achieved....."

We touched on the wetlands program in Chapter II, H. However, we have not as yet spoken of the fact that taking these lands off the tax rolls of the county poses some serious problems for those counties. Perhaps some kind of compensation is indicated.

We also touched briefly on problems of access to public waters by the public. Communities built around lakes are often completely built up; private owners object, naturally, to the public using their property as means of access to the water. Buying access areas is a costly undertaking.

Competition for sites may be of many kinds; residential housing, industry, for recreation, highway, airports, etc. Basic decisions as to the pattern of land uses will have to be made soon. (p. 10, Source #1)

Of major importance, also, is the enormous amount of productive farm land that is being retired every year in favor of other uses.

Use of ground water versus surface water; you noted the difference of viewpoints in Chapter IIa-probably we need more information in this area.

3 & 4 Also, "Our topography does not lend itself to large dams and reservoirs. Thus, the problem of inundation and loss of potential reservoir sites is not a major concern. The problem of supplemental irrigation and the consequent competition for water may become serious in the southern part of the state. This will very likely happen if our present agricultural economy changes from one of surplus to shortage." Mr. Herrick.

4. There are no conflicts regarding the production of power in the area, except those referred to in the first part of this chapter.

Conclusion: We have merely presented the areas of conflict, trying to do so in an impartial manner. In this chapter it seemed impossible to confine conflicts to the Metropolitan area, hence they are of state wide significance. Our final quote is from Dr. Hildegard Johnson, Professor of Geography, Macalester College.

"Even if the conflicting interests are recognized the solution is not necessarily at hand. We are obviously dealing with benefits which cannot be and are not by our society officially assessed in dollar value. To evaluate wildlife, fishing and scenic beauty, swimming and other recreational activities in terms of tourist income for certain interested groups, leaves out - among others, - such easily recognized items as outdoor education for youngsters, testing grounds for biological research, benefit or damage resulting from dislocation of families who must be resettled, political or strategic significance of power availability in times of distress."

"Co-existence, not conflict of interests, must become the guiding principle of those in charge of planning resource and water management.....The resource of site is becoming increasingly important with greater demands for wide highways, land demanding industry sites, growing populations in need of housing. Conservation which means literally to save together implies saving as a social and organized group as well as saving wildlife, recreational areas, industrial sites, clean rivers, endangered topsoil simultaneously and in the same state. In the final analysis we shall have to decide on the basis of preference and therewith make known our most cherished values. These will likely include love of comfort, ample and cheaply priced food and power, safe water supply, safety from floods and other tangible assets of life as well as such intangibles as respect for the historic site, humility before nature's gifts of beauty, rejection of man-created slums and other ugly sites, love of order and a sense of responsibility for resources to the next generation. Conservation is not a policy but an attitude reflected through a great number of policies."

CHAPTER V

MAJOR PROBLEMS
(Sources 24,37,57,58,59,60,61,62)

1. a) Local groups (landowners, county & township boards, municipalities, district courts) initiate requests for water resource programs in their own area for: flood control, drainage, supply, establishment of soil conservation and watershed districts. County agents, agriculture extension service, soil conservation committees, and the Water Pollution Control Board usually have to nudge local groups to an awareness of their problems and what agency functions can assist them. However, the initiative is grass roots. The State, through Conservation Department agencies, the Soil Conservation Service, and Water Resources Board assists in planning and programming, but financing and operation are local responsibilities unless the program falls within the category of a federal cost-sharing project, such as:
   Flood control and navigation - Federal funds entirely except for easements, right of way, etc.
   Watersheds qualifying under PL566 and approved by Water Resources Board - Federal cost-sharing
   Sewage treatment plants qualifying under PL660 and approved by the Water Pollution Control Board - Federal cost-sharing
   Farm improvement practices under Agricultural Stabilization Program - Federal cost-sharing

   b) Sportsmen, business and conservation groups work to inform and develop public opinion, and promote legislation, but do not control water development.

   c) There is need for further education to acquaint local communities with the advantages to be gained through participating in state and federal programs.

   d) Yes, in most cases. (See above)

2. a) No. b) Tax losses to counties for land areas withdrawn for wetlands habitat are not at present compensated. Under Soil Bank acreage reserves for conservation purposes there is payment from the federal government to landowners.

3. a) Congress has given the Department of Interior responsibility for administering legislation enacted to insure the perpetuation of waterfowl. The Fish & Wild Life Service of this Department is responsible for formulating and administering a program for regulating kill, establishing national refuges, restoring habitat, conducting research. Congress amended PL566 (Small Watershed & Flood Control Act) to provide for federal cost-sharing in watershed projects beneficial for fish, wildlife, & recreation. State purchase of wildlife lands comes in part from Pittman-Robertson funds*(a specific tax for aiding wildlife).

   b) Yes, in that the usual cost-benefit ratio employed by other departments of government would be impossible to apply in most wildlife or recreation projects. Mobility of population and geography are factors here.

   c) Yes, the state should bear some of the cost of resource development that benefits its people; our state provides its own Fish & Game Division at great expense.

4. Great Britain and the U. S. have a treaty to protect and perpetuate useful migratory birds. Minnesota is on the north-south flyway and the Fish & Wildlife Service is charged with carrying out that treaty.

* Federal Aid

CHAPTER VI

WHAT IS THE FUTURE OF YOUR BASIN - THE METROPOLITAN AREA
(Sources 1,15,24,41,61,63)

1. The main physical problems in this area are: flood prevention and control, pollution control, distribution of water supply, drainage, setting aside areas for recreation while space is still available, and urban growth. In the field of organization and legislation, problems include the need for recodification of state water laws, to take conflicting and overlapping statutes off the books; a central policy-making body; consolidation of uncoordinated agencies. The problem of land use lies in both categories.

2. The fact that reports from our state water-related agencies all contain recommendations for cooperation, coordination, and state-wide watershed development, is sufficient evidence to answer "yes" to both questions.

3. a) & b) The tools for planning objectives are in existence. We already have the agencies and personnel necessary to carry them out. We have in addition the Twin Cities Metropolitan Planning Commission, Twin Cities Sanitary District, Minneapolis and St. Paul and other municipal Planning Boards, League of Minnesota Municipalities, etc. The means are at hand, and if our progress seems slow it is because of the obstacles listed above as legislative problems. The entire blame cannot be dumped on our state legislature. Some of the confusion stems from the conflicting objectives and methods imposed at the federal level.
c) Yes, there is lack of understanding and support; this is because there is a lack of knowledge about the inter-relation of all these water problems. Unfamiliarity with the operation and main purposes of the many agencies involved is also a major obstacle to understanding and support.

4. a) There is no evidence of a timetable, although separate agencies such as the Metropolitan Planning Commission and the Minneapolis-St. Paul Sanitary District have their own timetables for specific accomplishments.
b) Yes, in that individuals at all three levels of government and in the University have given freely of their time to acquaint interested groups with their objectives and problems. (Even so, a very small proportion of the public is reached.) There is good newspaper coverage of specific problems, the radio and TV stations have donated time for programs to promote public understanding. "The Conservation Volunteer," official bulletin of the Conservation Department, does a fine job, but the number reached is limited. The various agencies have published reports and recommendations for the legislature and for distribution to interested groups. Publications of conservation groups help to spread information and form opinion. Much of this information put at the disposal of the public, however, shows no awareness of the indivisible nature of problems associated with water.
c) Not as yet a thorough understanding, but there is effort to achieve it. Commissioner Selke in his Biennial Report (1956-58) says: "Improved water management practices and increased public awareness of the importance of water will be major factors in providing an efficient water management program for the future.....We recognize that public understanding and support is a necessity to any program of conservation of natural resources; that public information is essential..."
d) Not by the general public. Irving Fox says: "The layman who wishes to understand and express himself intelligently upon the issues faces a formidable task, because of the background of information required and the conflicting views which he hears. Under these circumstances, the strength of the special-interest groups is enhanced, and the difficulties of the conscientious legislator and administrator in establishing wise policies are increased. Thus, the role of citizen groups...becomes more important in the attainment of prudent water resources policies."

5. To answer these questions we have asked for statements from experts in the many water-related fields, and their response has been prompt and generous. Major proposals by existing agencies for improving coordinated planning follows:

Commissioner of Conservation George Selke: "Of greatest urgency is the encouragement of the watershed approach to the management of our water resources. Integrated at the state level this program has infinite potential in the field of water conservation. Water for tomorrow is our obligation to future generations."

Sidney Frellsen of the Division of Waters: "Of immediate interest it is expected that a bureau of engineering will be established in the Commissioner's (Dept. of Conservation) office to provide greater efficiency and better coordination of technical services... The Division has planned increased activity in the protection of public waters against public and private encroachment ... It is anticipated that the most pronounced development of the years ahead will be the state-wide adoption of the watershed approach to the management of our water resources."

The Water Pollution Study Commission recommends: That Sanitary Regions be established to coincide as nearly as possible with the several major drainage basins of the state. (They have divided the state into 8 basins). Other recommendations provide for strengthening the authority of the Water Pollution Control Commission, implementing its powers and clarifying present laws. Of special interest is the recommendation for change in present law: "That specificiations of sewage treatment facilities be submitted to the Water Pollution Control Commission and approved before construction of industrial facilities is begun." The question is does this theory have application to new suburban housing development?

From the Minnesota Interim Commission on Water Conservation, etc., 1955: That water uses are interrelated and that in planning for water use and conservation, land use must also be taken seriously into account.

Virgil Herrick, Executive Secretary, Minnesota Water Resources Board: "Within the last four years the Legislature created a State Water Resources Board and a Watershed District Act. These programs are still in their infancy but if properly expanded should provide for a method resolving conflicts at the state and local level. The Board is about to initiate a project that would divide the state into suggested watershed districts... Once this project has been completed, the Board and other agencies will use whatever methods and organizations available to disseminate the information to the local levels.

William Marshall, Prof. Entomology and Economic Zoology, U. of M. "There seems to be little planning in these matters. The Department of Conservation (state) is acquiring marshland wherever possible and the U. S. Bureau of Fisheries and Wildlife will initiate an expanded purchase and lease program of waterfowl production areas in 1959. In the meantime a variety of state and federal agricultural agencies continue to participate (by drainage cost-sharing) in various aspects of drainage. At the field level members of the Soil Conservation Service are considering wildlife values. However, the ultimate decision is with the individual farmer. When drainage is presented as an opportunity to expand crop land acreage without additional land purchase, the answer is quite obvious to an individual landowner."

John Daley, Chairman, Water Resources Board: "If any sense of coordination is to be achieved, there must be an impartial, independent agency at each - the national, state, and river basin or watershed - level, to review the respective programs and determine which approach is in the public interest. Our water resources are too vital to our economy and to society to hope for voluntary coordination. The recommendations from this central agency must be mandatory if it is to be effective."

Dr. Hildegard Johnson, Professor of Geography at Macalester College, has sent a letter in response to our request which will be more extensively quoted in the LWV River Basin Survey next Fall. However, one sentence is pertinent here to serve not as a proposal for planning, but as a yardstick for our thinking. Perhaps it will help to slow down a quick judgment on a particular proposal and immediately label it as all good or all bad." ..."I emphatically point out that river basin development is NOT an issue which confronts us with choices between good and bad, but with decent man's most vexing problem: the choice between various 'good' aspects all justified but not all-practical at the same time and in the same place."

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KNOW YOUR RIVER BASIN

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