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NORTH DAKOTA STATE AGENCY

Third Biennial Report
OF THE
**State Water Conservation
Commission**
AND THE
Twentieth Biennial Report
OF THE
State Engineer
OF
North Dakota



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From December 1, 1940 to November 30, 1942

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North Dakota



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LETTER OF TRANSMITTAL

December 1, 1942.

Honorable John Moses
Governor of North Dakota

Sir:

In compliance with provisions of law, we transmit herewith for your information and consideration the Third Biennial Report of the activities of the State Water Conservation Commission and the Twentieth Biennial Report of the State Engineer from December 1, 1940, to November 30, 1942.

Respectfully submitted,

STATE WATER CONSERVATION COMMISSION

**HENRY HOLT, Vice Chairman
KENNETH W. SIMONS
SIVERT W. THOMPSON
EINAR H. DAHL**

**John T. Tucker
Secretary and Chief Engineer
State Engineer**

NORTH DAKOTA STATE WATER CONSERVATION COMMISSION

Bismarck, North Dakota

December 1, 1942

Honorable John Moses:

In this time of national emergency when we are in the midst of a stupendous global war, it would not be unexpected if interest lessened in the relatively unspectacular enterprise of water conservation. The increased precipitation in the past two years also tends to create a lack of interest in water conservation and irrigation.

We must not allow this interest to lag. In times like these, we, as people of an agricultural state, should be determined to do the utmost to improve our agricultural intelligence, agricultural industry, and agricultural wealth. The strengthening of country life is the strengthening of our United States. Upon the strength of the United States, in great part, rests the outcome of World War II. It is our duty to fight for the conservation of our soil and our lakes and streams just as it is our duty to fight for the economic right and for justice for the individual.

We live in a region of unusual innate potentialities. No other region in the world has been more generously endowed—in surface contour, soil and climate—for agricultural use. But we have one serious handicap. That is drought. Virtually every economic problem which confronts the people of North Dakota, including the problems of public debt and taxation, is, and has been in the past, due to the instability of production on our farms. The drought years brought economic disaster.

The effective control and efficient use of our water supply is a matter of extreme importance. If an adequate water supply were to become available to lands in this region, it would result in our possession of one of the most flexible diversified agricultural areas in the country, capable of changing its crop practice to meet the changes in demand for all products of agriculture. Only through means of courageous and intelligent investments in its future will it be possible to develop a successful and enduring economy. Our people must be educated to these facts.

There is great danger in war time, when need increases for food products and with rising prices, that farmers tend to exploit the soil and water resources. Scars from the punishment we gave our lands to produce food and fiber during World War I are still with us. We must guard carefully against this exploitation ever happening again, and keep constantly striving toward a better land and water use. We, members of an agricultural state, are charged with this responsibility.

Sincerely yours,

John T. Tucker
State Engineer

ORGANIZATION AND PERSONNEL

The State Water Conservation Commission was created by Chapter 255, Session Laws of 1937, which provided that the Governor be ex-officio chairman. Six other members were appointed by Governor William Langer and the first meeting was held March 23, 1937.

Chapter 256 of the Session Laws of 1939 amended and re-enacted the Water Conservation Act under which Governor John Moses reorganized the Commission by the appointment of four members beginning office on April 3rd of that year. Three of the original members were re-appointed and the Governor continued as chairman.

DUTIES: The Commission was created by the 1937 assembly with powers to investigate, plan, design and sell bonds for the construction of irrigation and drainage projects; cooperate in repairs on dams; aid in improvement of municipal and rural water supplies, improvement of stream channels, abatement of stream pollution, restoration and stabilizing water areas for recreational and wildlife conservation; to provide for the storage, development, diversion, delivery and distribution of water for irrigation; to establish rules and regulations governing water rights; provides for powers and duties concerning interstate compact commission agreements; to cooperate with county, state and federal agencies in the development and conservation of the state's water resources.

The State Water Conservation Commission is vested with the control and supervision of the waters of the state.

Membership

	Term Began	Term Ends
Governor John Moses	April 3, 1939	.....
Henry Holt, Vice Chairman	April 3, 1939	July 1, 1945
Kenneth W. Simons	April 3, 1939	July 1, 1943
Sivert W. Thompson	April 3, 1941	July 1, 1947
Einar H. Dahl	April 3, 1941	July 1, 1947
John T. Tucker, Secretary and Chief Engineer, State Engineer	April 1, 1941	.....

Chapter 223 of the Session Laws of 1941 amended and re-enacted the laws relating to the State Engineer, appointment, duties, powers, qualifications and salary. He shall be appointed by the State Water Conservation Commission. He shall serve as Secretary and Chief Engineer of the Commission. The Commission shall fix his salary. He shall hold office for such term as the Commission shall determine.

DUTIES: The State Engineer serves as Secretary and Chief Engineer of the Commission. He cooperates with the Board of University and School Lands, Dean of the School of Mines, and State Geologist, in determining coal bearing lands; has, subject to the control and direction of the State Water Conservation Commission, general supervision of

waters of the state; appropriations; filing licenses; stream measurements; and water supply records; cooperating with the U. S. Geological Survey; precipitation and runoff records; flood prevention; approval of designs, plans, specifications and construction of dams. He is Chief Engineer of the State Water Conservation Commission in irrigation development, including design and construction of projects, cooperating with state, county, and federal agencies engaged in similar work and other state engineering problems, and is a member of the Mouse River Valley Authority that has control, regulation and distribution of the Mouse River waters within the state.

The State Engineer is custodian of field notes, maps and records of government land surveys from the Surveyor General's Land Office and keeps a complete file of U. S. Geological Survey topographic survey maps.

WATER CONSERVATION MAP OF THE STATE

ATTENTION IS CALLED TO THE MAP FOLDED INTO THE BACK OF THIS REPORT WHICH GIVES INFORMATION ON ALL THE WATER CONSERVATION PROJECTS: DEVELOPED, PROPOSED OR POTENTIAL.

INTRODUCTION

Objectives and Program of the Commission

The North Dakota State Water Conservation Commission has a comprehensive plan and program for the development of the water resources of North Dakota. An examination of this report will show the scope of the work that is proposed. Careful study of the information contained herein will act as a reminder that construction of as many of the Commission's projects as possible is necessary in order to stabilize agriculture, the basic industry of the state. Stabilization of the farming and livestock industry is a major problem which, if solved, will do much to create security and raise the living standards of our people. The solution lies in the conservation and utilization of our water supplies and the construction of irrigation projects. Irrigation, wherever practiced, assures to a community permanent stabilized agricultural economy, and to each farmer a crop every year.

By chance, this area was settled when there were years of rainfall, many above the critical twenty inch margin, which produced good crops and created the idea that this was the permanent climate in this area.

On August 5, 1889, before the North Dakota Constitutional Convention, Major Powell, the Director of the U. S. Geological Survey, said:

"The State of North Dakota has a curious position geographically in relation to agriculture. The eastern portion of the state has sufficient rainfall for agricultural purposes; the western part has insufficient rainfall, and the western portion is practically wholly dependent on irrigation.

"In the western portion all dependence on rain will ultimately bring disaster to the people. They are unwilling yet, a good many of them, to admit it, but * * * they will have to depend forever on artificial irrigation for all agriculture * * *

"Years will come of abundance and years will come of disaster, and between the two the people will be prosperous and unprosperous, and the thing to do is to look the question squarely in the face and provide for this and for all years."

No statements have ever come more true as a prophecy than those included in Major Powell's address. Still it took too many years before North Dakota heeded the recommendation so far as the need for irrigation was concerned.

During the past two years, apparently due to the greatly increased rainfall, an interest in the need for irrigation has waned, and the Commission has found it necessary, in order to keep up this interest, to embark upon a program of education through articles prepared for newspaper publication, attendance at meetings and participation in various conventions and agricultural shows. In this, the Commission acknowledges the assistance of the American Legion, which, during the past

biennium, has conducted a series of 160 meetings throughout the state. Attendance at both the state and national Reclamation Association conventions by members of the Commission furthered the work for the need for irrigation and water conservation in our state. Dissemination of knowledge relating to conservation of our water resources, and the proper utilization of the lands will be continued through the press, the radio, and schools of the state, and by attendance at meetings and conventions, by the Commission.

In this state, which is predominantly agricultural, the conservation and intelligent use of our land and water resources are our most important problems. These problems the Commission has long recognized, and they have become increasingly important in the efforts that we are all making to win the war and to provide for the peace time economy to follow.

In view of the above, the Commission makes the following recommendations:

1. That more adequate provision be made for obtaining factual information upon which to chart a constructive program. More hydrographic and topographic data are needed to estimate the possibilities of many North Dakota streams and potential irrigable acreages.

2. That preparation be made now for a construction program to begin after the end of the war. Sixty-five million persons are now or soon will be in the military forces or in war industry. The demobilization of this huge force will make available a labor surplus which must be put to work. Everyone agrees that federal spending cannot be curtailed too sharply and bills already have been introduced in Congress to finance, jointly with the states, public work construction after the war.

We submit that North Dakota's best public construction projects will be found in the development of this state's irrigation possibilities. This is the only type of project yet proposed in this state which will create wealth, make jobs and increase ability to pay taxes.

But a long period of research and planning is necessary to get an irrigation project under way. Field studies must be made and plans and designs drawn. Legal phases of such developments must be carefully checked.

Failure to have this work done in advance prevented the Water Commission from getting any federal money during the last decade, whereas Montana, which was ready with prepared projects as a result of action by its legislature, received Twelve Million Dollars of federal money from the Public Works Administration on a fifty-five per cent loan and forty-five percent free grant basis, with which they constructed nineteen major irrigation projects. In addition, through plans prepared beforehand and with some materials and equipment participation, they secured construction of one hundred smaller projects which were

built with relief labor. In all, water was brought to four hundred thousand acres of land in the state, and irrigation projects were developed which enabled that state to maintain its population despite the drought.

3. That provision be made by the legislature for active cooperation in the financing of work looking to the construction of the proposed giant Missouri River diversion plan.

In that field two possibilities exist. One is for its construction by the Bureau of Reclamation, the other for construction by the U. S. Corps of Engineers. The Commission proposes to cooperate with either—or with both. But the time is at hand for state participation in the most effective way possible, which is by contributing state money to the financing of the necessary investigations by these federal agencies. It is the plan which has been followed—successfully—by other states where great federal development projects have been undertaken in recent years.

4. Many needed projects in North Dakota have been rejected by the federal Bureau of Reclamation as "economically unsound" because of the huge federal subsidy which would be required under the present reclamation law. Congress should be asked to change this law to permit federal construction of irrigation projects in this state.

Meanwhile, provision should be made for the state to build some of these projects, provided it is possible to obtain federal subsidies from sources other than that provided by the standard procedure under the Reclamation Act. That money from this source will be available in quantity and on favorable terms soon after the close of the war, is the basis of the Commission's planning in this direction.

North Dakota's population became stationary between 1920 and 1930 and, after 1930, dropped sharply because of the drought. Unless steps are taken to correct present handicaps, this state's population will remain at about 700,000. With the irrigation developments which are possible, it could support a population of approximately 2,000,000.

HISTORY OF IRRIGATION

Irrigation has been in use for countless centuries. Egypt, Assyria, Babylonia, China and India were practicing irrigation when the writing of history began. Today, in contrast to the primitive methods still in use, Egypt and India have the greatest modern systems in the world. Australia is irrigating her deserts in the southeast; Russia has built irrigation systems in the region of the Caspian; daring engineers have conceived plans for making the Sahara desert again support the civilization that once flourished there.

In the western hemisphere the Incas of Peru met the problem of supporting a population twice that of Peru today by a vast system of irrigation works, later destroyed by the Spaniards. They were not engi-

neers according to modern standards, but necessity drove them to work out their problem. Vestiges of their canals are still in evidence and their location was so wisely selected as to be used today by engineers in charge of constructing the modern government projects.

In the Pueblo country the Indians on the high mesas were almost entirely dependent on rainfall, which was none too abundant, and conserved every precious drop. There are ample evidences of the practice of water diversion after a sudden downpour to utilize the water and not allow it to run off. There are ample evidences of reservoirs, check dams and irrigation ditches. Ceremonials of the Hopia and the Zunis to this day show how the entire life of the people centered around the need for moisture for a thirsty land.

The settlers on the eastern lands of the United States found the rainfall sufficient for their needs. It was not until the Great Plains began to be settled that the idea of irrigation began to grow. John Wesley Powell, the organizer of the United States Geological Survey and the father of the Reclamation Service, was the first to conceive the idea on an extensive scale. It has remained for the United States, by the breadth of his vision and that of the men he trained, to construct in the last 40 years works of gigantic magnitude, undertaken purely and simply for the benefit and profit of the people. In the pure democracy of its great irrigation systems this country differs from all other nations, ancient and modern.

As director of the Geological Survey, Major Powell was able to devote attention and time to gathering facts for his educational campaign. By 1887 he had so educated certain leaders that the Senate appointed a committee to make a tour of the arid regions and study conditions. Then came the terrible drought of 1890 in the Great Plains region and that misfortune worked to promote the irrigation movement. National Irrigation Congresses were formed in the western states and met yearly to promote and arouse public sentiment. In 1897 a report by Captain Hiram Chittenden recommended that the government acquire full title and jurisdiction to any reservoir site which it might improve, and full right to the water necessary to fill the reservoir; also that it should build, own and operate the works, holding stored waters free for public use under local regulations.

As the political parties began to be conscious of the magnitude of the idea, two radically opposing views struggled for recognition. The first was for national development, and the second planned to turn over the public lands or the proceeds from their sale to the states. In accordance with the Powell policy a bill was drafted for Congress to set aside the proceeds from the sale of public lands to be devoted to purposes of irrigation. When Theodore Roosevelt became president, he threw himself into furthering the project of western development with his customary zeal and vigor, quickened by his personal knowledge of the West. The Reclamation Act became a law in 1902. It authorized the Secretary

of the Interior through the Geological Survey to continue the examination and ascertain the practical ways of diverting rivers and of providing water supplies by artesian wells. "The right to the use of the water shall be perpetually appurtenant to the land irrigated and beneficial use shall be made the basis, the measure and the limit of the right"—was the wise provision made.

Then the construction of projects too large for individual enterprises began. Money obtained by the sales of public land in sixteen states in the West was set aside to construct dams, reservoirs, and ditches for irrigation of land in these states: Arizona, California, Colorado, New Mexico, North Dakota, Oklahoma, Idaho, Kansas, Montana, Nebraska, Nevada, Oregon, South Dakota, Utah, Washington and Wyoming. Later Texas joined the list. The Department of the Interior, through the Reclamation Service, later the Bureau of Reclamation, was in charge of construction and planning.

The Reclamation Act of 1902 and amendments provided that the proceeds from the sale of public lands in 17 western states, including North Dakota, should be paid into a special fund in the Treasury designated as the Reclamation Fund, to be used for examination and surveys and for the construction and maintenance of irrigation works for the storage, diversion and development of water for the reclamation of arid and semi-arid land in these states. There was no requirement that the states should match the expenditures for irrigation works.

Until 1910 when the law was amended, the Secretary of the Interior was directed, so far as practicable, to expend the major portion of the funds arising from the sale of public lands within each state for the benefit of arid and semi-arid land within that state. The Secretary had unrestricted authority to make expenditures until 1914. The Extension Act of that year provided that expenditures should be made only from appropriations by the Congress.

The reports of the Bureau of Reclamation show that about \$12,500,000 received from the sale of public lands in the state of North Dakota, together with the proceeds of oil and gas leases, have been paid into the Reclamation Fund. Only \$2,300,000 from the Reclamation Fund has been expended in North Dakota while the remainder of the state's contribution has gone to aid Reclamation in other western states. The state may have a moral claim for the difference between the contribution to the Reclamation Fund and the money expended in this state, but, obviously, it has no legal claim to compel the amount received from the sale of public lands to be set aside as a trust fund for the sole use and benefit and the construction and maintenance of reclamation projects in this state.

Great engineering feats were undertaken under the Reclamation Program and the roll call of the great dams built and the projects successfully completed is a proud one. Roosevelt Dam in Arizona,

Arrowrock Dam in Idaho, Pathfinder Dam of the North Platte Project which waters 250,000 acres in Nebraska and Wyoming, Elephant Butte on the Rio Grande, Uncompahgre and Grand Valley in Colorado, and coming closer home, Belle Fourche in South Dakota and Shoshone in Wyoming—these are only part of the roll call. Later from general fund appropriations, Boulder Dam on the Colorado and Grand Coulee on the Columbia—these suggest great power plants, but they have equally great reservoirs which will aid irrigation.

All irrigation enterprises, federal and private, contain about 28,000,000 acres of reclaimed land and their crops are worth annually almost a billion dollars.

It is possible to turn desert and sagebrush land into productive areas with adequate irrigation, and by applying water at the right time and with the right quantity needed. Arid regions have rich soils not yet robbed of their mineral plant foods. These regions have more sunshine. The U. S. Government estimates that the average yield of agricultural crops on irrigation projects is just about double the average yield on non-irrigated lands in the country at large.

There is a large amount of public domain still unsettled. The National Reclamation Committee has been classifying land which can be put to use. This land may some day be needed, as Herbert Hoover foresees, not only to sustain settlers in the United States, but to feed the population of a war exhausted world.

But, you say, look at our agricultural surpluses! More land in production! Settle new farms in the West! How can you reconcile this?

Is the answer less production or more consumption? In the December 1940 Harpers', Milo Perkins cited the symptoms of malnutrition detected in many applicants for military service. He said 20,000,000 Americans spend an average of only five cents a meal for food. If all the families making under \$100 a month ate as much as those which earn more than that, the sum of two billion dollars would be added to the national food bill and an area as large as the state of Iowa would be needed to raise the additional food.

Irrigation in North Dakota

The proceedings of the First Irrigation Congress held in North Dakota in 1903 make highly interesting reading. Inspired by the fact that Congress had said that the proceeds from the sales of public lands should be devoted to reclamation, and knowing that there had been a large amount of such sales in North Dakota recently, a body of interested men determined to have North Dakota's money invested in North Dakota. Their enthusiasm resulted in the Buford-Trenton and Williston divisions of the Missouri River Pumping Project which cost nearly a million dollars and which might have, under different circumstances, saved that northwest corner of the state some of its dreary experiences in the

drought years, at least on the irrigated land. For three years after the project was opened, it was operated under difficulties. In 1916 Congress passed an act forbidding operations which had been carried on at a loss and in 1917 the project ceased operations. Various reasons have been assigned. This was not public domain and many of the lands were owned by non-residents who did not cultivate or lease their lands, but waited for an "unearned increment." There were years of sufficient rainfall and the interest in irrigation waned.

The Lower Yellowstone Project, which North Dakota shares with Montana, enabled McKenzie County to withstand ravages of the drought much better than counties without irrigation. Sugar beets have aided the water users there.

The Lewis and Clark Project, south of Williston on the Missouri River, furnishes a very interesting commentary on the situation. There have been many more avenues of guidance, instruction and financial help opened up in these latter days. There was so much those first people didn't know. The New Buford-Trenton Project is being constructed and a new opportunity given to use, before long, the methods that have succeeded elsewhere.

With the formation of a Water Conservation Commission in North Dakota a campaign of education began in 1937. Whether we shall have a project as thrilling as the great projects of the Southwest and West is dependent upon the vision and cooperation of our people. Meanwhile all the smaller plans are growing and are necessary. When the war is over, it is to be hoped North Dakota can reclaim her lost population as well as the returning soldiers. Ironically, many of the farmers, who moved away due to the drought of the 1930's, went to irrigated lands farther west.

ECONOMIC CHARTS SHOWING NEED FOR IRRIGATION

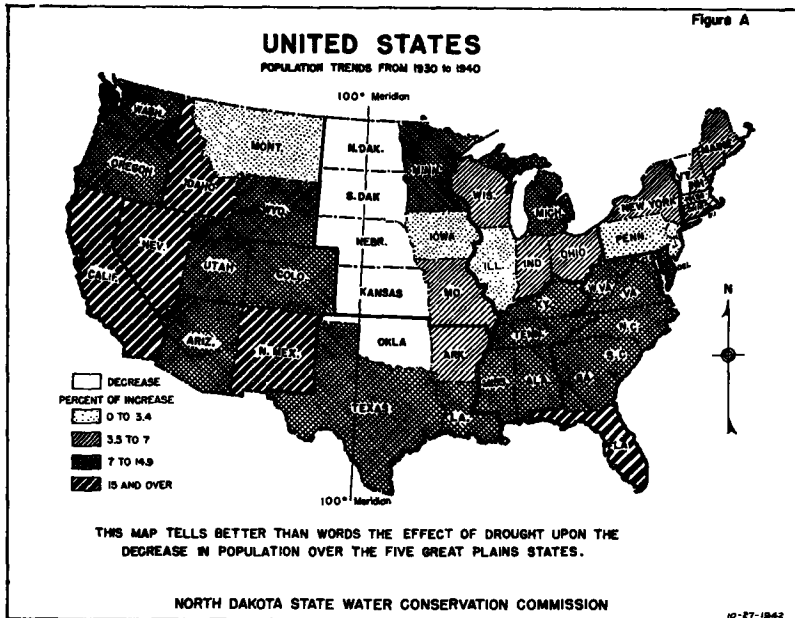


FIGURE A. Population Trends. The map of the United States illustrates clearly the trend of population, the shifting from one area to another, during the 10 year period of 1930-1940. While the increase in population for the United States was 7.2 per cent for the decade, the gain for the 11 Mountain and Pacific States, generally considered the irrigation states, was 14.8 per cent, more than double the average national rate. The map shows that typically dry-farmed areas in the semi-arid and arid regions lost in population during the 10 year period, while irrigation states gained more than their proportionate share.

The Pacific division had the greatest rate of increase, 18.8% and the west North Central States had the lowest. The former grew by a great shift of inhabitants from the rest of the nation, the five states on the 100th Meridian from North Dakota southward to Oklahoma having lost 860,000 in population, most of whom probably went west to settle on irrigated land in the Pacific Northwest where the U. S. Government is developing large irrigation projects.

The Great Out Migration of 1930-1940 shows what happened to North Dakota and the four Great Plains states during the drought period, when a large number of the inhabitants were forced to abandon their homes and property.

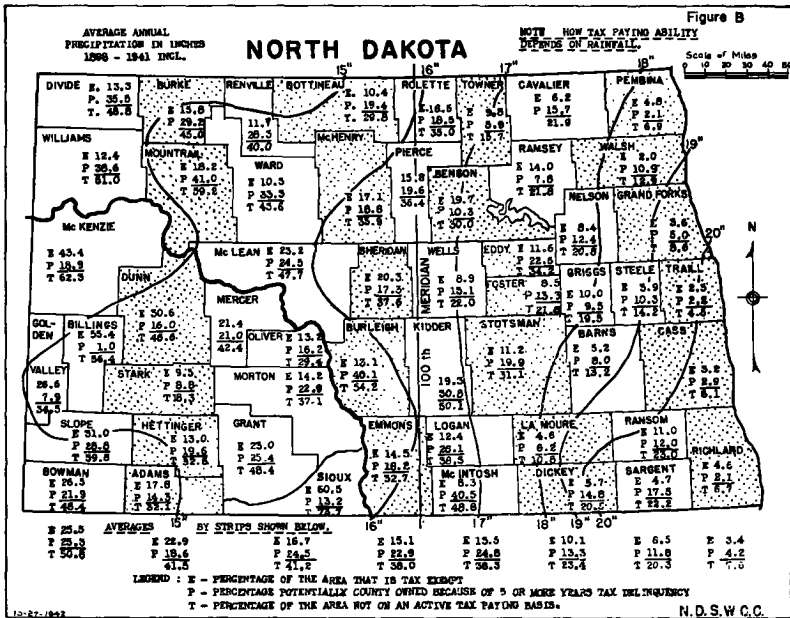


FIGURE B. Map of North Dakota. This map shows the average annual precipitation in inches from 1898 to 1941, inclusive, over a 43 year period. The heaviest rainfall occurs in the Red River Valley, where the annual rainfall exceeds 20 inches,—diminishing gradually toward the Montana state line, where the average annual precipitation is below 15 inches.

“E” on the map shows percentage of tax exempt land of the area; “P” potential percentage of county owned because of five or more years tax delinquency, and “T” shows the percentage of the land not on active tax paying basis. The figures under the map show in percentages how tax delinquencies increase with diminishing precipitation, a clear indication that tax paying ability depends on moisture in this area.

Figures below the map show averages of strips, indicating the gradual increase of percentages “toward the west.” The eastern or Red River Valley strip shows percentages of area tax exempt—“E” equals 3.4%; and the total area not on an active tax paying basis “T” equals 7.6%, in comparison with the western strip along the Montana state line. “E” equals 25.5% and “T” equals 59.8%, this clearly indicates the seasonal distribution of precipitation as it affects agriculture, stock raising and population trends.

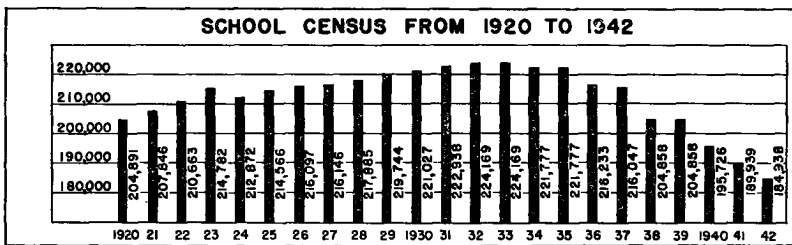
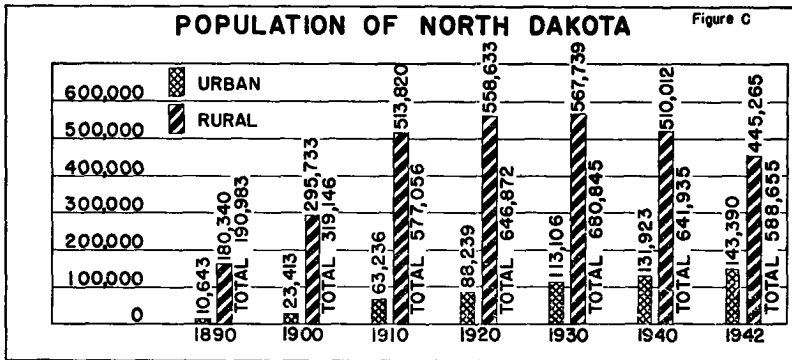


FIGURE C. North Dakota's population reached its peak in 1930, according to the accompanying graph. Since that year the state has shown a gradual decrease. The 1930 census gave North Dakota a population of 680,845. The 1940 census brought the figure down to 641,935 and the 1942 ration books registration indicated that the population at present is down to 588,655, a decline of 13.5 per cent.

Five counties lost about a fourth of their population, 13 others lost from a seventh to a fourth, 26 others lost up to 12 per cent, while only 9 counties gained inhabitants, the highest gain made being Burleigh County with a rate of 15 per cent.

The heaviest losers were in the west third of the state but there were some heavy losers in the east half. In general, the eastern half of the state fared better than the western half.

The chief causes of the difference between east and west half of state are less precipitation and greater drought effects in the west and more and larger cities in the eastern counties.

The lower chart showing school census attendance records was made available through information obtained from the Department of Public Instruction. The graph shows that during the school year of 1932-33 224,169 children attended school,—the largest number on record in North Dakota. At the end of the following nine-year period attendance showed a loss of 17.5 per cent, with a total attendance in 1942 of 184,938.

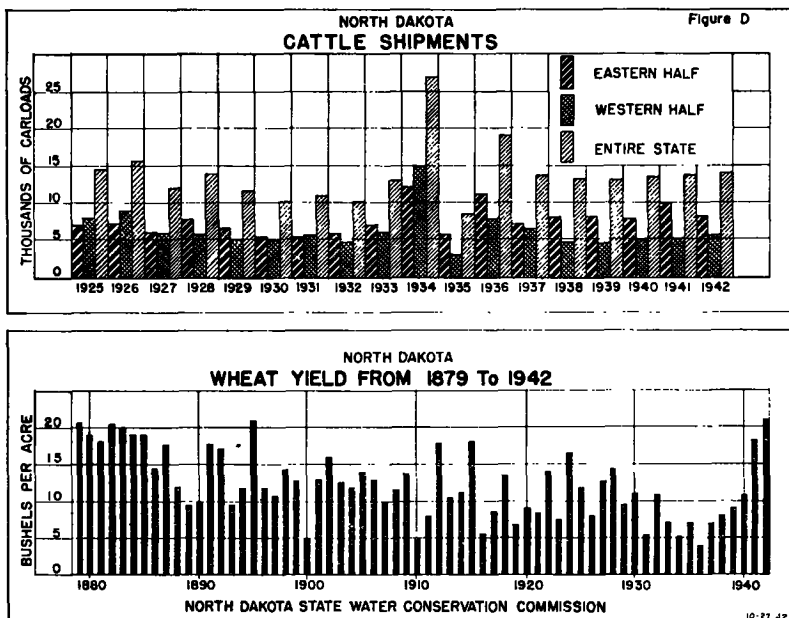


FIGURE D. North Dakota cattle shipments. This graph shows cattle shipments in carload lots for a period of 17 years, from 1925 to 1942, inclusive. The average annual shipments were fairly steady and uniform with a slight downward trend from 1926 to 1933. In 1934, shipments of cattle from North Dakota were more than doubled. The increase is, of course, attributed to the loss of native grasses, hay and forage crops, due to lack of precipitation. Reference is made to the annual rainfall graphs, which show several years when the average annual precipitation for the western part of the state was below 10 inches.

North Dakota wheat yields from 1879 to 1942. This graph shows the average annual wheat yield per acre over a 63 year period, with the maximum yield going over 20 bushels per acre and the minimum dropping down to less than four bushels per acre in 1936. From 1936 on, the graph shows severe fluctuations in yearly yields, with a gradual downward trend to 1936. Since that year a reversal in the trend has increased the yield with a culmination of over 20 bushels per acre in 1942. (latest estimate.)

IRRIGATION DEVELOPMENT

Records show there has been a gradual increase in the area brought under irrigation in North Dakota since 1889, with the exception of a few years of heavy rainfall, when there was a noticeable reduction in the number of acres irrigated. However, there has been a marked trend upwards since 1925, the greatest increase having occurred during the last five years, commencing in 1937, when the North Dakota State Water Conservation Commission was organized.

During this period irrigation increased from approximately 16,000 acres to over 33,000 in 1942.

In 1940, 80 projects comprising 358 farms irrigated 21,165 acres. At the present time, 1942, this irrigated area has been increased to 33,200 acres. In view of the increased precipitation during the past two years, this is a distinct accomplishment for the Commission. When these 80 projects are fully completed, 39,558 acres will be irrigated. The cost of irrigating the 21,165 acres during 1939 averaged \$1.41 per acre; a very reasonable amount when projects costing up to \$4.50 per acre per year to irrigate are considered feasible in this area.

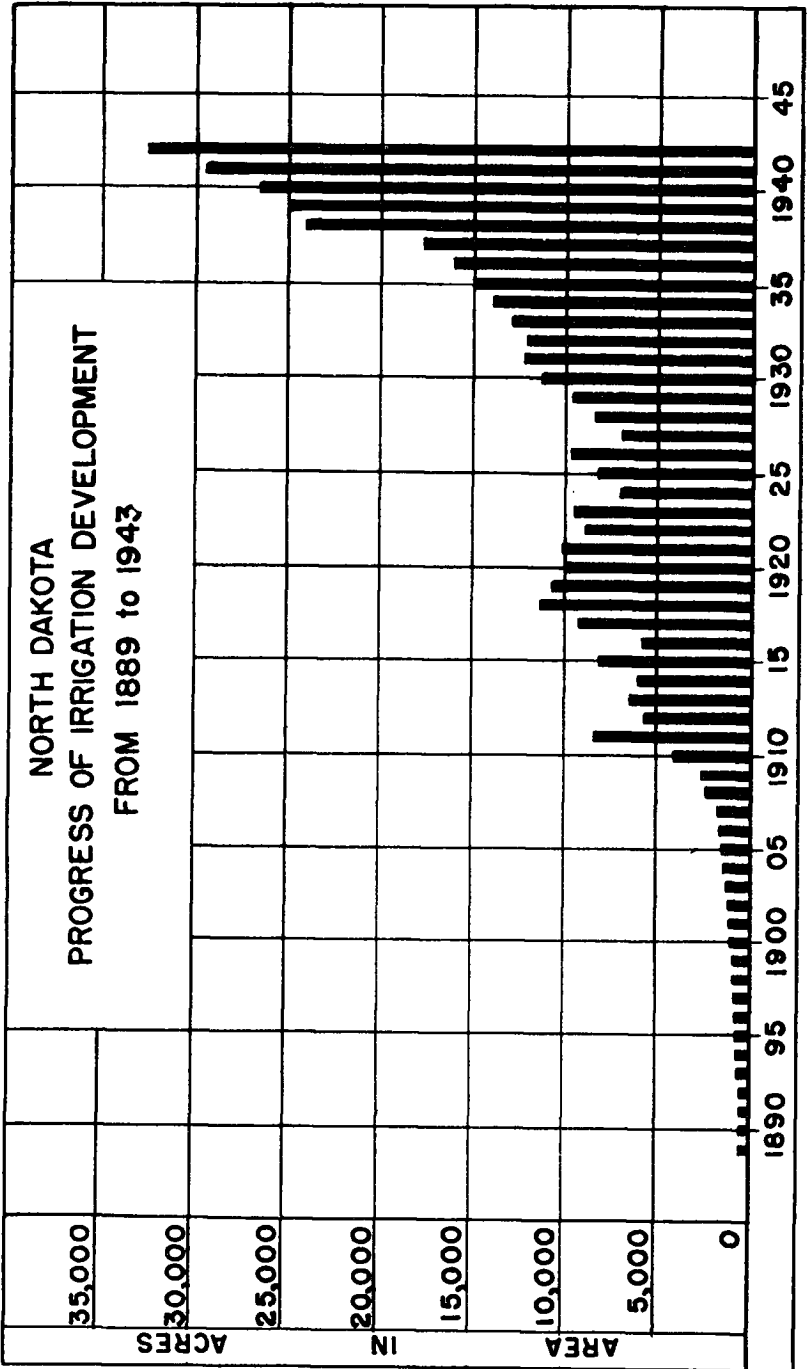
Of the 17 western states, where irrigation is practiced, North Dakota had the fewest farms and the least acreage under irrigation, the 1940 census showed, with California leading with 5,069,568 acres. Montana was in fourth place with 1,711,409 acres under irrigation.

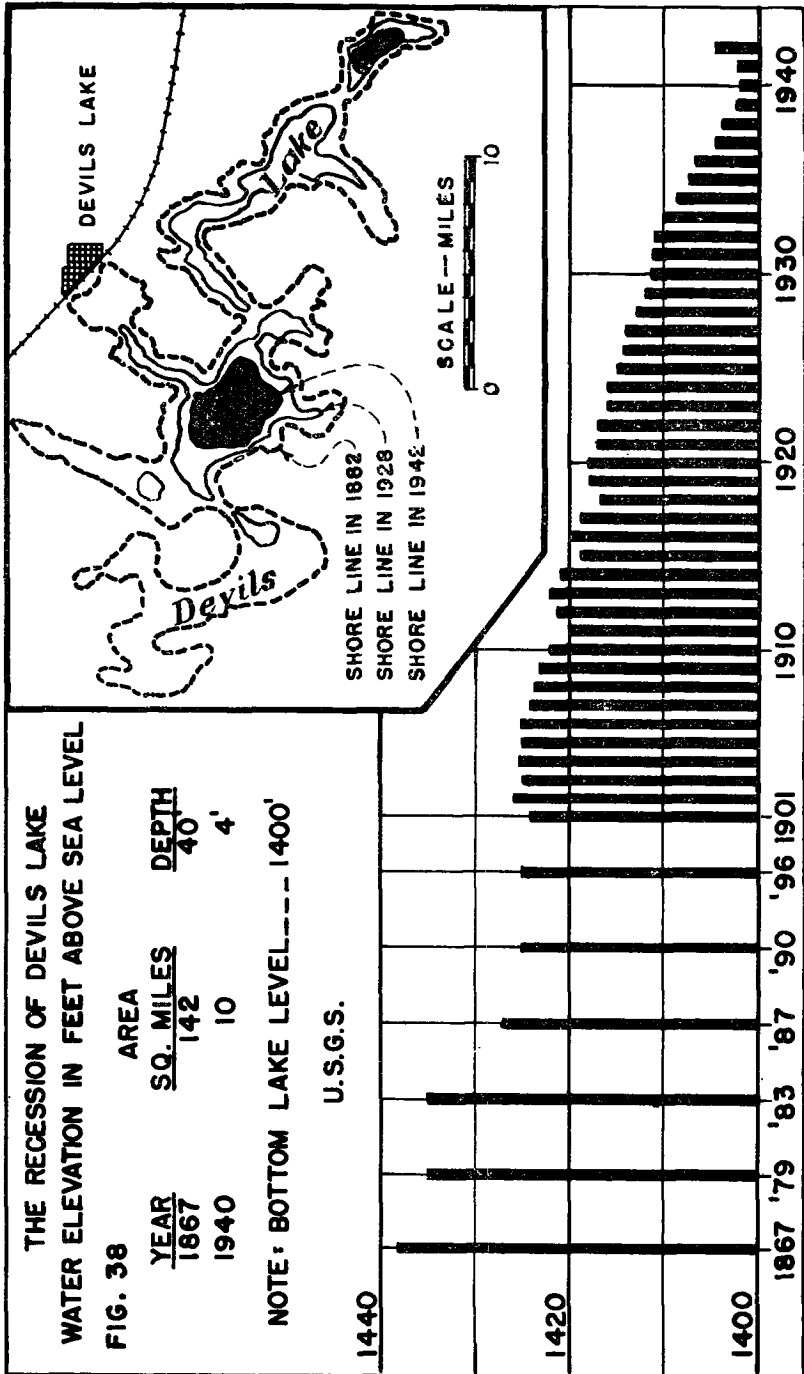
For all of the 17 western states, 130,022 farms were under irrigation, representing 21,003,739 acres, supplied with water by 91,697 irrigation projects, according to census records. The capital investment for all totaled \$1,052,049,261, an average per acre of \$34.36.

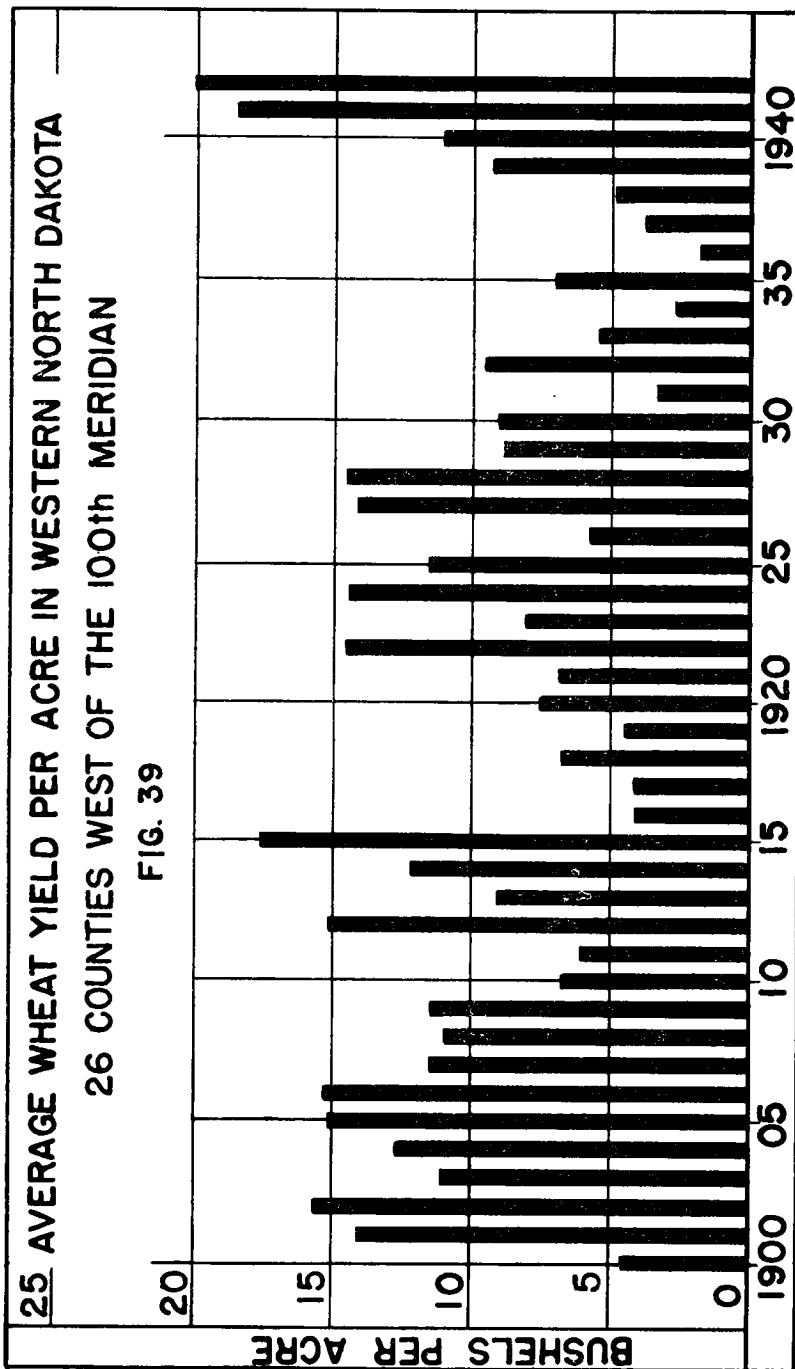
The following chart, "Progress of Irrigation Development in North Dakota," shows the trend of irrigation over a period of 53 years since North Dakota was admitted to statehood. (See page 19).

Figure 38 shows Devils Lake shoreline during the years of 1882, 1928 and 1942, and the graphs show the variations in the lake level from 1867, when the water surface elevation of 1,438.0 was recorded. The lowest water surface elevation recorded was during October, 1940, when the lake level was 1,400.87. During the past two years there has been a slight increase in the lake level, the present elevation being 1,404.02. (See page 20).

Figure 39 shows the average annual wheat yield per acre in the 26 counties west of the 100th meridian in North Dakota. The left-hand column shows bushels per acre. The lower figures indicate the years of record from 1899 to 1942, inclusive, ranging from an all-time low of two bushels per acre in 1936 to the present high recorded in 1942. (See page 21).







Lewis and Clark Irrigation District

This irrigation project was constructed by the North Dakota State Water Conservation Commission to reclaim approximately 5,000 acres of Missouri River bottom lands, located six miles southwest of Williston in McKenzie County. The Commission planned, designed and constructed the irrigation works. Bonds for construction of the system were purchased by the North Dakota Rural Rehabilitation Corporation. The greater part of the labor was furnished from Williston by the Works Progress Administration.

The project comprises a total area of 7,700 acres. Approximately 5,000 acres have been developed for irrigation. The work included clearing land of brush and trees, preparing and developing the land, including grading, floating, ridging, marking and irrigating before the soil was ready for planting. All of this land development work has been done under a cooperative agreement with the Farm Security Administration which has been in charge of all land leasing, farming operations and management carried on under the direction of their Project Supervisor.

During 1941 there were 3,415.5 acres in crop, an increase of 64% over the 1940 crop which consisted of 1,232 acres under irrigation.

The 1942 crop production report shows there were 52 farm units under irrigation, covering 4,818.5 acres of land in crop. This is an increase of 29% over the 1941 crop production report.

Varying results have been achieved by the farmers through the practice of irrigation. The increased yield in potatoes is a very good example of results gained from experience in the use of water.

The average crop production yields obtained under irrigation over the project are shown for the 1941 and 1942 crop season as follows:

	1941 Crop Report		1942 Crop Report	
	Number of Acres	Avg. Yield Per Acre	Number of Acres	Avg. Yield Per Acre
Wheat	725.0	29.5 Bu.	849.0	26.3 Bu.
Oats	491.0	37.7	450.5	40.8
Barley	565.0	30.0	737.0	29.0
Flax	1,060.0	3.1	1,145.5	7.5
Potatoes	166.0	175.0	191.0	235.0
Corn	136.0	35.5	322.0	22.1
Gardens	26.5		15.5	
Alfalfa	162.0	2.2 Tons	773.0	1.4 Tons
Millet	84.0	2.0 Tons		
Pasture			259.0	
Beans			56.0	5.4 Bu.
Speltz			20.0	60.0 Bu.
TOTAL	3,415.5 A.	in crop, 1941	4,818.5 A.	in crop, 1942

The Bismarck Victory Gardens Irrigation Project

This project was organized during the spring of 1942 as a community victory garden by the Bismarck Association of Commerce, sponsored and constructed by the North Dakota State Water Conservation Commission, labor being furnished by the Works Projects Administration, which also aided in supplying part of the material used in the ditch structures.

The State Water Conservation Commission laid out the system making surveys, plans, designs and supervised the construction. Pumps, motors, pumphouse materials, concrete pipe for road culverts and miscellaneous supplies, including shovels and rental of equipment, were furnished by the Commission.

The community victory gardens were located on U. S. Government land formerly occupied by the U. S. Indian Service. The land is now leased and farmed by the State Penitentiary.

As a large portion of the soil is composed of light silty sands, there were a number of irregular ridges and depressions before planting. It was necessary to remove these by grading, floating and leveling. This work was done by using heavy grading equipment rented from Burleigh County and the State Highway Department. Excavation of the ditches was done by equipment and hand labor furnished by the WPA. The Soil Conservation Service cooperated in checking the drifting soil by planting trees and shrubs around the gardens.

There were 86 one-quarter acre garden plots laid out and planted during the season to the following crops:

Potatoes	10.94 Acres
Corn	2.93
Miscellaneous, including all other crops	8.28

Total Acres in Crop	22.15 Acres

The results were very satisfactory and practically all the original signers have signified their desire to continue with their victory gardens for another year. Their experience with the use of water has demonstrated the value of irrigation by increasing yields and having green garden truck throughout the growing season.

Lower Yellowstone Irrigation Project

This project was constructed by the United States Reclamation Service during 1907 to 1909 and covers approximately 38,000 acres of irrigable land in Montana and 20,000 acres in McKenzie County, North Dakota. The irrigation system provided for the diversion of water from the west side of the Yellowstone River about 18 miles below Glendive, Montana.

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The operation of the project is carried on under the direction of a Board of Control, the Directors being elected by the water users, and operated by their Project Manager.

There is a large sugar beet plant located near the center of the valley at Sidney, Montana, for the manufacture of the sugar beets grown on the project. Diversified farming is carried on, first in line being sugar beets, followed by grains, alfalfa and row crops in order to make a balanced crop rotation program.

A small increase in acreage has been reported for North Dakota showing 14,349 acres were under irrigation in 1941.

The following is taken from the crop production record, showing the average yield per acre and the total value of each large crop grown on the project in North Dakota:

	1941		
Crop	Average Yield	Value Crop	Value
	Per Acre	Per Acre	
CEREAL:			
Barley	28.9 Bu.	\$11.56	
Corn	25.8	11.62	
Oats	35.6	9.61	
Wheat	21.5	18.07	
			\$ 63,576.00
SEED:			
Alfalfa	1.7 Bu.	\$17.00	
Clover	6.7	16.00	
Other Misc.	5.6	8.51	
			\$ 4,769.00
FORAGE:			
Alfalfa	2.0 Tons	\$10.07	
Other hay .....	.9	2.33	
Corn Fodder	2.1	7.34	
Silage	6.0	9.02	
Sugar beet tops	11.2	1.40	
			\$ 37,660.00
VEGETABLES:			
Beans, commercial	9.8 Bu.	\$ 9.84	
Potatoes, white	194.0	58.20	
Garden truck		37.56	
			\$ 19,934.00
Sugar Beets	11.2 Tons	\$54.84	\$200,488.00
Additional Revenues Received			\$233,536.00
TOTAL VALUE OF CROP			\$564,963.00
Average gross value per acre on 14,349 acres			\$39.37

Raising livestock in connection with diversified farming is one of the major revenue producing sources to the farmer on this project. Cattle and sheep feeding is gradually becoming another one of the main industries, giving the farmer an outlet to dispose of his grain and forage crops as well as sugar beet tops, grown on the farm. Dairying is in the forefront. The value and number of dairy cattle has been increasing at a rapid rate on the project during recent years.

Following is a tabulation showing the kind, number and total value of livestock on the project at the end of 1941.

Livestock on Project — December 31, 1941

Kind	Number	Total Value
Horses and mules	393	\$ 26,060.00
Cattle, beef	546	26,750.00
Cattle, range, feeders	1,545	77,641.00
Cattle, dairy	942	47,481.00
Pure bred sires	16	1,645.00
Scrub sires	24	1,715.00
Sheep, farm stock	1,654	11,300.00
Sheep, range, feeders	26,550	157,973.00
Hogs	1,893	14,859.00
Turkeys	265	596.00
Fowls	9,671	5,494.00
Other livestock or fowl		34.00
TOTAL VALUE		\$371,548.00

Yellowstone Pumping Irrigation District

The construction of the Yellowstone Pumping Irrigation District Project has been under consideration since 1937, when it was included as part of the Sidney Pumping Project of Montana. However, due to insufficient funds made available to Montana by the Public Works Administration for the completion of the entire project, that portion of the project in North Dakota was not constructed as originally planned.

During 1941 detailed topographic surveys were made of the project by the State Water Conservation Commission. From these surveys the irrigation system has been designed and planned to deliver water to 1,810 acres of land in North Dakota and to that portion of Montana on the northwest part of the project.

The pumping intake has been constructed on the Yellowstone River in Montana about two miles above the state line. The main canal has been built. No agreement has been reached yet between the parties involved over the apportionment of costs for the construction of the works. The directors of the Yellowstone Pumping Irrigation District have requested that all transactions and negotiations be postponed until after the war.

Projects Proposed for Construction

The first three projects listed below besides providing for irrigation of lands by systems of dams, canals, reservoirs and pumping plants will also consider water supplies for the James and Red River Valley watersheds and the restoration of Devils Lake and other lakes for recreation.

1. Missouri-Mouse River Diversion 1,000,000 acres. (Reported on by the U. S. B. R. 1941.)

2. Missouri River Diversion (Report by Corps of Engineers, U. S. Army.)

3. Alternate Plans (State Water Conservation Commission.) By increasing the scope of the above diversion plans, additional areas may be served by waters diverted from the Missouri River.

4. Little Missouri-Slope Diversion (SWCC). This proposal provides for irrigation of lands on the Heart and Cannonball River watersheds.

Projects Proposed for Irrigation (36)

Name	Acres	Name	Acres
5. Yellowstone	1,000	23. Manley	2,160
6. Cartwright	800	24. Wogansport	2,400
7. Williston	8,260	25. Square Butte	2,750
8. Birdhead	2,900	26. Burnt Creek	1,946
9. Seneschal	1,820	27. Bismarck	5,000
10. Nesson Valley	14,840	28. Little Heart	3,930
11. Goodall	3,820	29. Glencoe	4,010
12. Shell Creek	4,500	30. Long Lake Kyes	2,100
13. Independence	4,130	31. Horshead	9,710
14. Fort Berthold	9,400	32. Winona	5,940
15. Old Agency	9,210	33. Fort Yates	7,650
16. Fort Stevenson	6,830	34. Knife River	16,000
17. Mannhaven	1,550	35. Heart River	15,000
18. Hancock Flats	5,030	36. Cannonball River	18,000
19. Stanton	3,450	37. Bowman-Haley	5,000
20. Fort Clark	2,750	38. Little Missouri	24,000
21. Oliver-Sanger	6,880	39. Oakes	50,000
22. Painted Woods	2,300	40. Dickinson Reservoir	1,000

TOTAL ACREAGES — 266,066

Improvement of water supplies for municipal uses and flood control projects are proposed for the following rivers in the Red River Basin: Pembina, Tongue, Park, Forest, Turtle, Goose, Maple, Shyenne, Wild Rice and Red.

Attention is called to the fact that there are a great many undeveloped small irrigation projects located throughout the state which have not been listed herein.

MISSOURI RIVER DIVERSION PROJECTS

The Missouri-Souris Diversion Project (U. S. Bureau of Reclamation): This is a multiple-purpose project utilizing the waters of the Missouri river, and contemplates the irrigation of one million acres of land in northwestern North Dakota, furnishing municipal water supplies for many towns and cities in central and eastern North Dakota, and the restoration and maintenance of Devils and Stump Lakes.

It is a project of great magnitude and is one of the largest multi-purpose projects of its kind in the world. In the number of acres to be

irrigated and in the number of purposes which it will serve, it will exceed the Grand Coulee project in Washington state.

Preliminary plans call for raising of ground and lake water levels; maintenance of flows in our rivers by diverting Missouri River water for the use of our farmers and municipalities in the central and eastern portions of the state; and for the creation of low-cost power for lighting cities and towns and for rural electrification and manufacturing purposes.

It is proposed to irrigate one million acres in Williams, Divide, Burke, Renville, Ward and Bottineau Counties.

The Bureau of Reclamation has under consideration large storage basins and reservoirs in Montana. The largest of these, the Medicine Lake Reservoir, with a capacity of 5,200,000 acre feet, will extend into North Dakota near Grenora where a large pumping plant will be located. Water will be pumped at the rate of 12,000 cubic feet per second to a height of approximately 100 feet into the huge Souris Canal, which will carry the water to the Mohall-Crosby area. This pumping plant will be one of the largest in the United States, having an installed pumping capacity of 152,600 kilowatts.

About ten miles south of Crosby, it is proposed to construct a storage reservoir of 230,900 acre feet capacity. About eight miles further down is a canal drop of one hundred feet, where a power plant will generate power to be delivered to the Grenora pumping plant. This plant will have an installed capacity of 71,600 kilowatts and will operate under a maximum discharge of 11,000 cubic feet per second with a head of 98 feet.

Water from the Crosby reservoir will be released at the rate of 14,800 cubic feet per second for irrigation in the area during the peak of the season and also generate power at the Des Lacs power plant at Kenmare. This plant will have a capacity of 66,667 kilowatts and will operate under a maximum discharge of 6,300 cubic feet per second with a head of 158 feet.

The water level of the Des Lacs reservoir will be raised and make possible diversion into the extension of the Souris Canal, in the northern part of the Mohall area. An earth fill dam near Kenmare, 1,640 feet long and 30 feet high, will raise the water surface in the reservoir 27 feet.

The Crosby-Mohall distribution system will consist of a network of canals ranging in capacity from 200 to 6,700 cubic feet per second. The total length of all distribution canals will be 668 miles.

Return flow water will drain into the Des Lacs and Mouse Rivers and be carried in the Mouse by way of Minot and Velva to Verendrye, where a diversion dam about 30 feet high will be constructed for diverting water into a 2,000 cubic feet capacity canal, which will extend across

the Mouse-Sheyenne divide by way of Balta and Lake Gerard to the Sheyenne River. A few miles downstream from the town of Sheyenne a dam 90 feet high will be constructed, which will create a reservoir extending upstream to near the summit of the Mouse-Sheyenne divide. From this reservoir, lateral diversions will be made to Devils Lake and to the James River and regulated flows will be released down the Sheyenne to the Red River. From Devils Lake water will be carried in a canal to Stump Lake and from there an outlet canal will extend to Sheyenne River. By these diversions Devils Lake and Stump Lake will be restored and maintained and Missouri River water will be made available for municipal and agricultural purposes along the James, Sheyenne and Red Rivers.

Plans for eventual diversion of Missouri River waters include diversion from Stump Lake to the Goose and Turtle Rivers; from the Sheyenne River to the Maple River and the Wild Rice River and from the James River to the Wild Rice River and to Lake Traverse and the Red River.

The Big Bend Dam (U. S. Army Engineers): The plan of the Army Engineers for diverting Missouri River water to the eastern part of the state calls for a 50 foot dam at Big Bend, near Garrison. Pumps would lift the water 117 feet to higher bench lands and into a canal that would cross the lower half of McLean County and utilize a number of natural lakes in the Turtle and Mercer areas as storage reservoirs. The canal would cross Sheridan County in a southeasterly direction and pumps would again lift the water, this time 70 feet, to the top of a hill, known locally as Prospect Mountain, just east of Mercer, and continue through gravity canals to the Sheyenne River to a point about ten miles upstream from Harvey, where a storage reservoir will be located and continue in the water course of that river until Wellsburg is reached, where a reservoir will direct water through a canal southeast to the James River at Bremen. Another dam and power drop would be located at Brantford, southeast of New Rockford.

North of Jamestown a dam and reservoir would be created and water carried through canals and lakes, including Spiritwood Lake, to the Sheyenne River, north of Valley City. A dam and power drop would be located on the Sheyenne seven miles up from Lisbon. In the southeast corner of Cass County the water would be diverted through a canal into the Wild Rice River and empty into the Red River south of Fargo in order to raise the level of that river.

Devils Lake would be served by a lateral diversion canal from the James River west of New Rockford.

Power plants would be operated at the different dams, and it is estimated that the electric energy produced and sold to cities and towns along the route will take care of a large part of the construction and operating cost of the project.

MISSOURI RIVER DIVERSION WILL SUPPLEMENT RED RIVER WATER SUPPLY

An adequate supply of water for Red River Valley farms, towns and cities is part of the program of all Missouri River Diversion plans, all centering on the Devils Lake region as storage basins for diverting the water into canals and reservoirs to connect with rivers having their outlet in the Red River.

A comprehensive program, some of it based on the fulfillment of the Missouri River Diversion Project, has been worked out by the State Water Conservation Commission.

The stream flow of the Red River is great during the spring run-off period, but becomes very low during other times of the year. A number of storage reservoirs on streams tributary to the Red are, therefore, needed. Some of these reservoirs will be fed by water from the Missouri River through diversion canals, some by pumping projects, and others by storing the surplus run-off water in the spring until later in the season, when additional water is needed by farmers and municipalities. This will also guard against banks of the streams overflowing during the run-off period.

A large reservoir is proposed in Steele County, northeast of Finley. The reservoir will be fed by Missouri water through canals from Devils Lake, through Stump Lake and a pumping project and canals through Steele County to connect with an arm of the Goose River. This reservoir will provide Portland, Mayville and Hillsboro with adequate water supplies for municipal purposes and pollution abatement. The reservoir will also provide great recreational facilities and assist in the regulation of the Red River.

The Stump Lake Pumping Project will supply Missouri water to the Turtle River running through Grand Forks County. Several small towns along this stream will be benefited with sufficient water for municipal purposes and for pollution abatement.

Other plans on the program for the Red River Valley are:

Fordville, Inkster, Forest River and Minto will be served with sufficient water supplies by two storage reservoirs: one at Fordville; another at Inkster. These storage basins can also be used for recreational purposes.

The program for improving the Park River in Walsh County calls for a larger storage basin at Park River for impounding the run-off water in the spring, straightening the channel and building adequate levees near Mandt to keep the stream in the channel. It may also be necessary to build a storage basin on the south fork of the river in Cavalier County in order to insure adequate water supplies during the drier years.

The proposed large reservoir on the Pembina River, south of Walhalla, will insure an adequate supply of water at Walhalla, Neche and Pembina for municipal purposes and pollution abatement. In addition to the recreational benefits downstream from the dam, this reservoir will furnish the recreational facilities of swimming, boating and fishing to a large area.

A regulating reservoir on the Tongue River, west of Cavalier, will furnish a continuous flow for municipal supply, pollution abatement and recreation for Cavalier and Bathgate. A possible alternate method of maintaining a flow in the Tongue River will be by diversion from the Walhalla reservoir.

IRRIGATION AND MUNICIPAL WATER SUPPLIES IN THE JAMES RIVER BASIN

While a land-classification survey has not been made of the James River Basin in North Dakota for irrigation purposes, it is known that large areas on both sides of the river are adapted for irrigation.

Most of the area is and has been under cultivation for more than half a century. The soil is fertile and will be very productive under irrigation.

Vast areas in the James River Basin can be served by gravity canals, when water from the Devils Lake unit of the Missouri River Diversion Project is diverted into the headwaters of the river through a canal from the Sheyenne River, near Harvey, by canal into the James River above New Rockford.

The James River Project will be two-fold in scope, irrigation and an adequate water supply for the cities and villages along the route of the river.

The cities of LaMoure and Oakes will, besides Jamestown, be amply supplied with pure water for all purposes. A diversion dam will be created immediately north of Oakes for irrigating 50,000 acres in that neighborhood and the southeast part of Sargent County.

The Baldhill Reservoir in the Sheyenne River will be backed up to a point northeast of Cooperstown and terminate a few miles north of Valley City. There will be plenty of water for municipal purposes, both at Valley City and Lisbon and the other towns and cities along the streams, besides what will be needed for irrigation.

Plans also call for a diversion dam originating in northern Richland County connecting the Sheyenne River with Maple River in Cass County and another diversion dam in the extreme southeast corner of Cass County, connecting the Sheyenne with the Wild Rice River.

The proposed pumping plant at Stump Lake in Nelson County, which will be fed by a canal connected with Devils Lake, will supply water to a

reservoir in the northeastern corner of Nelson County for diversion into the Goose River. The diversion canal from Stump Lake will also feed Turtle River.

Another project on this comprehensive program calls for the diversion of water from the James River above Oakes into the Wild Rice River in eastern Sargent County and a system of canals and reservoirs through the southwest corner of Richland County in an easterly direction until Hankinson is reached, when a turn to the south is made. Several lake reservoirs will be created immediately west of Hankinson and the canal system extended from there to the south border of the county for eventual connection with the Bois de Sioux River. There will be sufficient water diverted through these canals for irrigation and municipal purposes.

SLOPE AREA OFFERS IDEAL POSSIBILITIES FOR IRRIGATION

The Slope area is in more need of a permanent irrigation program than any other part of the state. The annual average rainfall in that area is less than 15 inches, records for many years show. But that is not the worst feature of what farmers and ranchers there have to contend with. The annual variation in rainfall is so great that it ranges from over 20 to as low as four inches. It is also of interest to note that during certain years, while a surplus of precipitation accumulated at Dickinson, deficiencies prevailed at Marmarth.

The soils in the Slope area are of good fertility. This has been demonstrated by the many good crops produced from time to time when sufficient precipitation was received.

The largest and most comprehensive plan now being investigated for the area is the Little Missouri River Slope Project with a reservoir and pumping plant on the Little Missouri River in Slope and Billings Counties for irrigating large areas of Stark, Hettinger and Slope Counties. The reservoir would be created by the construction of a dam in the vicinity of Bullion Butte on the Little Missouri River. The reservoir at normal pool level would have a surface area of approximately 7,000 acres and an ultimate capacity of 400,000 acre feet of water, and extend approximately 29 miles up the river.

The dam would be an earthen embankment and at the maximum section would be over 120 feet above the stream bed. The minimum top width is to be 20 feet with side slopes of 3 to 1.

The pumping plant placed at the eastern end of the reservoir will lift the water into a canal feeding two storage basins, one in Slope County and the other on the border lines of Billings and Stark. Large areas in the south and southwest part of Stark, northern Hettinger and northeast Slope are proposed for irrigation through a system of canals.

"In the valley of the Little Missouri River," a government report says, "the United States Geological Survey in 1922 investigated the river bottom lands to see what could be put under irrigation. According to this survey there are approximately 20,000 acres within a maximum lift of 35 feet, which are suitable." The report says further: "Soil is dark loam and very rich in appearance."

"Irrigation possibilities also exist in the valley of the Little Beaver Creek," the same report says. "It is estimated that there are 4,000 acres in this valley that can be incorporated in an irrigation project."

Other important projects for the area are the Little Missouri Reservoir in the southwest corner of Bowman County and the Bowman-Haley Project in southeastern Bowman and southwestern Adams Counties. Plans call for storage basins for both projects, one on the Little Missouri and the other on the Grand River. The Little Missouri project is to irrigate approximately 8,000 acres and the Bowman-Haley Project 7,400.

Adams County has another project in the northern part of the County, known as the Cedar Creek Project, with plans calling for a reservoir at the northwestern end of the Project. Several thousand acres can be irrigated from this reservoir through a system of canals.

Other proposed projects in this area are the Dickinson Reservoir on the Heart River, and the Heart Butte Reservoir in northwestern Grant for irrigating 12,000 to 15,000 acres further east along the Heart River in Grant and Morton Counties.

Another important project in the Slope Country is the Knife River Project, which will originate in Dunn County by the creation of the Bronco Reservoir with a 60,000 acre feet capacity. It is proposed to irrigate 16,000 acres of land tributary to the Knife River from the Dunn County line and across Mercer County until the river enters the Missouri.

SOURIS (MOUSE) RIVER INVESTIGATIONS

Recommendations of apportionment of the waters of the Souris (Mouse) River, which cross the international boundary to the Province of Saskatchewan, the State of North Dakota, and the Province of Manitoba were made by the International Joint Commission in their report approved at Ottawa on October 2, 1940.

Recommendations

In view of the incompleteness of available stream flow data, it is the judgment of the Commission that no permanent method of control and operation designed to regulate the flow and use of the waters of the Souris river and the tributaries should be adopted at this time. Flow measurements, now being obtained, are superior to those obtained prior

to the present drought cycle both as to standard of accuracy and continuous gaugings at critical points. By 1945 available flow records should be much more dependable and informative.

The Commission deems it advisable to continue the investigation of the principal questions embodied in the reference for such period of time as may be found necessary, and in the conduct thereof to avail itself of such technical service and advice as it may require. The Commission proposes to appoint a joint board of engineers consisting of two members, one to be drawn from the public service of the United States and one from the public service of Canada, to be officially designated as the International Souris River Board of Control; the board to be charged, during the intervening period prior to the adoption of permanent measures, with the responsibility of ensuring compliance with the interim measures set out hereinafter, and of submitting to the Commission regular semi-annual reports, and also such special reports as the Commission may require, or the board in its discretion may desire to file. In event of disagreement between members of the board, the matters in controversy shall be referred to the Commission for decision.

The Commission recommends interim measures, pending permanent settlement of the questions presented in the reference as follows:

1. The Province of Saskatchewan shall be permitted to continue its present use of the waters of the Souris River, and, in addition, to construct a reservoir with usable capacity not exceeding 4,000 acre feet, for the purpose of providing an adequate water supply for the town of Weyburn and the mental hospital at Weyburn.
2. The State of North Dakota shall be permitted to continue its present use of the waters of the Souris river, and, in addition, to construct a small reservoir on Long Creek, with capacity of 200 acre feet, to provide an adequate water supply for the town of Crosby, North Dakota.
3. A regulated flow of not less than 10 cubic feet per second shall be released from the State of North Dakota to the Province of Manitoba during the months of June, July, August, September and October of each year.
4. In the event that the State of North Dakota or the Province of Saskatchewan should desire to construct any additional storage works, or otherwise make additional use of the waters of the Souris river basin, application shall be made to the International Joint Commission for authority to construct the desired storage works or otherwise to make use of additional water.
5. The interim measures for which provision is hereinbefore made shall remain in effect unless subsequently qualified or modified

by the Commission prior to the adoption of permanent measures in accordance with the requirements of questions (1) and (2) of the reference.

After two years of operation under the terms recommended, the International Joint Commission on November 17, 1942 issued an Interim Order in the matter of the apportionment of the waters of the Souris (Mouse) river, as follows:

WHEREAS, pursuant to a Reference submitted to the International Joint Commission under date of January 15, 1940, by the Governments of the United States and Canada in respect of apportionment of the waters of the Souris (Mouse) River among the Provinces of Saskatchewan and Manitoba and the State of North Dakota, and in respect of the regulation of the flow and use of said waters, the Commission, under date of October 2, 1940 submitted its recommendations to the two Governments which recommendations were duly approved; and

WHEREAS, in accordance with the terms of the aforesaid approved recommendations, the Westhope Dam on the Souris River (also known as Dam 357) in North Dakota near the international boundary is so operated as to provide an average flow of not less than 10 cubic feet per second from the State of North Dakota to the Province of Manitoba during the months of June, July, August, September and October; and

WHEREAS, an average flow across the international boundary of 10 cubic feet per second has been found to be inadequate to supply minimum water requirements along said river in Manitoba during the period covered by the aforesaid months; and

WHEREAS, in the judgment of the Commission, the release of stored water at said dam could be increased moderately during said months without occasioning any serious damage to properties of the United States government or of United States nationals along said river;

NOW THEREFORE, as an interim measure it is ORDERED, that:

1. At times during said months when no surplus flood water is passing over the spillway of said dam, or when the spillage of flood water is less than 20 cubic feet per second, said dam shall be so operated that the average flow of the Souris River into Manitoba shall be 20 cubic feet per second.

2. At the request of the Deputy Minister of Mines and Natural Resources of the Province of Manitoba, the release of water from storage at said dam may vary, so as to average less than 20 cubic feet per second on some days and more on others; Provided, that the total release of water during said period, extending from June 1st to October 31st, inclusive, shall not exceed 6069 acre feet; and, PROVIDED FURTHER, that in determining such release no account shall be taken of water passing over the spillway at a rate in excess of 20 cubic feet per second; but

otherwise the release shall be reckoned on the basis of an average discharge of 20 cubic feet per second.

3. This Interim Order shall remain in effect until otherwise ordered by the Commission.

Dated at Washington, D. C. this 17th day of November, 1942.

(Signed) A. O. Stanley, U. S.
Chas. Steward, Canada
Roger B. McWhorter, U. S.
J. E. Perrault, Canada

LITTLE MISSOURI RIVER COMPACT

The consent of Congress has been granted to the states of Montana, North Dakota, South Dakota and Wyoming to negotiate and enter into a compact or agreement for division of the waters of the Little Missouri River. The following are the provisions of the Act granting consent of Congress:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That consent of Congress is hereby given to the States of Montana, North Dakota, South Dakota, and Wyoming to negotiate and enter into a compact or agreement not later than January 1, 1943, providing for an equitable division and apportionment among the States of the water supply of the Little Missouri River and of the streams tributary thereto, upon conditions that one suitable person, who shall be appointed by the President of the United States, shall participate in said negotiations as the representative of the United States and shall make report to Congress of the proceedings and of any compact or agreement entered into; PROVIDED, That any such compact or agreement shall not be binding or obligatory upon any of the parties thereto unless and until the same shall have been approved by the legislature of each of said States and by the Congress of the United States."

This Act was approved June 13, 1940. No action with respect to this compact has yet been taken by the four states. It is estimated that there are 24,000 acres of irrigable lands along the Little Missouri River in North Dakota. The equitable apportionment of the waters of this stream is a highly complicated problem and it is most important that this state be allotted its equitable share of the waters for irrigation and for general agricultural purposes.

YELLOWSTONE RIVER COMPACT

During recent years there have been a number of vexing problems in connection with the use of water in the Yellowstone River Basin. The Yellowstone River is an interstate stream and offers a necessity of life that must be rationed among those who have power over it. Its drainage

basin is located in the States of Wyoming, Montana and North Dakota, and each of those states has an interest in it which should be respected by the others.

As irrigation use increases within its valleys, the remaining supply of available water would be reduced. Some areas have been developed more rapidly than others which might equally be entitled to use water that is available, and it is necessary to settle the rights of each state as to the flow still remaining and divertible for use, if there is to be an adequate growth in each of the states. These state rights can be settled either through an action in the Supreme Court of the United States or by means of a state compact as provided in the Federal Constitution. Court proceedings of this nature are costly and slow, frequently requiring thousands of dollars and covering a span of years. Furthermore, when apportionment of water is sought in this manner it has been the general experience that the final result was achieved by substantial agreement between the states rather than the application of arbitrary formula by some disinterested tribunal.

The states whose residents are directly concerned have decided to try the state compact method of settling their respective rights to the waters of the Yellowstone River Basin. Some years ago representatives of the states met for the purpose of ascertaining what data could be assembled and what means could be employed to determine those rights.

On June 15, 1940, an Act was enacted, which reads as follows:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of Congress approved August 2, 1937 (50 Stat. 551), granting the consent of Congress to the States of Montana and Wyoming to negotiate and enter into a compact or agreement for division of the waters of the Yellowstone River, be, and it is hereby amended to provide that the consent of Congress is given to the State of North Dakota to negotiate and to enter into the compact or agreement therein authorized providing for an equitable division and an apportionment between the States of the water supply of the Yellowstone River and of the streams tributary thereto, upon condition that the representative appointed by the President of the United States under the Act of August 2, 1937, to participate in said negotiations as the representative of the United States and to report to Congress of proceedings and of any compact or agreement entered into, shall continue to represent the United States and to report under this Act: PROVIDED, That Such Act of August 2, 1937, is amended by striking out "June 1, 1939," and inserting in lieu thereof "June 1, 1943": PROVIDED, That such compact or agreement shall not be binding or obligatory upon any of the parties thereto unless and until the same shall have been approved by the legislatures of each of the said States and by the Congress of the United States: PROVIDED FURTHER, That nothing in this Act shall apply to any waters within or tributary to the

Yellowstone National Park or shall establish any right or interest in or to any lands within the boundaries thereof."

In addition to representatives of the three states, the Compact Commission has had as Federal representative Clyde L. Seavey, Commissioner of the Federal Power Commission. Through the services which Commissioner Seavey has made available, and through other Government departments and State agencies, a vast amount of data has been collected on land and water use, actual and prospective, in the Yellowstone River Basin. While the information so far collected has been characterized as the most complete accumulation used in any compact negotiations, it is recognized that there must be some flexibility in the allocation of water between the three states and that it is necessary to take into account not only the present actual needs, but also future requirements and possibilities. The Compact Commissioners have taken these factors into consideration.

At the Compact meeting held in Billings, Montana, on December 1, 2 and 3, 1942, the Commissioners of the three states prepared a draft of a compact which was deemed satisfactory to the three states concerned. This compact has been approved by the members of the Commissions of the signatory states and it is being presented to the State Legislatures for their approval. The next step then in the approval of this agreement is its ratification by the U. S. Congress prior to June 1, 1943.

MISSOURI RIVER BASIN COMPACT

Proposals have been made for a Missouri River Basin Compact to include the states of Wyoming, Montana, North Dakota, South Dakota, Nebraska, Colorado, Iowa, Kansas and Missouri to enter into a compact or agreement for an equitable diversion and apportionment among the above states to the waters of the Missouri River and of the streams tributary thereto.

Preliminary organization work has been initiated and the Missouri River States Committee formed with members appointed from Nebraska, South Dakota, North Dakota, Montana and Wyoming. The first meeting of the organization was held at Billings on July 29, 1942, where the Missouri River States Committee adopted a resolution to include the states of Iowa, Missouri and Kansas.

Mr. O. S. Warden of Great Falls, Montana, was elected temporary chairman of the Committee and Mr. M. Q. Sharpe of Kennebec, South Dakota, was elected temporary secretary.

COOPERATING AGENCIES

Both the state and the national organizations with whom the work of the State Water Conservation Commission is coordinated have shown their cooperation by contributing to this biennial report their own statements of work accomplished and proposed. The network which at first

seems confusing and over-lapping becomes clarified as it is studied, particularly if that study begins with the organization which is the clearing-house through which all plans must go to be coordinated to avoid duplication.

ACTIVITIES OF THE BUREAU OF RECLAMATION IN NORTH DAKOTA

The Bureau of Reclamation has under investigation in North Dakota a total ultimate irrigable area of 1,335,800 acres. Of this land it is estimated that 1,200,000 acres could be served by the proposed Missouri-Souris project. The remainder would be divided among 27 smaller pumping projects possible on the Missouri, and 5 on western tributaries of the Missouri.

Reclamation engineers estimate that irrigation water can be provided for 1,720,000 acres in North Dakota.

Before this area or any major part of it can be served by Bureau of Reclamation irrigation works, much more investigative work must be completed. A Missouri River compact, participated in by the states of North Dakota, Montana, South Dakota, Wyoming, Colorado, Nebraska, Iowa, Kansas and Missouri must be formulated in order to allocate and control the distribution of the water resources of the Missouri Basin.

Commissioner John C. Page, speaking at the Second Annual Convention of the North Dakota Reclamation Association at Mandan, said:

"The time is propitious for the water-minded leaders of these three states (North Dakota, South Dakota, and Montana) to take the leadership in the solution of this problem. A Missouri River compact, including also other states involved, would pave the way for an equitable distribution and control of that great stream."

The records show that the first surveys for potential irrigation development in North Dakota by the Bureau of Reclamation, then the Reclamation Service, began in the summer of 1902, only a few months after the Service had been created. These early surveys were brought to a head by the authorization for the Missouri Pumping project, which included the Buford-Trenton and Williston Divisions in Williams County.

Unfortunately, a series of circumstances resulted in the abandonment of the Missouri Pumping project, and in its final disposition by sale in 1923. The factors which brought about the project's failure stemmed largely from lack of precedent at that time, and a misunderstanding of the economics of irrigated agricultural production, as well as a wet cycle which caused farmers to lose interest in irrigation.

On the other hand, the value of irrigation has been demonstrated in nearby McKenzie County, where the North Dakota district of the Lower

Yellowstone project has been in operation since about 1910. Here approximately 150 irrigated farms with diversified crops have maintained their operators through drought and depression.

The present Buford-Trenton project, now being constructed, will avoid the errors of the earlier work. A series of dry years prior to 1939 impressed upon the residents of the area the value of irrigation in stabilizing agricultural production. The original area of 13,400 acres was extended this year to 14,800. Work is being pushed as rapidly as War Production Board priorities and available labor will permit. This development is planned to rehabilitate 265 farm families—150 on the project and 115 in the area.

The surveys now in progress can be placed into two general divisions; (a) projects involving the use of water directly from the Missouri River, principally by pumping; and (b) projects which would receive water from the western tributaries of the Missouri River.

Missouri River Projects (a)

In September, 1938, surveys of potential developments in the Missouri Valley below Fort Peck Dam in Montana, North Dakota and South Dakota, were started, and in February, 1942, a preliminary report was completed. This report presented data on a large potential development to serve the Crosby-Mohall area in northwest North Dakota and several small pumping projects along the Missouri River.

Missouri-Souris Project

Water released at Fort Peck Dam would be diverted from the Missouri River to the Medicine Lake Reservoir site on Big Muddy Creek, from which it would be pumped into the Souris Canal. This canal would serve the Crosby-Mohall area of over 1,000,000 acres of irrigable lands in Divide, Burke, Renville, Ward and Bottineau Counties. Two power plants along the Souris Canal would operate seasonal power to supplement the supply of Fort Peck power at the Grenora pumping plant. Return flow from the Crosby-Mohall area would be diverted from the Souris River near Simcoe to the Sheyenne River, and thence to Devils and Stump Lakes and to James River. In addition to its irrigation benefits, the Missouri-Souris project may supply supplemental municipal water for some cities and towns in North Dakota.

Missouri River Pumping Projects

These small pumping projects may be divided into two classifications, namely, those within reach of Fort Peck power, and those beyond reach of Fort Peck power. Sanish, North Dakota, is considered to be the easterly limit of use of Fort Peck power, and is the division point

between the two classifications. The following tabulation lists the possible projects:

PROJECT	LOCATION	AREA (Acres)
Within practicable reach of Fort Peck power.		
16 Projects	Montana	40,000
Williston*	Williams County near Williston	8,620
Birdhead	McKenzie County near Williston	2,900
Seneschal*	McKenzie County near Seneschal	1,820
Nesson*	Williams County near Hofflund	14,840
Goodall*	McKenzie County near Goodall	3,820

* Detailed surveys have been authorized.

PROJECT	LOCATION	AREA (Acres)
Beyond practicable reach of Fort Peck power.		
Shell Creek	McLean County near Sig	4,500
Independence	Dunn County near Sig	4,130
Fort Berthold	McLean County near Elbowoods	9,400
Old Agency Flats	McLean County near Nishu	9,210
Fort Stephenson	McLean County near Mannhaven	6,830
Mannhaven	Mercer County near Mannhaven	1,550
Hancock Flats	McLean County near Cole Harbor	5,030
Stanton	Mercer County near Stanton	3,450
Fort Clark	Mercer County near Fort Clark	2,750
Oliver-Sanger	Oliver County near Sanger	6,880
Painted Woods	McLean County near Painted Woods	3,680
Manley	Oliver County near Price	2,160
Wogansport	Burleigh County near Baldwin	2,400
Square Butte	Morton County near Harmon	2,750
Burnt Creek	Burleigh County near Arnold	1,940
Little Heart	Morton County near Mandan	3,930
Long Lake-Kyes	Emmons County near Livona	2,100
Horsehead Flats	Emmons County near Linton	9,710
Winona	Emmons County near Winona	5,950
Fort Yates	Sioux County near Fort Yates	7,650
Bismarck	Burleigh County near Bismarck	4,880
Mandan	Morton County near Mandan	2,920

Missouri River Tributaries (b)

In June, 1939, a general survey of the Western Tributaries of the Missouri River was started. In the course of this survey, various North Dakota streams were considered, and basin reconnaissances or surveys made of the individual stream basins.

Little Missouri River

A basin reconnaissance is in progress to determine the best use of the water resources of the basin for irrigation and flood control. Before any construction is undertaken, a compact between the States of North Dakota, South Dakota, Montana and Wyoming, is desirable.

Knife River

The basin investigation of Knife River revealed a promising project below a reservoir site about eleven miles below Marshall, North Dakota, and a final project report is expected in the near future. It was found that there are 14,380 acres of irrigable lands in the basin, with sufficient water for all uses. However, the cost of the project would be extremely high and for this reason the feasibility of the development is questionable.

Heart River

A project investigation is now in progress on the Heart River to determine the feasibility of irrigating lands in the basin below the site of a proposed dam in Township 136 North, Range 89 West.

Cannonball River

A reconnaissance survey on the Cannonball and Cedar Rivers has been in progress for some time. There are approximately 10,000 acres of irrigable lands on Cannonball River, and 8,000 acres on Cedar River. Development of these areas would require storage on both streams for irrigation, flood control and power.

Grand River

A preliminary draft of the basin survey report on Grand River has been completed. Only one irrigation development is possible in this basin in North Dakota, namely, the Bowman Project (also known as the Bowman-Haley Project), since only a small portion of the basin is in North Dakota. The results of the survey indicate that this project would be very costly and the feasibility is questionable for this reason.

Construction

The Buford-Trenton Water Conservation and Utilization Project in Williams County was approved by the President on September 23, 1939, under the terms of the Interior Department Appropriation Act of 1940. Construction surveys began in November, 1939, and actual construction was started on May 6, 1940. Labor was furnished by the Work Projects Administration and Civilian Conservation Corps until July, 1942, when the CCC camp was closed. A small force of WPA laborers is now carrying on construction. During the early construction period possibilities became apparent for bringing additional land under cultivation, at a comparatively small increase in cost, by making slight changes in canal locations and capacities. Authorization for enlarging the project area from 13,400 acres to 14,800 acres was granted by the President on August 7, 1942. The pumping plant and the main canal excavation have been completed. Excavation of drains, the lateral system, and installation of appurtenant structures are in progress. The War Production Board early in 1942 assigned this project a favorable rating, and unless this is disturbed or difficulties are experienced in

constructing a transmission line, it is expected that 8,100 acres of land will be placed under cultivation in the spring of 1943.

Funds for the Buford-Trenton expansion were made available by rescinding money previously allotted for the Bismarck project in south central North Dakota. The principal reason for rescinding the allotment was the unwillingness of owners in the Bismarck area to reduce large land holdings to 160 acres. Since both the Buford-Trenton and Bismarck projects were approved under the Great Plains Act, the transfer avoided many complications which would have arisen if funds for the Buford-Trenton expansion had been requested from other sources.

CORPS OF ARMY ENGINEERS

At the meeting of Upper and Middle Missouri Drainage Basin Committees "A" and "B" of the National Resources Board, held at Bismarck, North Dakota, December 15-16, 1941, several reports on authorized investigations for stream basins in the State of North Dakota were under preparation at that time, or had been submitted to the Chief of Engineers within the period to be covered in the Water Conservation Commission's biennial report. I am pleased to inform you at this time of the general purpose for which these basins are being investigated and the current status (September, 1942) of each of the reports. No investigations have been assigned for stream basins in North Dakota in addition to the investigations mentioned at the Bismarck meeting. A brief statement follows:

Multiple-purpose Investigations

(a) Yellowstone River, Wyoming, Montana, and North Dakota. This report was submitted to the Chief of Engineers on August 24, 1940. This report is now before the Board of Engineers for Rivers and Harbors, Washington, D. C.

(b) Missouri River Diversion Project, North Dakota. This report is under preparation by a Board of Officers consisting of the following:

Division Engineer, Upper Mississippi Valley Division, St. Louis, Mo.

Division Engineer, Missouri River Diversion, Omaha, Nebraska.

District Engineer, St. Paul, Minnesota.

District Engineer, Omaha, Nebraska.

(This is the Project which concerns a dam at Garrison.)

Flood Control Investigations

(c) Knife River. This report was submitted to the Chief of Engineers, September 12, 1942.

(d) Missouri River at Bismarck. This report is being reviewed by the Division Engineer, Omaha, and is scheduled to be submitted to the Chief of Engineers about November 1, 1942.

(e) Mandan. This report was combined with the report on the Heart River, which was submitted to the Chief of Engineers on September 23, 1941. (See item "F".)

Flood-control and Irrigation Investigations

(f) Heart River. This report was submitted to the Chief of Engineers on September 23, 1941.

(g) Bowman Irrigation Project, North Fork of Grand River, North Dakota and South Dakota. This investigation is now in preparation by the District Engineer, Omaha.

(h) Little Missouri River and tributaries, Wyoming, Montana, North Dakota and South Dakota. This report will be correlated with studies of the Bureau of Reclamation for this basin.

(The report of Delbert B. Freeman, Major, Corps of Engineers, from the Office of Division Engineer, Omaha, dated Sept. 18, 1942.)

NATIONAL RESOURCES PLANNING BOARD

Water Planning Activities: As far back as 1931 the Federal Government realized the necessity for establishing a procedure whereby the different points of view of the many local, state and federal agencies interested in and working toward the development of water basin plans could be combined into a unified program. A national drainage basin study was conducted in 1936 and the next year Drainage Basin Committees were organized. These committees are not organized to do work which other agencies normally perform. A distinctive function is to bring together and unify the local, state and federal points of view.

Missouri Basin: A tentative list of problems has been set up as those which must be solved before a comprehensive program for the Missouri Basins can be organized. Those which concern North Dakota are:

(1) Adjustment of Missouri headwaters' supplies above Canyon Ferry in Montana. Here the Montana Power Company, the State of Montana, and the Bureau of Reclamation came into a three-party agreement. The Bureau is completing a comprehensive investigation of all reservoir and irrigation potentialities, as well as sources of power.

(2) Adjustment of interstate controversies in the Yellowstone Basin. In 1940, the Yellowstone Compact Commission, originally created to include Montana and Wyoming, was enlarged to take in North Dakota. The compact is designed to make equitable allotments of the waters of the Yellowstone and its tributaries. North Dakota is interested in these waters for three purposes: irrigation along the Yellowstone within the state; a sufficient flow into the Missouri to support irrigation along the Missouri; and plans for diversion of waters from the Missouri.

(3) Coordination of the plans of the Bureau of Reclamation and the Corps of Engineers for development of the Yellowstone and its tributaries. These agencies have been making comprehensive studies for the use of the waters of the Yellowstone and its tributaries. Though their final results have not been released, it appears that they are not in accord. It is imperative that these plans be coordinated. The Yellowstone Compact Commission's efforts to allot water among its member states requires this coordination, if its program is to be executed.

(4) Development of the Great Plains tributaries. Economical development of meager and erratic water supplies of the Missouri tributaries in the central part of the Northern Plains presents a difficult problem. A few projects under the Case-Wheeler Act have been undertaken, and the Water Facilities Board has authorized fifteen projects in that area. Because of the amount of the non-reimbursable funds necessary to build such projects, this region requires most careful study. In future construction even larger proportions of non-reimbursable funds will be necessary and ultimate justification will rest on benefits to increasingly greater contiguous areas.

(5) Early determination of a general policy concerning priority in the use of waters of the Missouri River. Recent studies emphasize the potential conflict between navigation and other uses of the Missouri main stem and its principal headwaters' tributaries. Until principles of priority are determined it is likely that further major developments will be retarded.

The construction of the Fort Peck reservoir with more than 19,000,000 acre-feet of storage capacity was undertaken primarily for the purpose of regulating the discharge of the Missouri River for the benefit of navigation below Sioux City, Iowa, with incidental purposes of flood control, hydropower and irrigation.

The dry cycle of the past ten years showed that only two-thirds of the original estimate of water needed for navigation could have been maintained and this with difficulty. Meanwhile consumptive-use development during the past few years, and the current studies of potential developments indicate the possibility of vastly greater depletion of river flow than was anticipated when the Fort Peck project was undertaken. Current studies by the Bureau of Reclamation on the Missouri River diversion in North Dakota include 1,250,000 acres for irrigation. A large portion of these will be developed if a firm title to adequate water can be secured. All such developments are in direct competition with navigation. There is a pressing need for a statement of principles of priority in the waters of the Missouri. This must include the apportionment of the storage waters at Fort Peck, and such water as may be stored later.

The determination of this policy ties in with the work of the Yellowstone Compact Commission. It is also suggested that a Missouri River Compact be formed among all the states in the Missouri Valley. At a meeting of Upper Missouri Drainage Basin Committee "A" and "B" on December 16, 1941, a recommendation was made that a committee be formed composed of state representatives appointed by the Governors of Montana, Wyoming, North Dakota, South Dakota and Nebraska. Since that time it has been determined to include also the states of Iowa, Missouri and Kansas. The purpose of this committee is to "consider comprehensive water development and adjustment of problems in connection therewith, with a view to setting up a compact when this is practical." This committee is still in the process of organization.

(Condensed from the report of T. Hillard Cox, Senior Planning Technician, National Resources Planning Board, Omaha, October 28, 1942.)

NATIONAL RIVERS AND HARBORS CONGRESS

This is the country's oldest and largest waterway organization, organized in 1901. It acts in an advisory capacity to the National Congress of the United States and the government agencies charged with matters relating to river and harbor development, flood control, irrigation and reclamation, soil and water conservation. All projects relating to navigation, flood control and prevention, reclamation and irrigation, prevention of soil and shore erosion and stream pollution, hydro-electric power, recreational and related uses, are investigated and studied by a permanent projects committee, composed of an outstanding waterway expert representing each of the ten engineering divisions of the United States, with an additional member for the inter-mountain region of the West. Hon. Henry Holt represents the Missouri River Division on this committee.

The committee has recommended the following projects in the State of North Dakota be placed in Class I—"Endorsed," which means the Committee was convinced these projects were sound, needful, sufficiently advanced in status, and should be promptly constructed in the public interest:

Project No.	Name of Project
214-R	Heart River Valley Project
218-R	Baldhill Reservoir
219-R	Park River Flood Control Project
220-R	Pembina and Tongue River Project
297-R	Dickinson (Heart Butte) Reservoir
389-R	Nesson Irrigation Project
579-R	Missouri River Diversion
610-R	Knife River Valley Project

Placed in Class II—"Meritorious," which means the committee believed that although these projects were not sufficiently advanced in

status to warrant their then endorsement, they were meritorious and open for further consideration:

Project No.	Name of Project
607-R	Forest River Project
608-R	Grand River Project
624-R	Goose River Project

The committee also recommended for survey two projects located partly in North Dakota: a survey of the drainage basin of the Red River of the North, and of the Little Minnesota River Diversion Project. At a later meeting of the committee this last project was placed in Class III—"Expeditious Report on Authorized Survey Requested."

The projects listed above, which have been recommended by the Projects Committee and endorsed by the N. R. & H. Congress, in addition to others considered at previous sessions, will be vigorously pressed for inclusion in the Government's public works program, during the present emergency if they are of sufficient value to the war program, or during the post-war period.

(Condensed from the report of William H. Webb, Executive Vice President of the National Rivers and Harbors Congress, Nov. 5, 1942.)

FARM SECURITY ADMINISTRATION

The Wheeler-Case Act: Under the provisions of this Act, as amended, the Secretary of Agriculture is authorized to:

(1) Conduct investigations and surveys of projects proposed under the authority of the Act, in cooperation with the Bureau of Reclamation.

(2) Arrange for the settlement of the projects on a sound agricultural basis and, insofar as practicable, the location thereon of persons is needed.

(3) Extend guidance and advice to settlers thereon in matters of farm practice, soil conservation and efficient land use.

(4) Acquire agricultural lands within the boundaries of such projects with titles and at satisfactory prices.

(5) Arrange for the improvement of lands within the project boundaries including clearing, leveling, and preparing them for the distribution of irrigation water.

(6) Enter into the repayment contracts provided by the Act and take over the administrative duties connected with the project after the Secretary of the Interior announces that the project is ready for operation.

Irrigation and the War

By reason of war needs, first priority emphasis is placed upon action that will increase food production. This war emphasis has meant a program in which the preparation of the land to receive and use the

water is of equal importance with provision of water. It has meant the concentration of all project power and personnel upon the development of projects where water is or will be available to quick preparation, such as the

Buford-Trenton Project

This project is the only water conservation and utilization project approved under this Act which is now under construction in North Dakota. Originally it was to cost (estimated) \$1,500,000 for 13,400 irrigable acres. An expansion of the project permitted the development of an additional 1,400 acres and the total estimated cost would be \$2,116,000.

Prior to the inauguration of the Project here, the lands were farmed by 32 farm operators. Of the 14,800 acres, 9,357 acres was crop land and 5,433 acres was brush land and grass land used for pasture. The common practice was to summer fallow approximately 50% of the crop acreage each year, leaving 4,678 acres of land on which crops were produced each year. The value of the crops thus produced, based on average yields and prices, was approximately \$42,821. The value of the pasture land when used for pasture purposes was approximately \$1,500, making a total value of crops under dry land practices of \$44,321 per year.

Starting in 1943 the irrigable land under the Buford-Trenton Project will be used primarily for the raising of feed crops to stabilize the livestock economy of the area in which the project is located. Approximately 20% of the irrigable acreage will be seeded to alfalfa. Oats, Barley, Corn and other feed crops will utilize another 30%. Approximately 10% of the irrigable acreage will be used for irrigated pasture mixtures and for building locations, gardens and shelterbelts. The remainder will be used for such crops as potatoes, beans, flax, and other intensive crops which will yield a high return per acre to the operator. All are essential to the food and fiber production goals of the "Food for Victory" program.

The Average Family Unit

The size of the individual irrigated unit is approximately 100 acres which will be adequate to support an average family. This means that there will be 147 operators on irrigated units after the development has been completed.

The use of the irrigated lands will be integrated with the use of approximately 65,000 acres of grazing land when the adjustments are complete in the surrounding area. Availability of grazing land increases the number of farm families that can be settled on the irrigation project. Small feed base units will also be a factor in stabilizing the surrounding area.

During the present emergency building construction is being held to an absolute minimum consistent with a maximum contribution to the

"Food for Freedom" production goals of the community. A temporary two-room house for one out of four units, together with leases to surrounding farmers, will place approximately 4,000 acres under an intensified irrigated cropping program during 1943. The balance of the acreage will be dry-farmed until such time as development activities make irrigation possible. The entire project should be irrigated in 1944.

In general, the area adjustment of the project development will bring a shift from risky one-crop wheat farming in the surrounding area to a more extensive type of agriculture in which livestock production dominates. It is difficult to estimate the value of the crops which will be produced when the project is operated under irrigation. However, based on average yields and prices, the 14,800 acres will yield approximately \$364,560 worth of produce, which, compared with the \$44,321 average produced under dry land farming shows an increased value of crops through development and irrigation of \$320,239 a year.

(Condensed from the report of C. H. Willson, Area Director, Farm Security Administration, Denver.)

Water Facilities Section

To date only a few water facility loans for irrigation purposes have been made in North Dakota. All of the loans have been for installation of relatively small individual pumping plants. The majority of the loans have been for the purpose of providing water for house hold use, for livestock and for garden irrigation.

Irrigation facilities are authorized in Little Muddy Creek, Upper Cannonball, the Upper portion of Hard River, Timber Creek, Clear Creek, Charbonneau Creek, and Cherry Creek Watershed.

(Extracts from a letter from Cal. A. Ward, Regional Director, Lincoln, Nebraska, dated October 31, 1942.)

BUREAU OF AGRICULTURAL ECONOMICS

Water Facilities Program: The Act under which the Water Facilities Program is conducted in North Dakota, among the seventeen western states, was enacted by Congress in recognition over a period of many years of the need for small water facilities in these states. Section 1 of the Act summarizes the evils resulting from wastage and inadequate utilization of water resources on farm and grazing lands in this area, resulting in decline in standards of living and excessive dependence upon public relief. The objective of the Act was to have a planned program to "effectuate and promote" proper water-land use in the arid and semi-arid areas. The Secretary of Agriculture is authorized to keep current a program of projects for the construction and maintenance in approved areas of ponds, reservoirs, wells, dams, pumping installations and other facilities for water storage or utilization.

The Act and its amendments provided funds for small water facilities with a maximum of \$50,000 of federal funds on any one project, but generally costing less than \$2,000 each. Most of the irrigation development would be to furnish supplemental water supplies. The program is now directed toward increasing the types of crop and livestock production needed for the war effort. The facilities constructed under the Act must promote proper land use and not encourage the cultivation of submarginal lands.

The services of the program may be made available to any area and may originate from any source but should be based on the desire of the local people. The program is conducted by the Bureau of Agricultural Economics and the Farm Security Administration. The former conducts the investigations and area planning upon which to base recommendations for proper land-water use. The latter prepares the detailed plans for the facilities and handles the loan portion of the program.

The Water Facilities Program has been in operation since 1939. Areas approved for operations during this time in North Dakota are the Upper Cannonball Watershed in April, 1939, the Little Muddy Watershed in February, 1940, the Mackenzie Area in August, 1940, and the Upper Heart River Watershed in September, 1940.

Construction throughout the state of farmstead water facilities, which also include irrigation of up to one acre of garden and domestic and livestock water supplies at the farmstead, were authorized in January, 1942.

Facilities for flood irrigation and water-spreading, and for farmstead and range livestock are recommended by the area plans for western North Dakota. These include windmills, small reservoirs, and spring developments, irrigation by pumping from stream channels, sub-irrigation by means of channel checks, and reservoirs for storage of water for irrigation.

Funds for development under the Water Facilities Program, which are largely reimbursable, are made available to eligible farmers in approved areas by the Farm Security Administration. Loans bear interest at 3% with a repayment period up to twenty years, although they can be repaid before the due dates if desired.

(Report of Edward C. Gwillim, Regional Water Utilization Supervisor, Denver, dated October 22, 1942.)

NATIONAL RECLAMATION ASSOCIATION

The National Reclamation Association, representing as it does the seventeen arid and semi-arid states of the West, was organized in 1932 to serve as a clearing house for all of the irrigation, reclamation and water conservation interests of the nation, and to advocate, represent and protect those interests.

The Association is a voluntary, non-profit association "to promote the cause of reclamation by irrigation." Its membership is composed of the governors, state water engineers or commissioners, United States senators and representatives in Congress from the member states; also of individuals and organizations including irrigation districts, water users associations, chambers of commerce, commercial organizations, farm organizations, civic clubs, labor groups, companies and corporations, and all civic associations having a membership of twenty-five or more members, which are interested in the development of the various states by irrigation.

The Association is governed by a board of directors composed of one member from each of the seventeen states chosen in caucus by the delegates of the respective states who are in attendance at the annual meetings. The resolutions which the members approve at the annual meetings provide a program of work.

The National Reclamation Association maintains an office in the nation's capital where an effort is made to translate the association's program into accomplishment. Largely as the result of such organized and intelligently directed effort, the western half of the nation, which must depend upon irrigation and water conservation for its future development, is gradually making the nation conscious of the national benefits of a well-considered program of federal irrigation, reclamation and water conservation for the arid and semi-arid states of the West.

Because of the Missouri River and its tributaries North Dakota can become one of the major beneficiaries of a forward-looking federal reclamation program, providing her people desire and prove the economy of such development.

(Report of F. O. Hagie, Secretary-Manager, National Reclamation Association, Washington, D. C., dated August 28, 1942).

SOIL CONSERVATION SERVICE

The U. S. Soil Conservation Service, a bureau of the U. S. Department of Agriculture, had its beginning in North Dakota in March, 1935, when the Service took over the operation of several CCC camps from the U. S. Forest Service. These camps were constructing water conservation dams. Their work was expanded to include soil erosion control. Demonstration projects were established in Walsh County in 1935, and in Bottineau County in 1936, to try out various soil and water conservation practices.

In 1937 the State Legislature enacted the North Dakota Soil Conservation District Law. Under this law, Soil Conservation Districts have been organized in all or parts of Williams, McKenzie, Hettinger, Slope, Bowman, Sioux, Grant, Burleigh, Kidder, Sargent, Mountrail, Bottineau, McHenry, Wells, Eddy, Benson, Towner, Nelson, Grand Forks,

and Walsh counties. Districts are being organized in Stark, Adams, Griggs, and Dickey Counties.

The Soil Conservation Service, among other practices used to establish a more stable agriculture on individual farms, assists in developing water spreading and irrigation for supplemental feed supplies, and developing necessary livestock water. Approximately 600 small dams and dugouts for livestock water have been constructed under direct supervision of the Service since the beginning of the district program in 1937. This includes 113 such developments on government owned land. Whenever possible, overflow is used for irrigation and water spreading. The above figures do not include a large number of springs and wells for domestic and livestock use. Numerous small pump irrigation and flood irrigation systems have been laid out and constructed within districts. These occur mostly in Sioux, Grant, Hettinger, McKenzie, Williams and Mountrail Counties.

Until July 1st, 1942, the Service was furnishing technical assistance to the Farm Security Administration in a joint Water Facilities Program in North Dakota. Under this program, 22 small irrigation projects were laid out and constructed, and 86 wells for domestic and livestock use were drilled or dug.

The Service has been assisted by, and has worked in close cooperation with the Extension Service, Experiment Stations, Farm Security Administration, Bureau of Agricultural Economics, North Dakota State College of Agriculture, and other agricultural agencies. It has received the fullest cooperation of the State Water Conservation Commission, and the Service has attempted in all cases to assist the Commission within the limits of program and resources.

The Service is in sympathy with the Commission's program of water conservation for stabilizing agriculture in North Dakota. It is a proven fact that this can be done by making the best use of the soil and water resources available.

(From the report of A. D. McKinnon, State Conservationist, Soil Conservation Commission, dated Nov. 9, 1942).

AGRICULTURAL ADJUSTMENT AGENCY

Water Development Practices Completed in North Dakota under the 1941 AAA Program: Farm dams and reservoirs constitute a major portion of these developments, especially in our western range area. All of these developments must have prior approval by county AAA committees before farmers start the practice. For farm dams and reservoirs the project is adequately staked and a survey made so that the operator is given as much assistance as possible in completing a worthwhile practice. A sketch is also left with the farmer which describes

in detail the various steps he is to follow in completing the development. The State Water Conservation Commission through its chief engineer has been very helpful and cooperative in assisting with specifications for farm dams and reservoirs. The state AAA committee has made a practice of submitting plans for all large dams to the Water Commission engineer for approval before granting approval to the operator. We believe that this has done much toward impressing not only farmers but county AAA personnel with the need for following specifications set up by experienced engineers in completing dams. The fact that in recent years very few AAA dams have been lost is an indication that this is true.

During 1941 we had difficulty getting approval from federal agencies to complete dams and reservoirs within the Souris River watershed. The State Water Conservation Commission has given us assistance in getting approval to complete a limited number of structures in this area, and we feel that now it will be possible for farmers to complete such small farm dams and reservoirs as are necessary to provide an adequate supply of water for farm livestock.

In addition to actual water development practices North Dakota farmers under the AAA program are carrying out such water conservation practices as pit cultivation on summer fallow acreage, strip cropping, both straight and contour, and some water spreading work. These directly affect water conservation. Areas not suited for continuous cropping are being re-seeded to grass which conserves moisture, and properly using native grasses is being stressed.

Some gully-control work has been started by building small check dams in the gullies and following this with practices necessary to re-vegetate the gully area and prevent erosion. Other practices sponsored are: application of super-phosphate, planting trees, cultivating trees, and control of perennial noxious weeds.

Encouraging these practices is, in the opinion of the state AAA committee, a very important part of the AAA program contributing to the stabilizing of agriculture in North Dakota.

(Report of the State AAA Committee by John Bruns, Fargo, Acting Chairman. Practices performed in 1942 were not available in time for this report, dated Oct. 3, 1942).

WATER DEVELOPMENT PRACTICES COMPLETED IN 1941

COUNTY	Earthen Tanks or Reservoirs			Development of Springs		Wells	
	No. of Farms	No. Tanks Completed	Total Cubic Yards	No. of Farms	No. of Springs	No. of Farms	No. of Wells
Adams	17	17	12,423	---	---	2	2
Barnes	1	1	96	---	---	---	---
Benson	4	4	3,756	---	---	---	---
Billings	71	91	80,483	---	---	1	1
Bottineau	27	27	38,198	---	---	---	---
Bowman	66	79	65,665	2	2	2	2
Burke	4	4	2,619	---	---	1	1
Burleigh	24	24	16,189	1	1	10	10
Cass	---	---	---	---	---	---	---
Cavalier	7	7	4,769	---	---	---	---
Dickey	1	1	301	---	---	---	---
Divide	7	7	3,080	---	---	1	1
Dunn	31	32	14,965	18	18	3	3
Eddy	---	---	---	---	---	---	---
Emmons	163	163	88,179	5	5	1	1
Foster	---	---	---	---	---	---	---
Golden Valley	60	63	55,529	15	16	3	3
Grand Forks	---	---	---	---	---	---	---
Grant	91	91	62,747	9	9	5	5
Griggs	3	3	1,992	---	---	---	---
Hettinger	12	12	9,458	---	---	---	---
Kidder	---	---	---	1	1	4	4
LaMoure	---	---	---	---	---	---	---
Logan	5	5	3,429	2	2	---	---
McHenry	3	3	1,848	1	1	---	---
McIntosh	26	26	25,136	2	2	---	---
McKenzie	105	131	126,588	33	35	---	---
McLean	4	4	7,481	1	1	---	---
Mercer	48	51	28,668	14	14	1	1
Morton	231	234	142,457	9	9	1	1
Mountrail	30	30	21,134	6	7	4	4
Nelson	2	2	1,096	---	---	---	---
Oliver	9	9	3,777	4	4	1	1
Pembina	4	4	5,393	---	---	---	---
Pierce	3	3	740	---	---	1	1
Ramsey	1	1	350	---	---	---	---
Ransom	---	---	---	---	---	---	---
Renville	3	3	1,077	---	---	---	---
Richland	---	---	---	---	---	---	---
Rolette	1	1	230	---	---	---	---
Sargent	---	---	---	---	---	---	---
Sheridan	---	---	---	---	---	2	2
Sioux	39	47	59,633	9	9	---	---
Slope	59	65	33,887	9	9	1	1
Stark	35	35	25,050	---	---	2	2
Steele	---	---	---	---	---	---	---
Stutsman	10	10	2,519	5	5	---	---
Towner	---	---	---	---	---	---	---
Trail	---	---	---	---	---	---	---
Walsh	21	21	24,011	---	---	---	---
Ward	9	9	2,951	2	2	---	---
Wells	9	9	7,529	2	2	---	---
Williams	14	14	8,620	2	2	2	2
STATE	1,260	1,343	999,103	150	154	48	48

**UNITED STATES GEOLOGICAL SURVEY
DEPARTMENT OF THE INTERIOR**

Activities of the Mapping Division in North Dakota: The U. S. Geological Survey has completed the topographic survey of the Heart River bottom lands between Mandan and the proposed Heart Butte dam site. This work makes available very valuable information for use in planning and designing the proposed Heart River irrigation development that is being investigated by the U. S. Bureau of Reclamation.

During the past two years several new quadrangles have been printed and released for distribution, showing the topography in Morton, Rolette, Cavalier and Pembina counties.

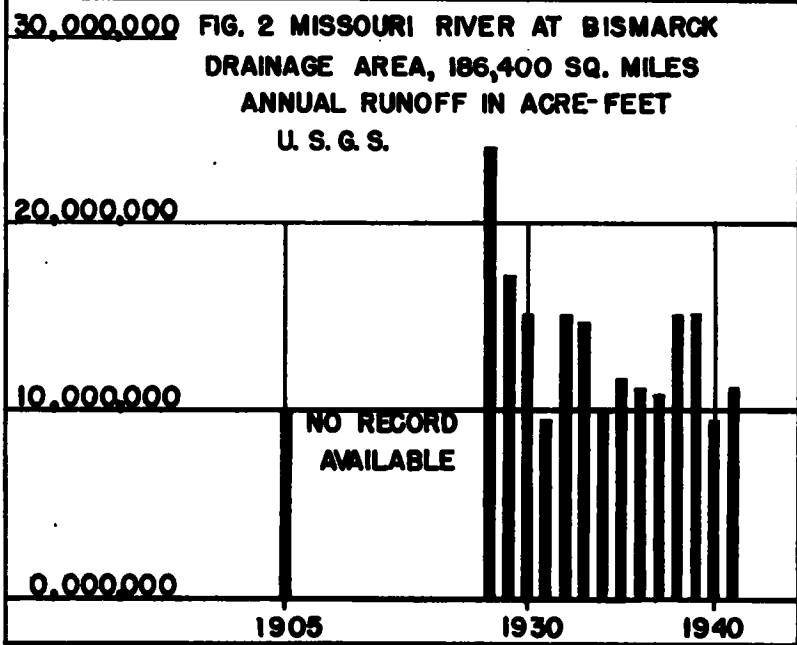
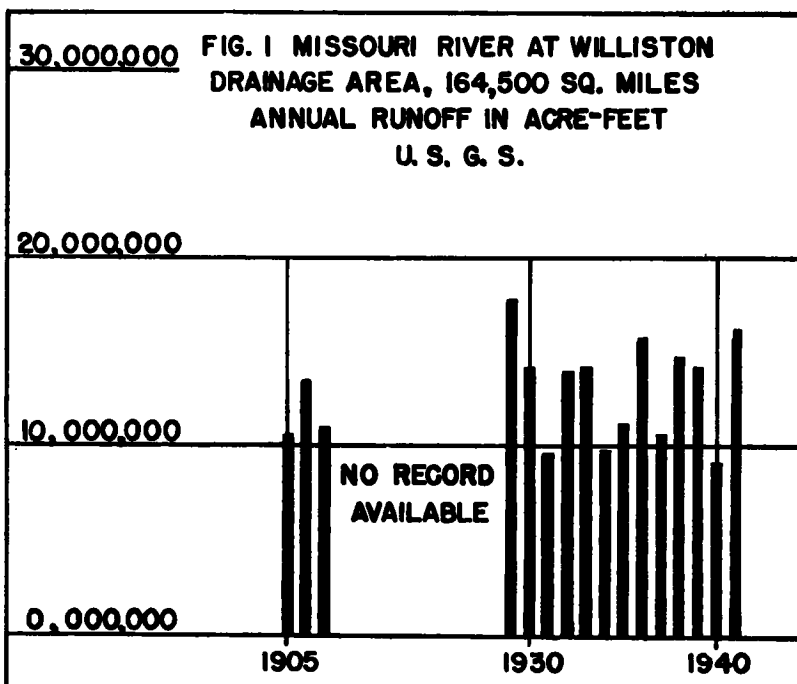
All topographic and hydrographic surveys were made on a 50-50 cooperative basis between the U. S. Geological Survey and the State Water Conservation Commission.

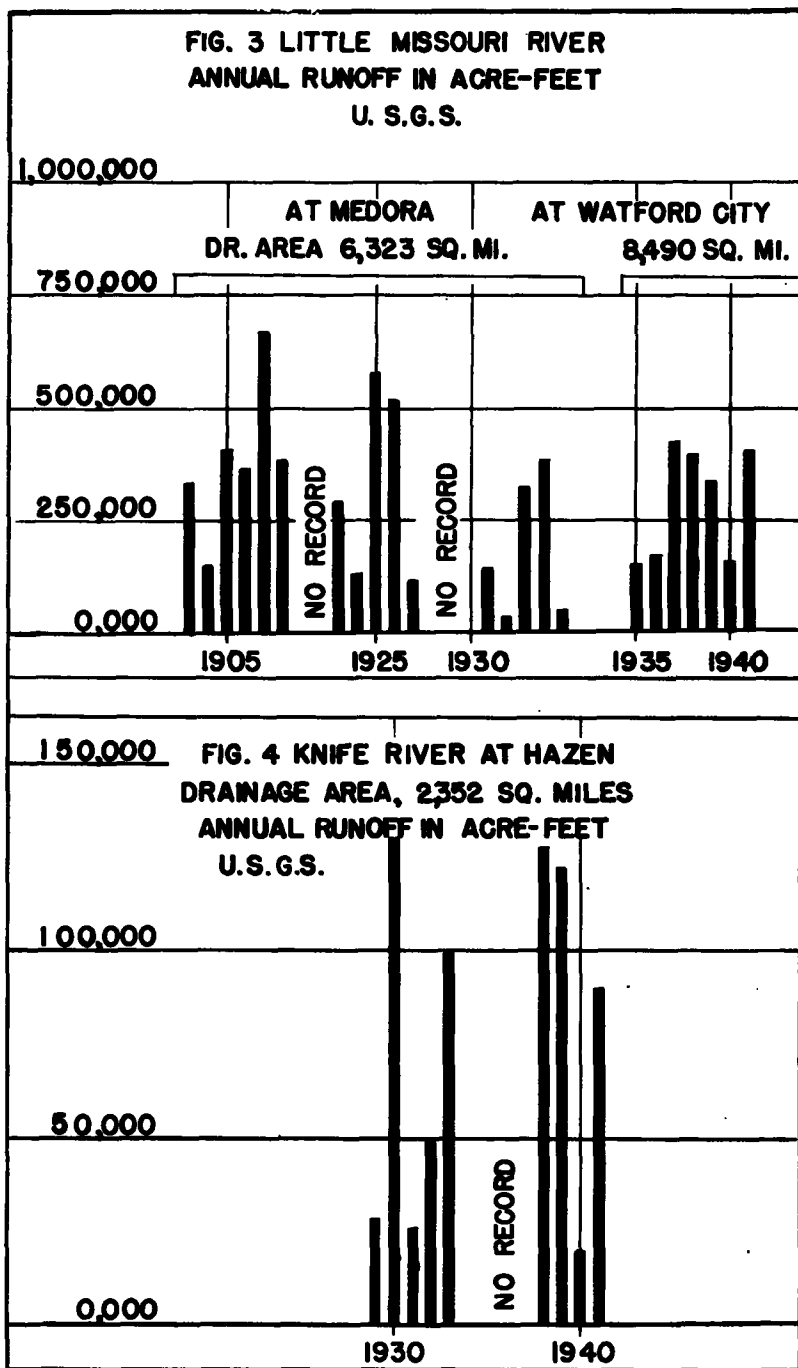
Water Resources Branch, Hydrographic Division: This work includes installation of stream gages, automatic recording devices, current meter measurements, gage reading, and compilation of data collected and discharge records. The stream gaging work is being conducted by the Geological Survey through the St. Paul, Minnesota; Rolla, Missouri; and Helena, Montana, Division Offices. Other federal agencies cooperating are: the U. S. War Department, U. S. Department of State, and the U. S. Fish and Wildlife Service.

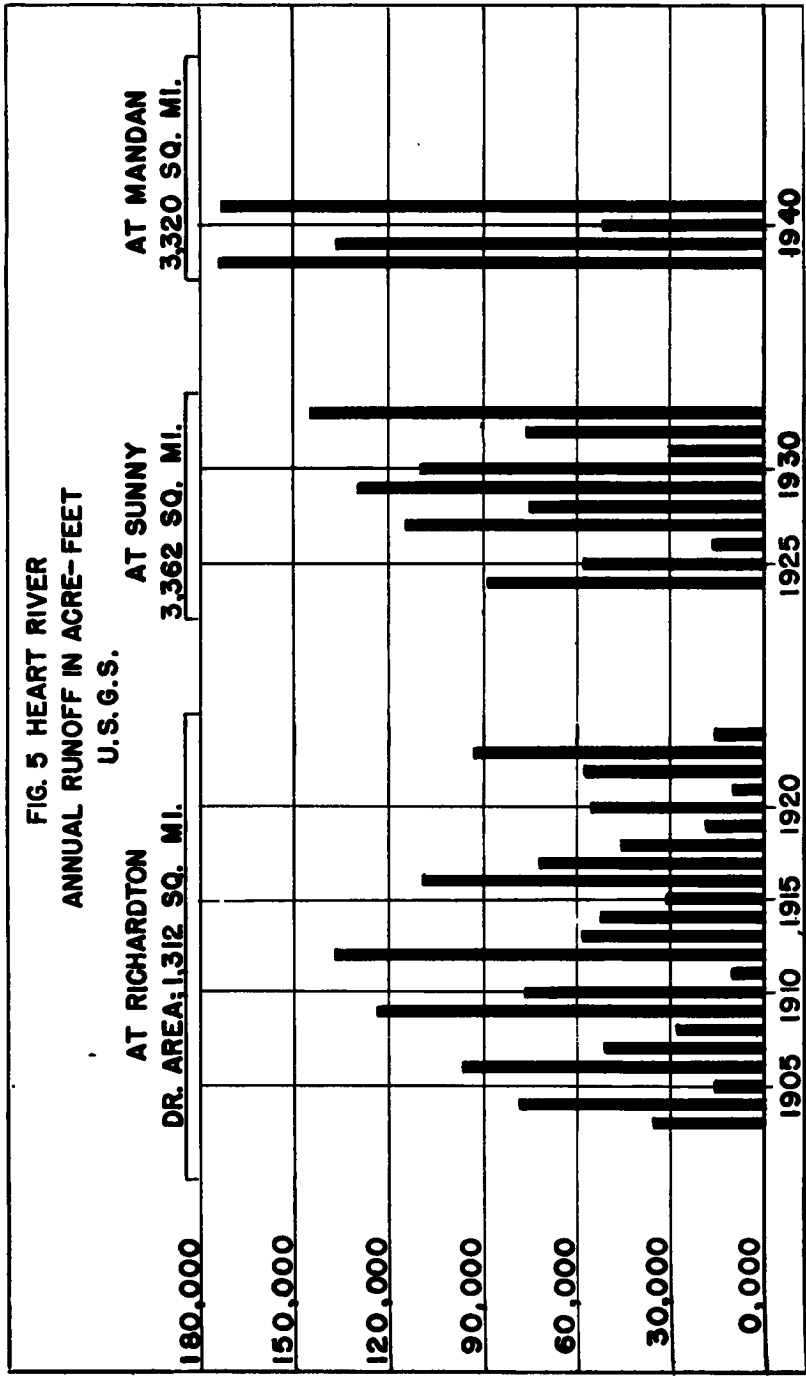
This state-wide program is necessary so that authentic records of the surface run-off from streams and rivers of North Dakota may be known. The records are published in the U. S. Geological Survey Water Supply papers and are available to those concerned with irrigation, flood control, and municipal uses.

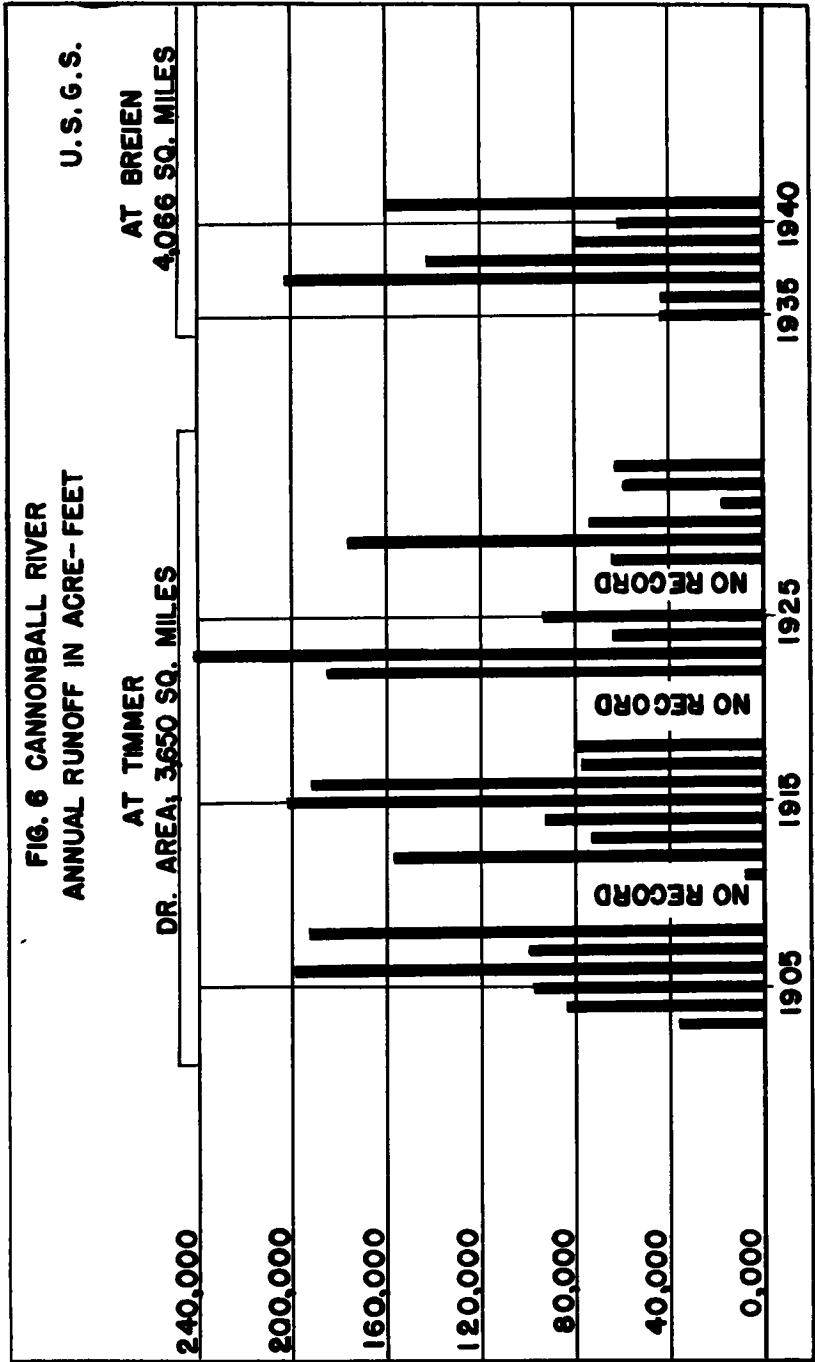
The following graphs, showing run-off records, have been compiled from U. S. Geological Water Supply publications, U. S. Army Engineers' reports, and from the State Engineer's files. Figures 1 to 26, inclusive, show the drainage area in square miles and annual run-off in acre feet. In the left-hand vertical column of the graph, is shown the discharge in acre feet. On the lower side is shown the period of years records are available. Variations of annual run-off in acre feet are indicated by the heavy black vertical lines. (See pages 55 to 70).

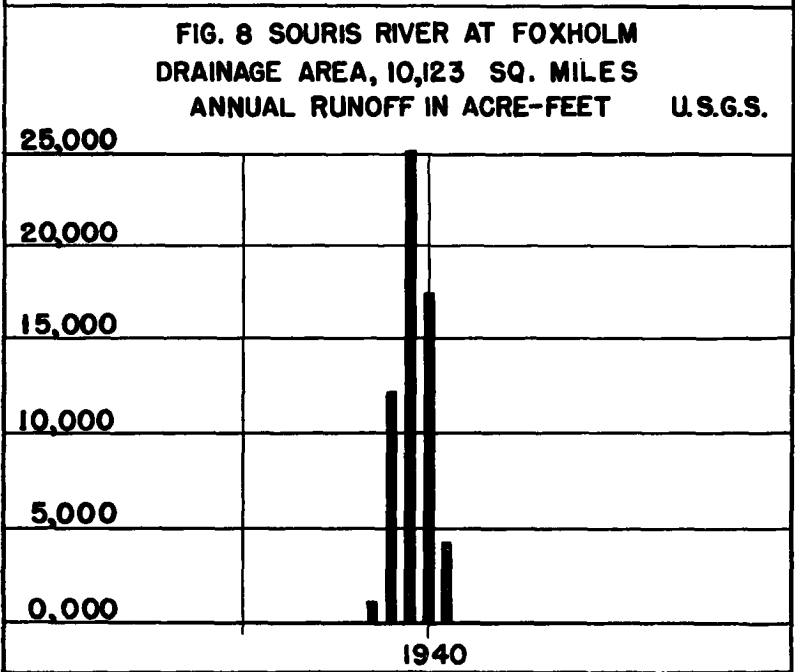
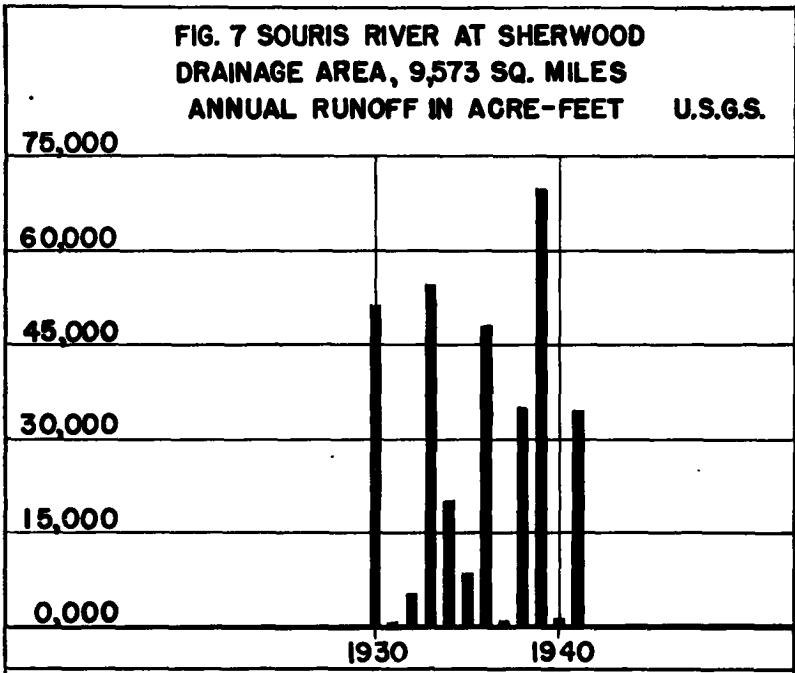
Figures 27 to 37, inclusive, show annual rainfall in inches as compiled from the U. S. Weather Bureau reports. The vertical left-hand scale shows rainfall in inches. The lower horizontal scale at the bottom of the graph indicates the yearly records. Annual variations are shown by the heavy black vertical lines and represent the total annual precipitation in inches. (See pages 71 to 75).

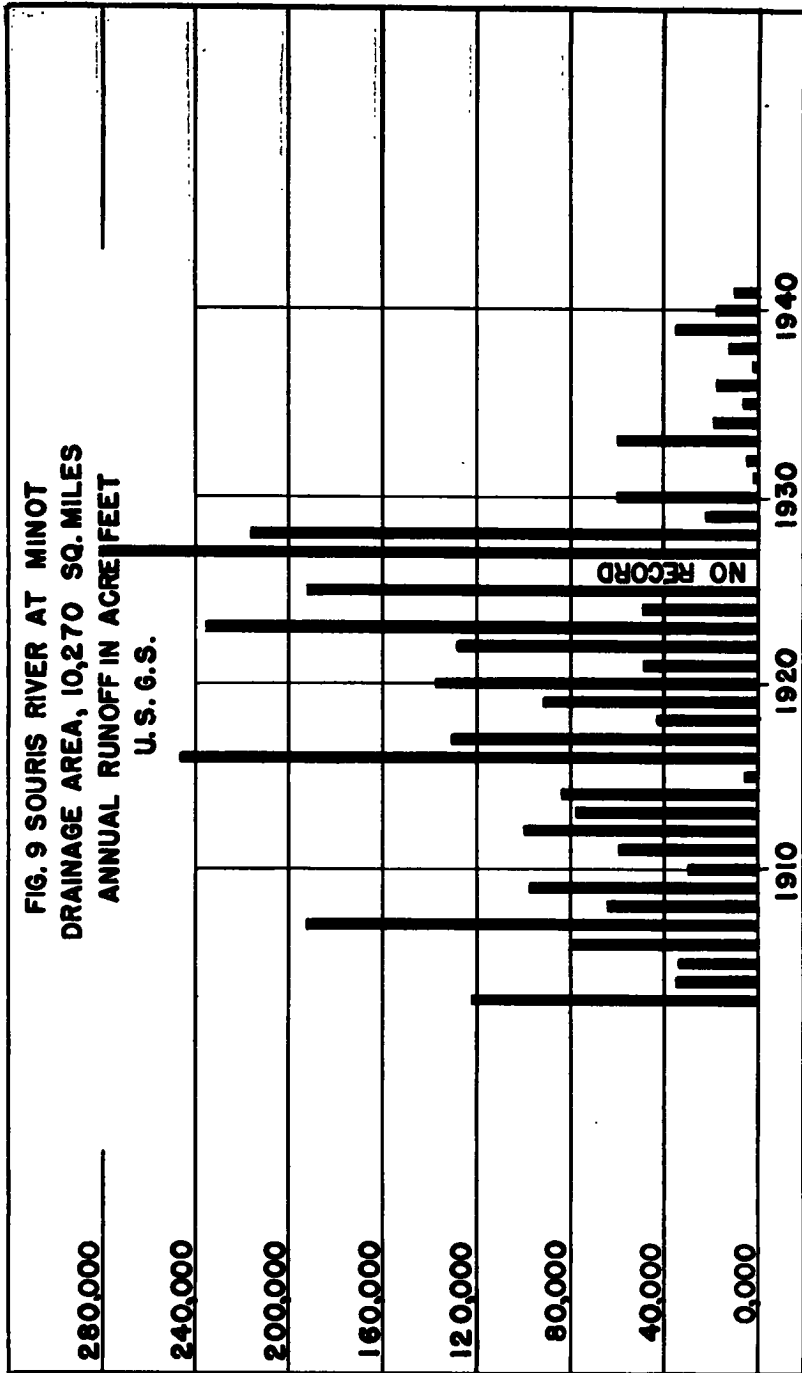




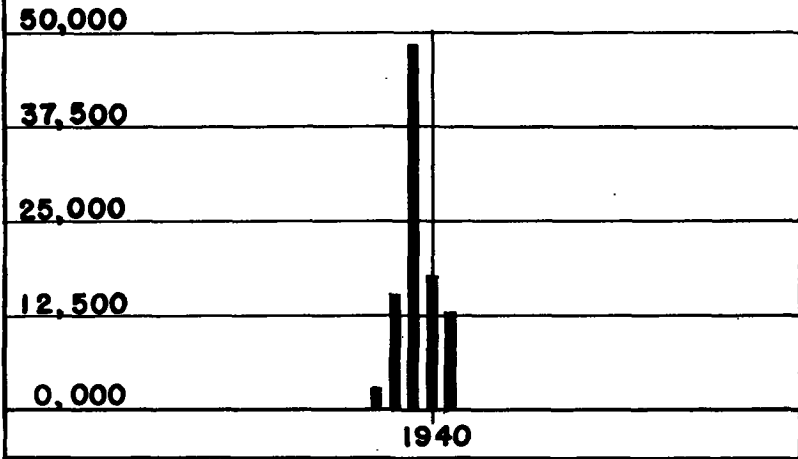




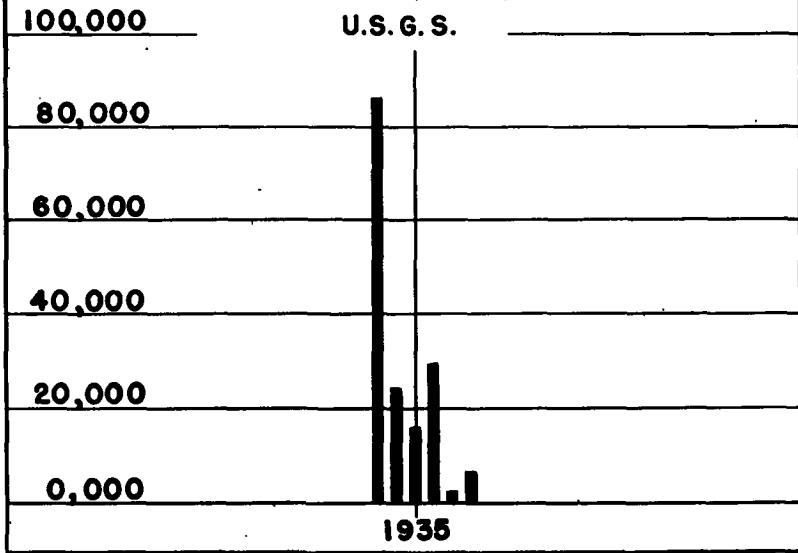




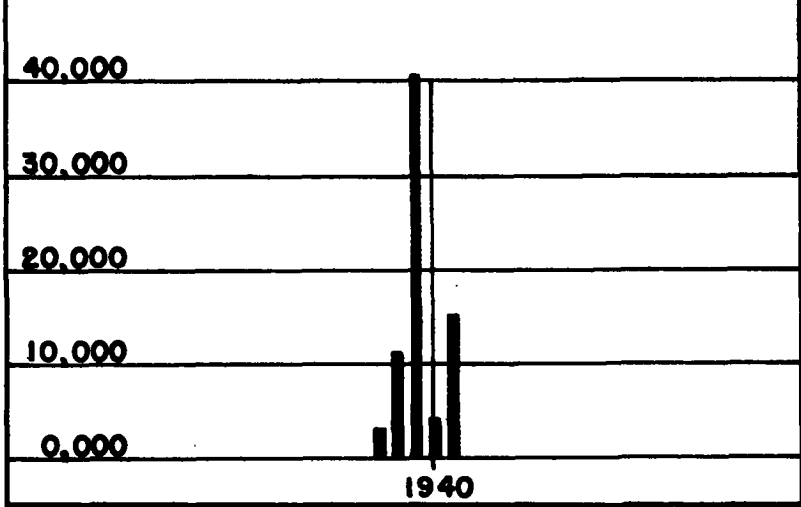
**FIG. 10 SOURIS RIVER AT VERENDRYE
DRAINAGE AREA 12,196 SQ. MILES
ANNUAL RUNOFF IN ACRE-FEET
U. S. G. S.**



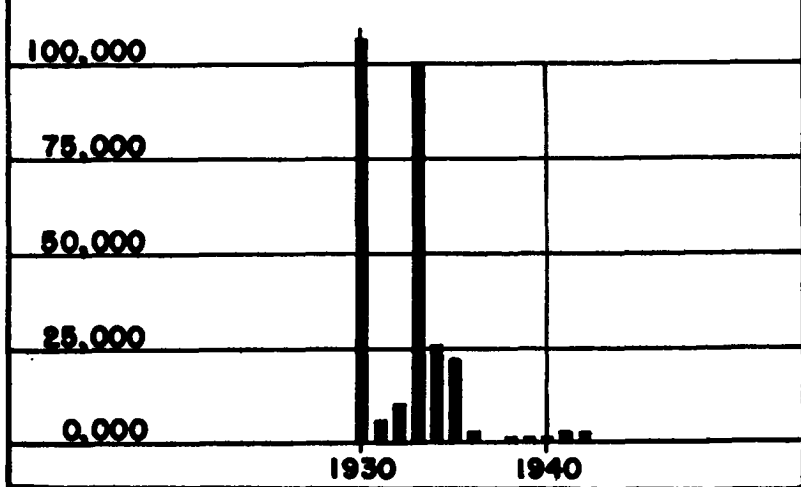
**FIG. 11 SOURIS RIVER AT TOWNER
DRAINAGE AREA, 13,200 SQ. MILES
ANNUAL RUNOFF IN ACRE-FEET
U. S. G. S.**



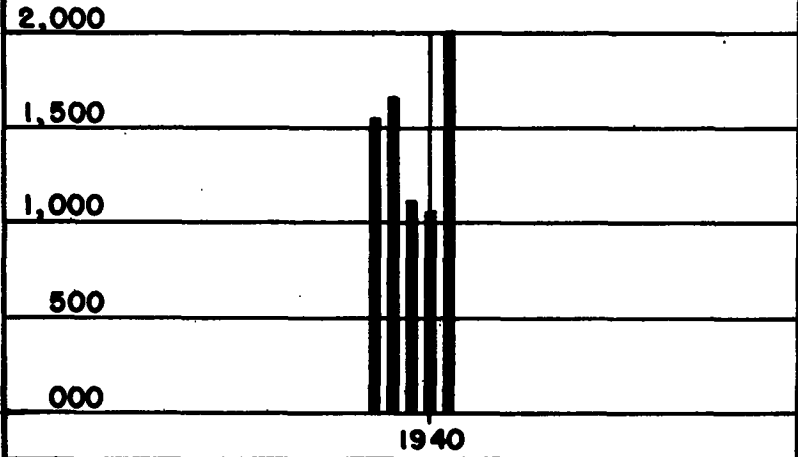
**FIG. 12 SOURIS RIVER AT BANTRY
DRAINAGE AREA, 13,371 SQ. MILES
ANNUAL RUNOFF IN ACRE-FEET
U.S.G.S.**



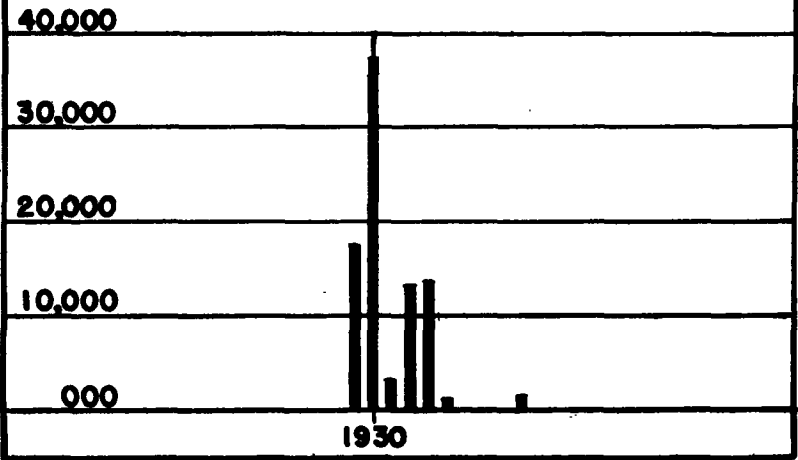
**FIG. 13 SOURIS RIVER AT WESTHOPE
DRAINAGE AREA, 17,566 SQ. MILES
ANNUAL RUNOFF IN ACRE-FEET
U.S.G.S.**



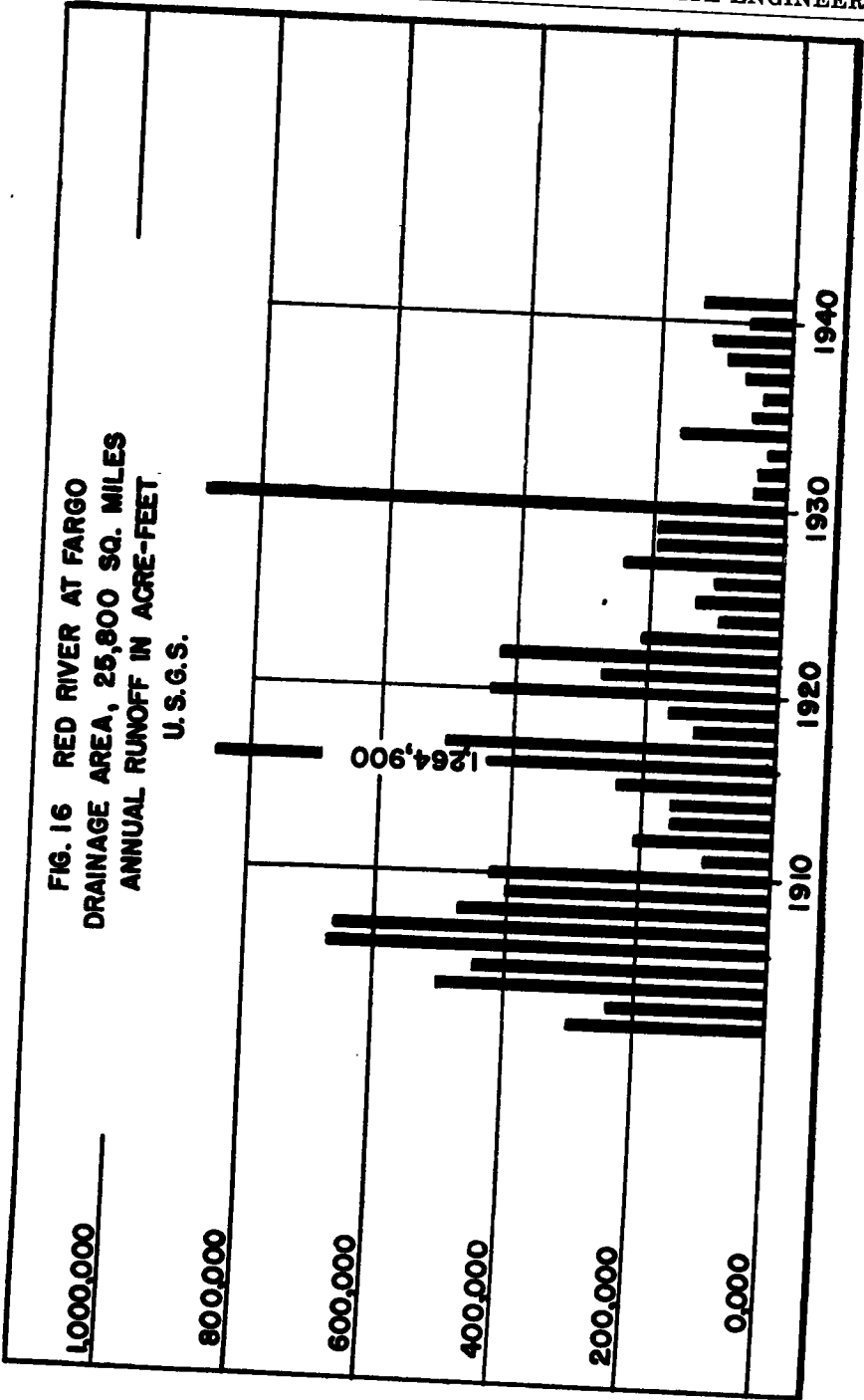
**FIG. 14 WINTERRING RIVER AT KARLSRUHE
DRAINAGE AREA, 675 SQ. MILES
ANNUAL RUNOFF IN ACRE-FEET
U.S.G.S.**



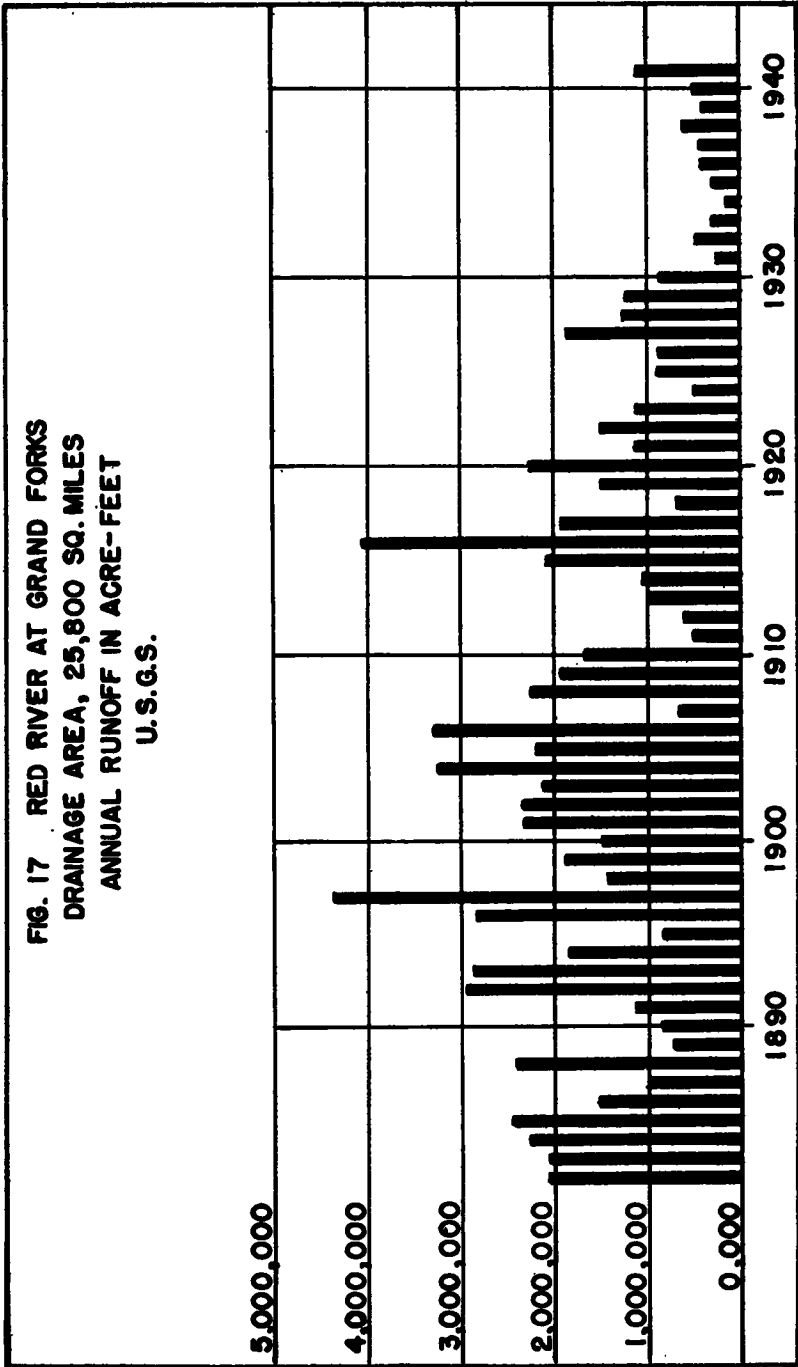
**FIG. 15 JAMES RIVER AT JAMESTOWN
DRAINAGE AREA, 3,140 SQ. MILES
ANNUAL RUNOFF IN ACRE-FEET
U.S.G.S.**

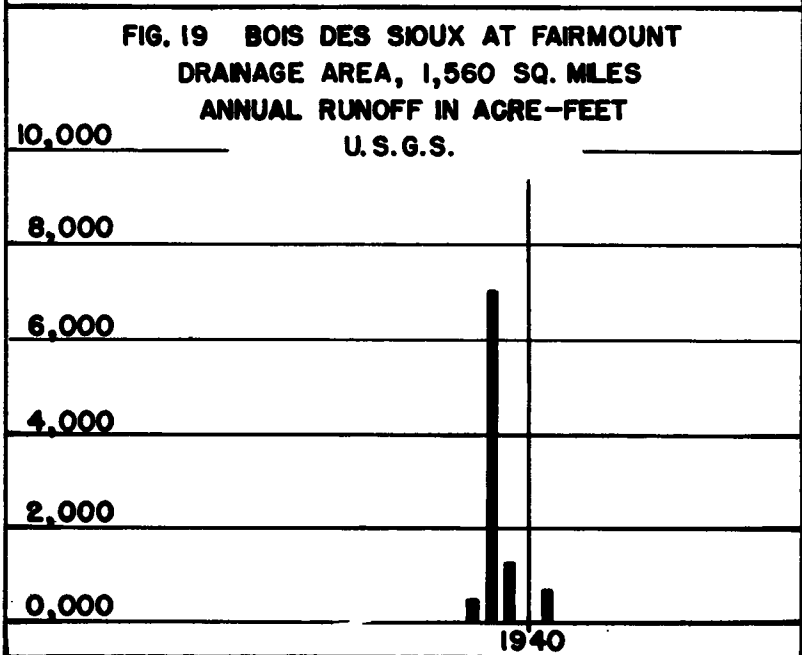
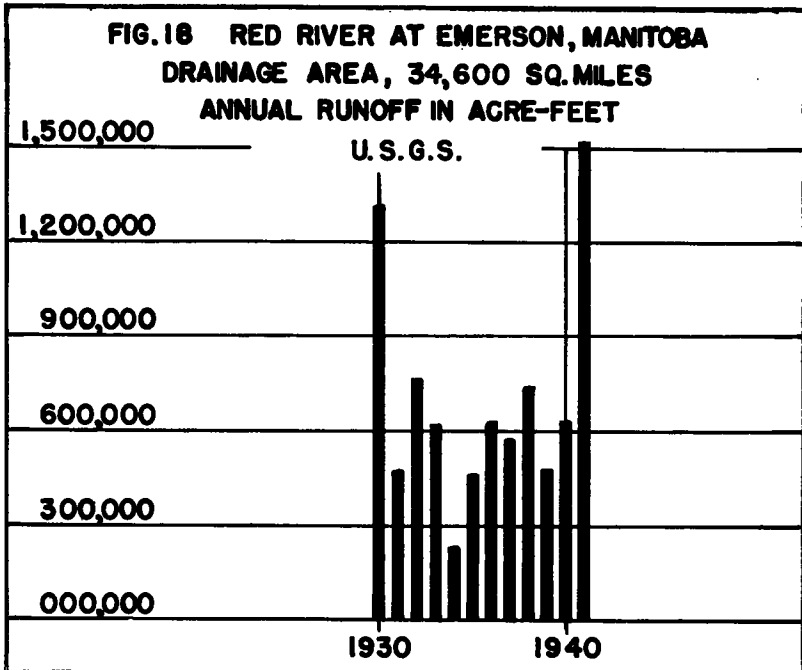


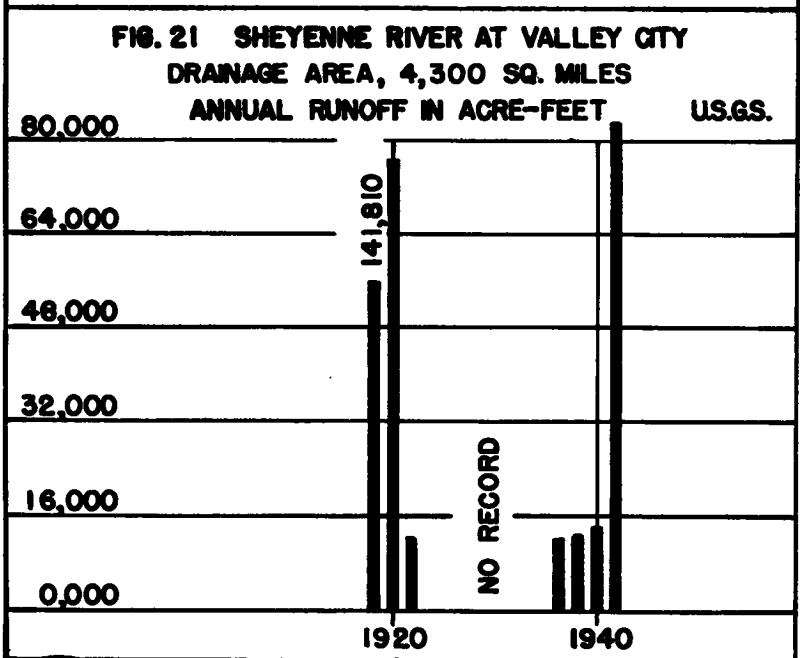
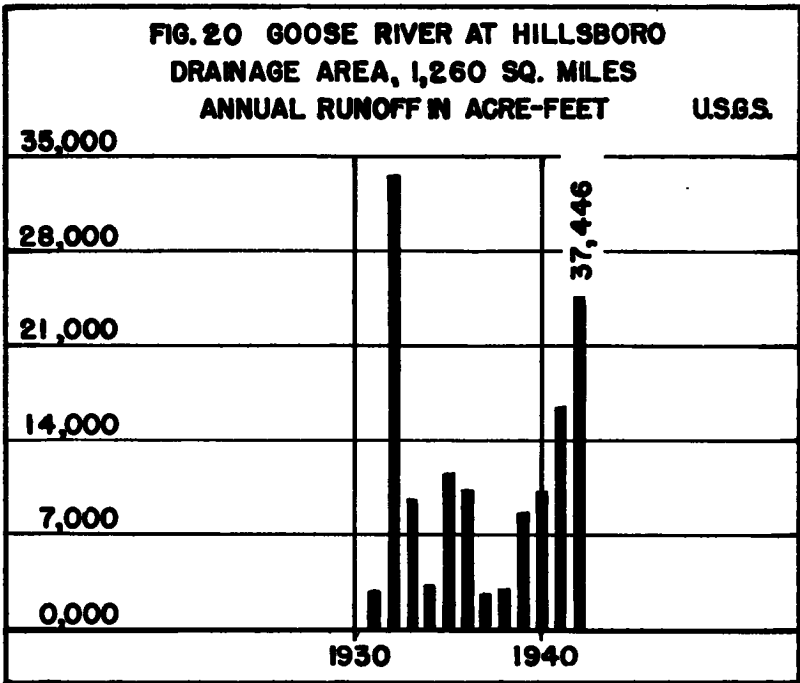
**FIG. 16 RED RIVER AT FARGO
DRAINAGE AREA, 25,800 SQ. MILES
ANNUAL RUNOFF IN ACRE-FEET
U.S.G.S.**

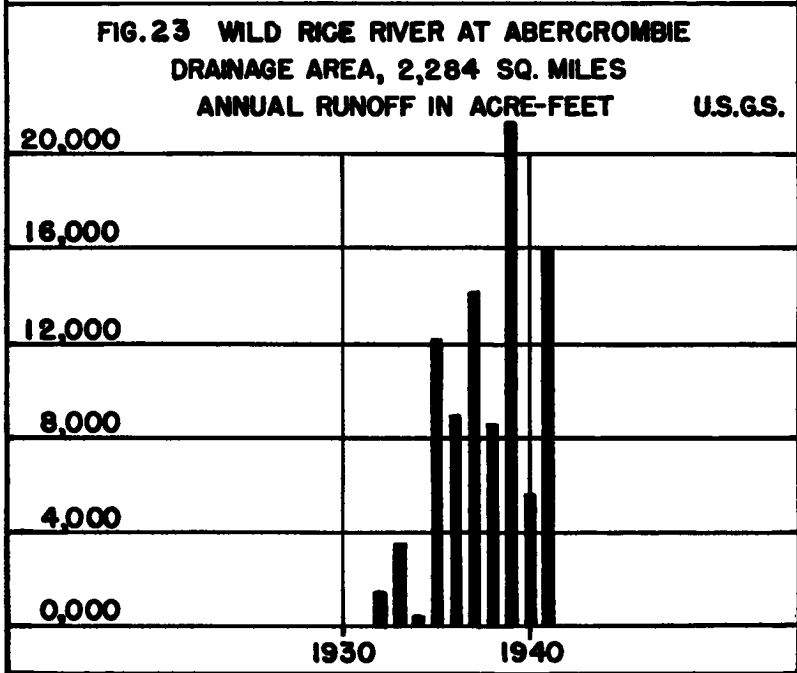
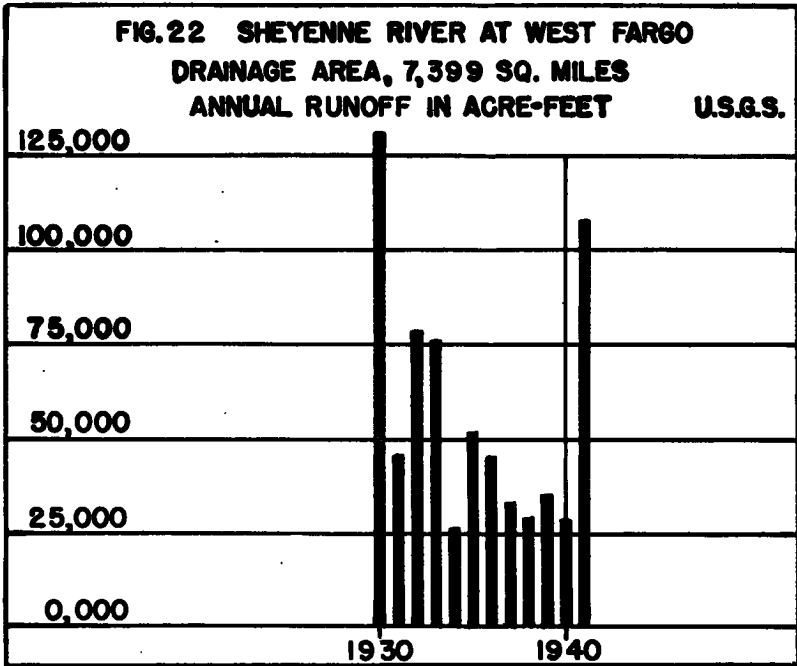


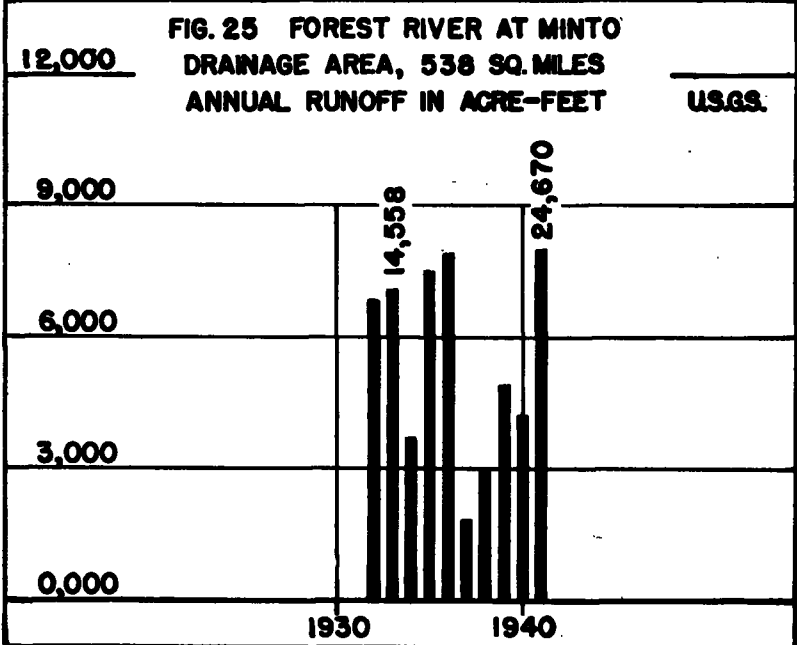
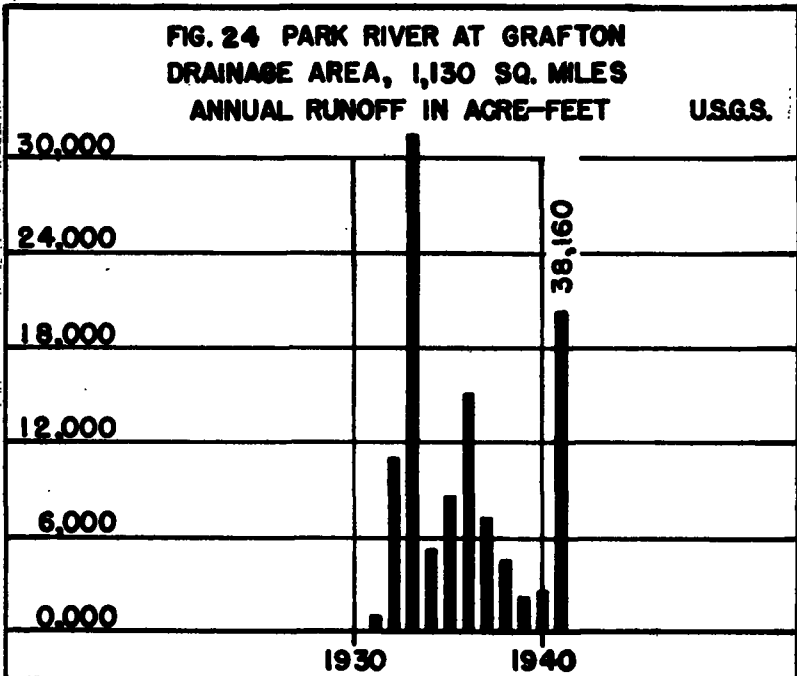
**FIG. 17 RED RIVER AT GRAND FORKS
DRAINAGE AREA, 25,800 SQ. MILES
ANNUAL RUNOFF IN ACRES-FOOT
U.S.G.S.**

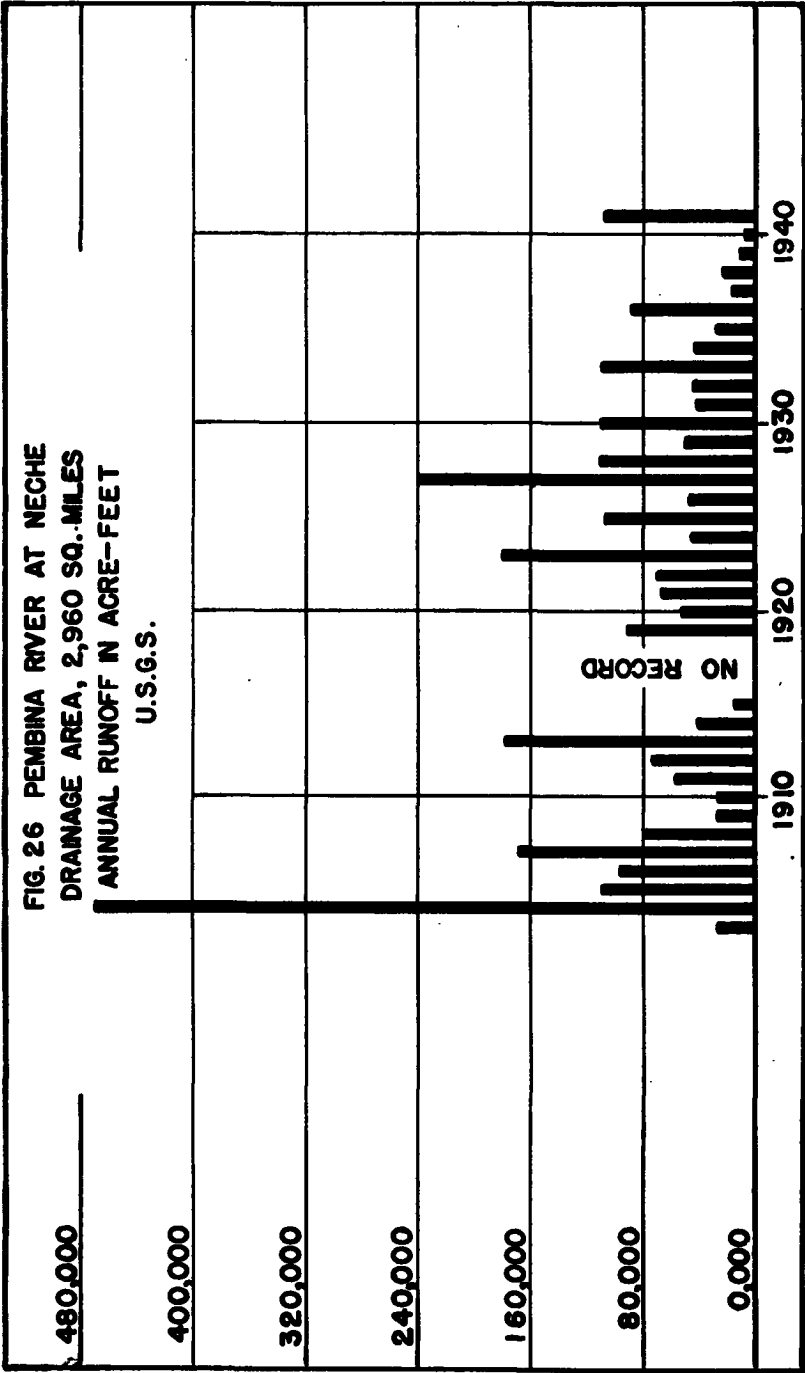


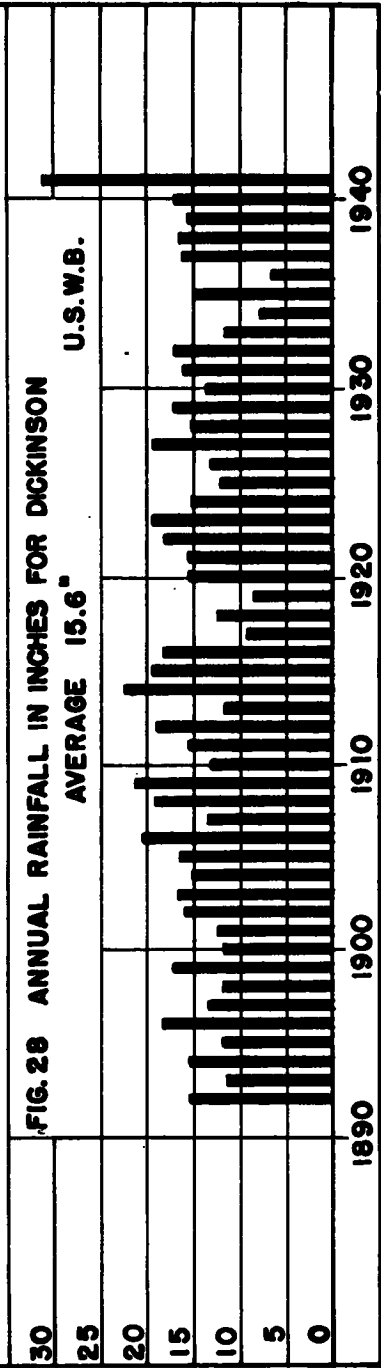
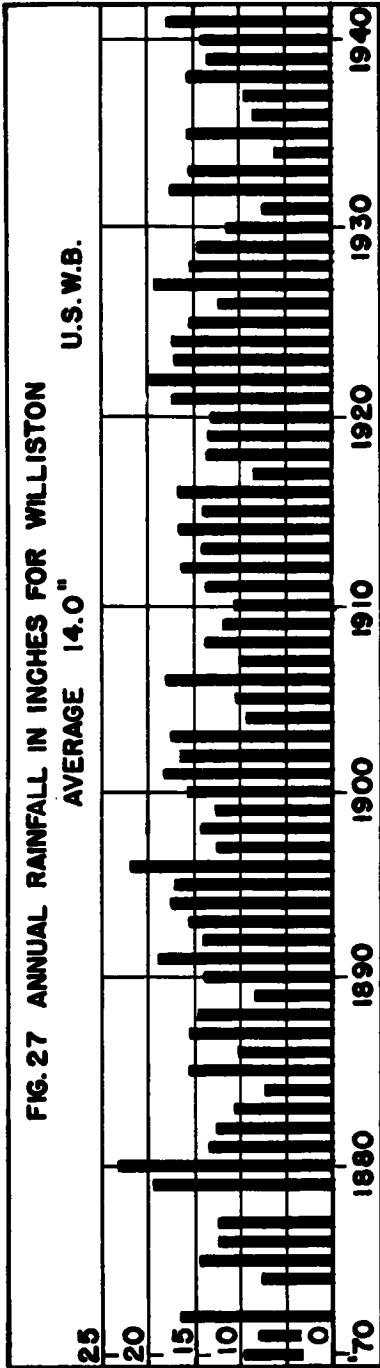


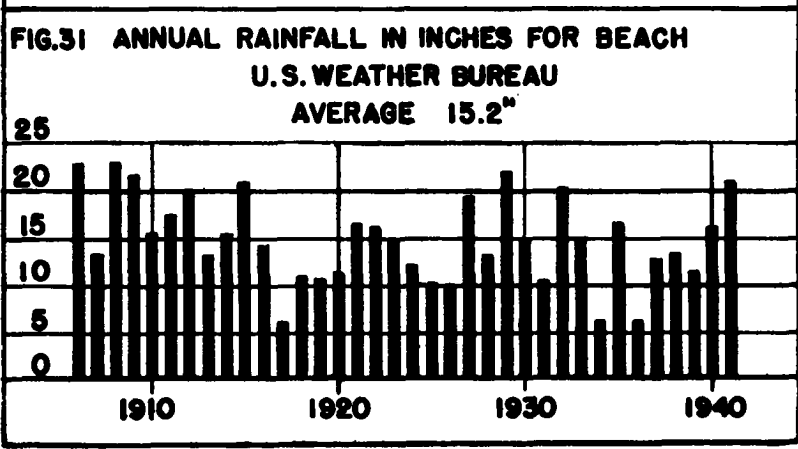
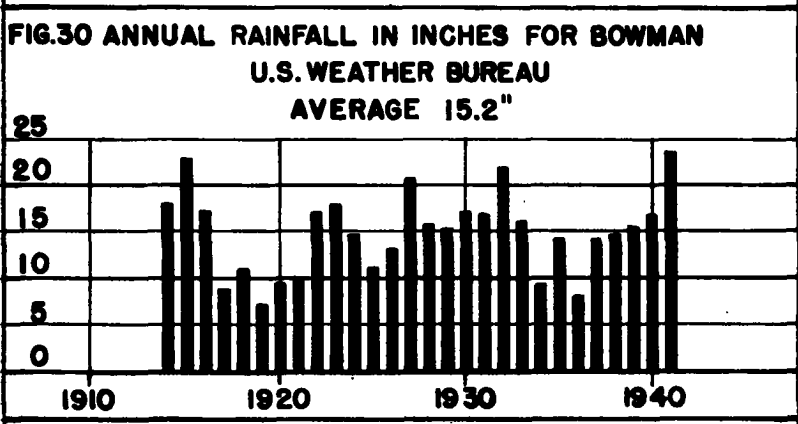
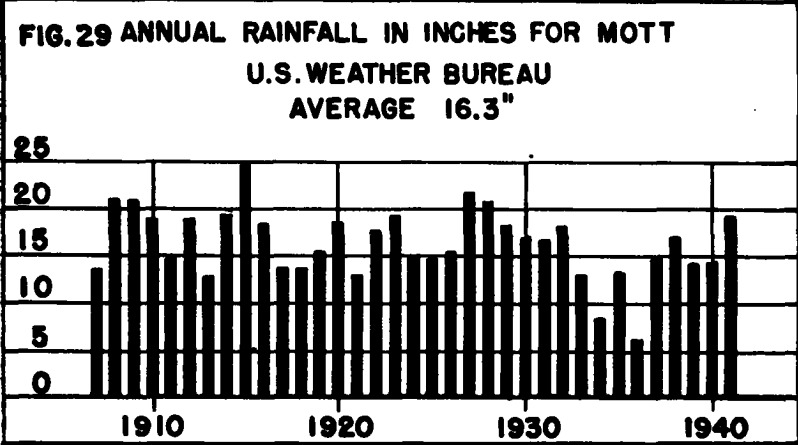


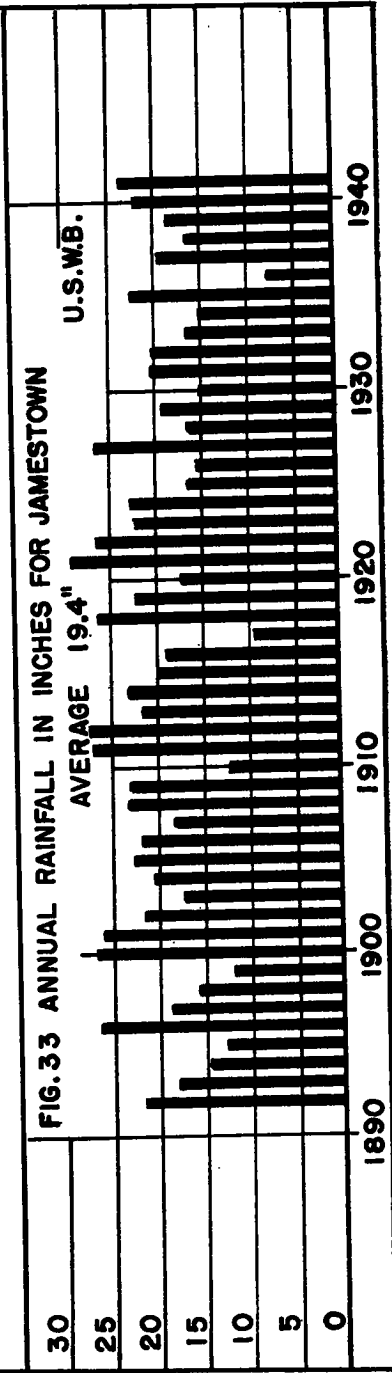
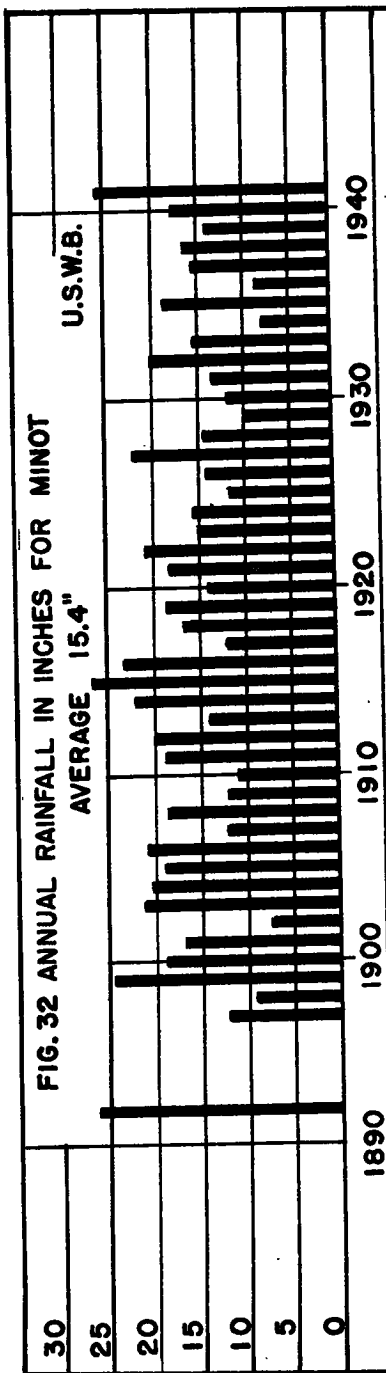


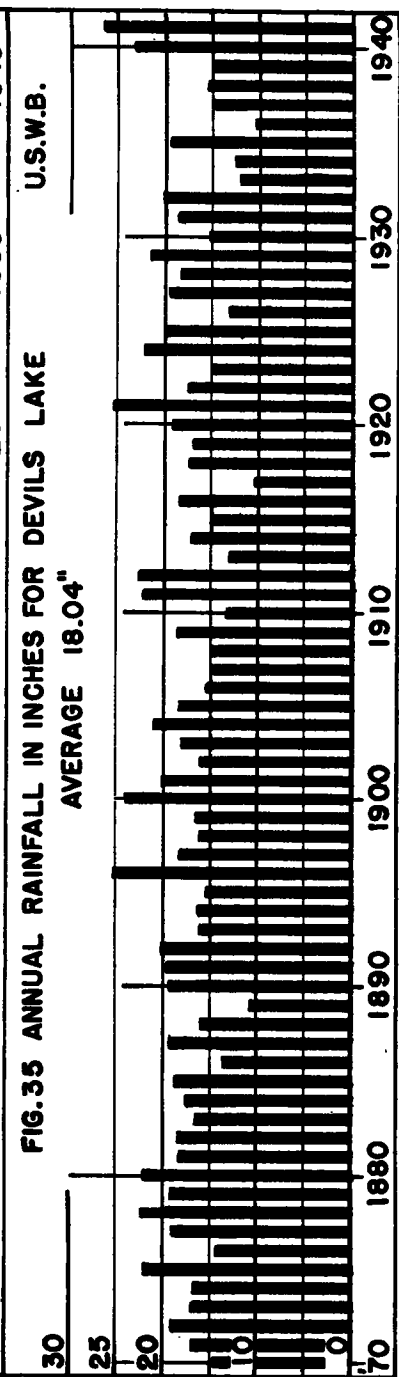
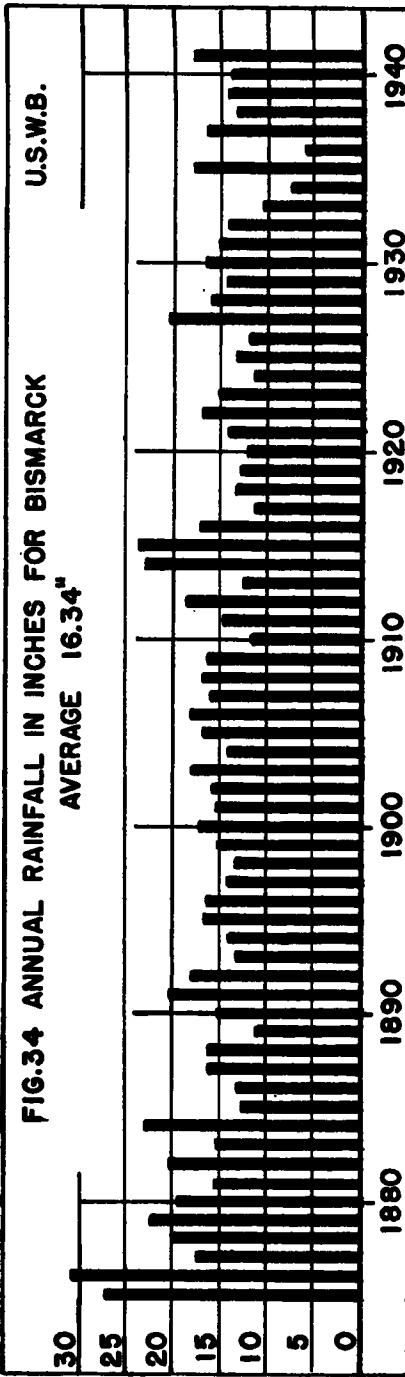


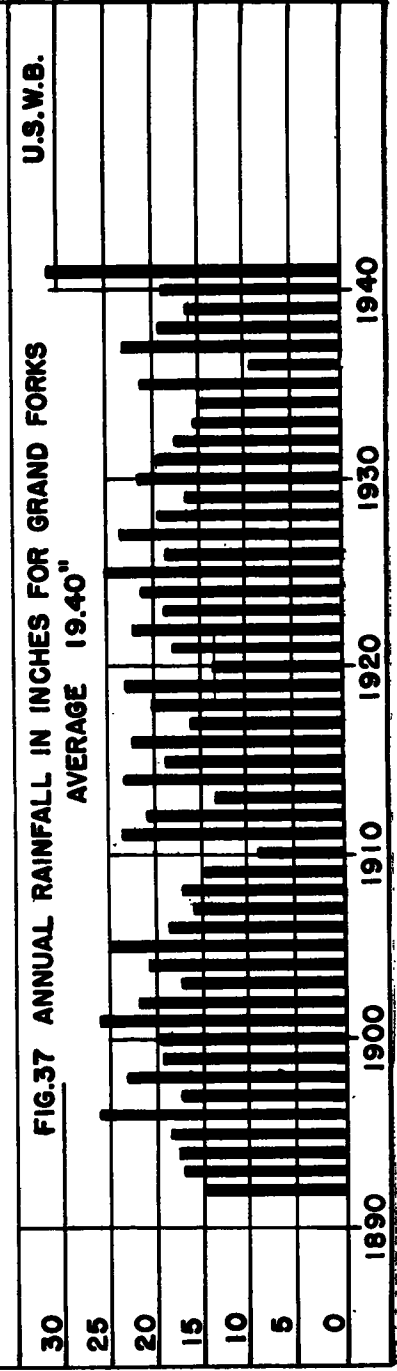
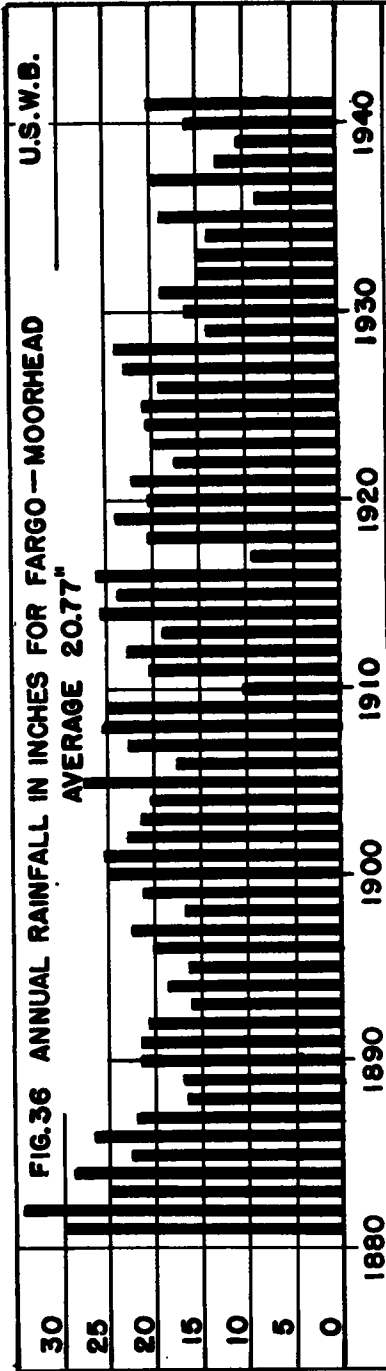












UNITED STATES GEOLOGICAL SURVEY

Regarding Heart River, North Dakota: During 1941, working under a cooperative agreement between the U. S. Geological Survey and the State Water Conservation Commission, the Topographic Branch of this Federal Bureau completed a survey of the Heart River between Mandan and Breckenridge Ford, which is located near Lat. $101^{\circ} 45'$ West. The map was drawn on a 2000 feet to the inch scale, using a ten foot contour interval, and covers an area of 62 square miles, delineating 55 linear miles of the river bottoms.

In order to tie this survey to the North American Datum, an arc of third order triangulation was extended over the area starting on the first order station near Mandan and tying to another near Elgin. Thirty-six stations were occupied and monumented with bronze tablets set in concrete and forty additional stations were intersected and marked on the ground for use of the topographic parties.

All of the monumented stations and possibly a portion of the others also will serve for the future mapping of seven standard quadrangles for incorporation in the Topographic Atlas of the United States. Seventy-nine miles of third order levels were run and thirty-six permanent bench marks were established.

Photographic copies of the field sheets were delivered to the co-operating officials of the state soon after the completion of the field work. Subsequently, the area was inked and checked in the Rolla, Missouri, office of the Geological Survey and is ready for reproduction.

(Report of C. L. Sadler, Division Engineer in Charge, Central Division, Rolla, Missouri, dated August 27, 1942.)

UNITED STATES FISH AND WILDLIFE SERVICE

Water Conservation Activities in North Dakota: The encroachment of man upon former duck-breeding grounds, coupled with a series of years of low rainfall, (the so-called drought years), caused the launching of a national waterfowl restoration program by the Federal Government in the summer of 1934. The Bureau of Biological Survey (now the Fish and Wildlife Service) was designated as the agency responsible for the consummation of this program.

While primarily for the restoration of waterfowl-breeding grounds and resting areas for the birds while in migration, the construction of the water control structures necessary for this restoration became part of the general state-wide program of water conservation in North Dakota.

The largest construction program in North Dakota completed by the Fish and Wildlife Service is on the Souris River within the boundaries of the Upper Souris and the Lower Souris Wildlife Refuges. Near Foxholm,

in Ward County, at River Mile #83 (zero mile on the International Boundary where the Souris River enters the United States from Canada), an earth fill dam was constructed having the following dimensions:

Length.....	3300 feet
Maximum height above stream bed.....	39 "
Top width.....	31 "
Maximum width at base.....	275 "
Spillway section.....	320 " wide
Outlet structure—2 reinforced concrete culverts, 14' x 10' with a 12' x 10' steel slide gate in each.	
Bottom of outlet gate =	0 on gauge = 1577 feet M.S.L.
Bottom of spillway =	21' on gauge = 1598 feet M.S.L.
Top of dam =	29' on gauge = 1606 feet M.S.L.

The lake created by this dam and known as Lake Darling, covers an area of approximately 11,000 acres at spillway level and has a capacity of 112,000 acre feet.

Located immediately downstream from Lake Darling some 2300 acres of marsh area was made possible by the construction of two large concrete control gate structures and several miles of dikes.

The Lower Souris Refuge, extending from a point some ten miles north of Towner to the Canadian border, contains some 17,900 acres of marsh, made possible by the construction of five concrete control structures with connecting dikes.

To keep this 20,200 acres of marsh supplied, water is released from Lake Darling. The following table shows the maximum yearly water supply that has been in Lake Darling since the gates were closed during the fall of 1935:

<u>Year</u>	<u>Date of Max Reading</u>	<u>Max Gage Reading (Feet)*</u>	<u>Storage Acre-Feet</u>
1936	May 23rd	10.8	34,200
1937	May 1st	4.3	12,900
1938	April 1st	8.28	24,840
1939	April 10th	14.14	52,840
1940	April 11th	9.57	29,280
1941	June 21st	10.44	32,760
1942	July 8th	16.80	71,400

* (Crest of spillway is at gage height of 21.0 feet).

Other developments in the State include:

<u>Name of Refuge</u>	<u>Drainage System</u>	<u>(acres) Marsh Area</u>	<u>(acre-feet) Storage Cap.</u>
Des Lacs	Des Lacs River	6,855	65,000
Arrowood	James River	3,289	15,890
Lake Ardock	Forest River	1,150	2,875
Dakota Lake	James River	1,600	3,200

In addition to the refuge development indicated above, there are 68 additional areas containing a total of 110,237 acres of land area. These refuges were acquired either by direct purchase or by easement and the maximum possible water and marsh areas developed on each refuge.

Beside serving the primary purpose for which they were constructed, all of the water developments of the refuges have a secondary usefulness in providing stream regulation and water conservation in line with other water conservation projects built by other state and federal agencies.

UNITED STATES WEATHER BUREAU

The Weather Bureau in North Dakota: Climate and weather are basic national resources but they must be understood if they are to be turned to good advantage. As civilization has become more complex our dependence upon an intimate and accurate knowledge of climate and weather has increased. Today this knowledge is so indispensable that every civilized country has an elaborate weather service. In the United States this service functions twenty-four hours a day and endeavors to bring up-to-date information to every individual in the land who needs it.

Due to the weather extremes in North Dakota and the fact that one or two inches of rain at a critical time produces a bumper crop or a crop failure, the people of North Dakota are more weather conscious than people in most other sections of the country. There are four first-order weather Bureau stations in North Dakota and ten airway stations rendering twenty-four hour service. At the present time much of this service is for the army and for aviation. There are also one hundred twenty cooperative weather observers in North Dakota supervised by the section center at Bismarck.

These cooperative observers make daily readings usually about sunset. They record the high temperature, low temperature, twenty-four hour precipitation, sky condition and wind. These observers are scattered over the state, usually two or three to a county. The observers receive no pay for the work, but there are enough public spirited citizens who are interested in the weather in all counties that little difficulty is experienced in finding observers.

Mr. F. O. Alin at Fullerton, North Dakota, has been a cooperative observer for the Weather Bureau continuously for forty-four years. Mr. Charles J. Hoof has been the cooperative observer at Napoleon for forty-three years and his father was cooperative observer for nine years before Charley took over the work.

The first weather records available for North Dakota were made by Lewis and Clark in 1804-05. Regular observations were begun at a few stations by the Army in 1860, but a good distribution of stations was not secured until 1892 when there were forty-two stations in the state.

Besides the one hundred twenty stations maintained by the U. S. Weather Bureau, there are more than one hundred other observers, such as employees of the Army, Soil Conservation Service, State Historical Society and individual observers. All reports made by the cooperative observers are on file at the Weather Bureau for public use from 1860 to the present time.

There seems to have been a very slight decrease in precipitation from 1892 to 1940, but the past two years indicate a wetter trend again. Temperature averages and extremes have changed very little over the years. About 77% of the annual precipitation in North Dakota occurs during the crop season. This is a greater percentage than is received by any other state.

(Report of F. J. Bavendick, U. S. Weather Bureau, Bismarck, North Dakota, dated August 25, 1942)

STATE GAME AND FISH COMMISSION

Water Conservation and the Game and Fish Department: Water conservation has always been of paramount interest to this department and financial contributions have been made to various organizations sponsoring the construction of dams and other water control structures. Naturally our first consideration in any project of this kind is the wild-life and recreational benefit to be derived from the impounded waters. Waterfowl and fish propagation tie in very closely with any program of water conservation. Even a small pond properly managed offers opportunities of recreation to small groups, while lakes of several acres can be enjoyed by the whole community.

North Dakota's natural lakes with wooded shores, such as Spiritwood, Wood, Metigoshe and Upsilon, have attracted cottagers and community groups from the length and breadth of the state. Other bodies of water, both natural and impounded, are continually being improved to offer recreation possibilities. Cedar Lake in Slope County, Lake Odland near Beach in Golden Valley County, Spring Lake at Rhame in Bowman County and the Epping-Springbrook Dam in Williams County are outstanding examples.

Other impounded lakes and ponds could be further improved for fish production if the shore lines were adequately protected from over-grazing and trampling by livestock, with the resulting fouled water. If cattle are allowed access to a pond, it would best be to a portion near the dam, but not including the dam itself, which would be injured by their continual tramping. The upper part of the pond will then be kept in better shape for swimming, fishing and wildlife cover. A good growth of vegetation on the dam itself will prevent excessive wave action and washing.

A well-managed lake or pond is a popular place for community meetings combining business and pleasure. Such bodies of water should

be even more carefully guarded. Sanitation and orderliness are essential. Part of the shoreline ought to be left in its natural condition with supplemental plantings of wildlife cover. Birds and animals will endure a certain amount of disturbance if left in peace the rest of the time.

The possibilities of waterfowl, fish and muskrat production can be greatly enhanced by proper management of impounded waters after the projects have been completed, and an opportunity for studying the needs of each individual area has been given the sponsors.

Thanks are due the Water Conservation Commission and its engineering staff for the cooperation given in the construction and repair of structures to which it has lent financial aid.

(Report of William J. Lowe, Commissioner of the State Game and Fish Department, dated Oct. 15, 1942).

STATE GEOLOGIST

The North Dakota Geological Survey maintains a ground water survey in North Dakota cooperatively with the United States Geological Survey. The financial obligations of the projects maintained are divided on a 50-50 basis; an agreement in effect since 1937.

When the cooperative program first went into effect there was a considerable interest in well water irrigation, so a survey of possible ground water irrigation sites was made in the eastern part of the state. The one at Oakes appeared most feasible, and for two summers, 1939 and 1940, the U. S. Geological Survey had a man working in this area. His report on ground water irrigation for this area should soon be complete. Preliminary readings indicate that there is sufficient underground water here for a limited amount of well irrigation.

A number of observation wells have been maintained in various parts of the state. Some are measured weekly, others in the spring and fall, to an accurate picture of the fluctuations of the ground water level. Some have been observed for nearly 15 years and up to 1941 there had been a steady decline in the ground water level. In 1941 the ground water level for the first time began an upward rise, due to the unusual amount of precipitation. The rise appears to have continued in 1942.

The city of Fargo has the problem of finding supplemental supplies of water for use by that city. A ground water project was financed by Fargo, the United States and the North Dakota Geological Surveys. The report is not complete and no conclusions can be drawn at present.

In the summer of 1941 a ground water survey of Pembina County was started. The county, while in a moister part of the Red River Valley, has acute ground water problems due to the low permeability of the silt deposited by Lake Agassiz. This project has only been started and no definite conclusions can as yet be reached. It seems that additional

feasible sources of water may be found for domestic and stock supplies which have heretofore been neglected.

The State Geologist has been invested with the control and supervision of artesian waters of the state. (Chapter 17, S. L. 1921.) The most recent work done was that by Mr. L. H. Wenzel and Mr. Herbert H. Sand who have written their findings in a paper entitled, "The Water Supply of the Dakota Sandstone, with reference to changes in the Ellendale-Jamestown area, North Dakota, from 1923 to 1938." The report is complete and the manuscript copy is filed with the State Geologist, awaiting printing by the U. S. Geological Survey. In recent years, with this exception, little has been done in connection with our artesian water supplies, due to insufficient appropriations to supervise properly this phase of the ground water problem. It is advisable that the work in certain artesian areas be renewed, with the view to conserving these supplies. These wells are allowed to flow much too freely, while in other areas wells have gotten out of control with damage to property and danger to life. It would seem wise for the State to make provision for the control of these wild artesian wells.

The test drilling program has also been retarded by insufficient appropriations. Ground water irrigation in other states has been successful and with sufficient study might also be in certain areas of North Dakota; a result which would amply repay the amount spent for investigation. (Condensed from the report of Wilson M. Laird, State Geologist, in June, 1942.)

NORTH DAKOTA RURAL REHABILITATION CORPORATION

The Lewis and Clark Irrigation District, a little southwest of Williston on the McKenzie County side of the Missouri River, was developed with the co-operation of the Rehabilitation Corporation and the work done there is fully described in the Biennial Report of the State Water Conservation Commission for 1939-40, pages 21-26.

Granting the necessity for irrigation in western North Dakota, it is not sufficient to merely establish and construct irrigation systems. Unless the land which is to be irrigated can be properly leveled so as to provide an even distribution of water over the land, the construction of an irrigation system is useless. Assessments for construction costs can not be paid unless the land is immediately developed and irrigated crops produced thereon.

The statement is frequently heard that it takes at least three generations to make irrigation farmers. Such a statement is misleading. For while it is true that experience is valuable, it is also true that land which is not suitably developed can not be farmed under irrigation.

Before water can be spread on the land, it must be properly leveled. Land that is covered with brush or timber must be cleared, stumps and

roots must be removed and the land must be plowed with a brush plow. Such development is expensive. In the Lower Yellowstone Project area near Sidney, Montana, the labor of at least two generations has been required. Each farmer had to clear and level his land. If some government agency had acquired this land when the irrigation system was built and had cleared, leveled and developed it, all of the land could have been put into production many years ago. It remained for the sugar beet industries to use the expensive machinery. The Williston Project, built some thirty years ago, was abandoned in a few years, although over a million dollars had been spent to construct the pumping plants and the irrigation canals. Inquiry as to the real reason for the failure has revealed that very little of the land that could be irrigated was ever leveled or developed for irrigation.

Now such land preparation can be done expeditiously and economically by modern power machinery designed for the purpose. It has been the purpose of the Rehabilitation Corporation to cooperate in this regard where possible.

STATE DEPARTMENT OF HEALTH

Division of Sanitary Engineering: The State Department of Health through its Division of Sanitary Engineering has worked in close cooperation with the Water Conservation Commission and the State Engineer. Valuable information on stream flows and the adequacy of water supplies in various areas has been furnished to the State Department of Health by the Water Conservation Commission when requested. In return, the Division has made studies of the suitability of various waters for irrigation purposes, principally with respect to mineral content.

The Red River of the North Research Investigation Report recently completed provides extremely valuable data and information on which to base calculations for stream flow requirements in the Red River Basin, which will be found of infinite value in any water control program in that area. The report indicates that even with control within the state itself, insufficient water for sewage dilution purposes is available in the Red River Drainage Basin and that satisfactory stream conditions can be obtained in that basin only by supplementary flows from other drainage basins. The Missouri River, of course, is the only stream which can supply this needed supplementary flow.

Economic benefits to cities, resulting from stabilized flows in streams have been computed and the figures furnished to the Water Conservation Commission and the Army Engineers. Such benefits are confined to water supply and sewage dilution purposes only.

The State Department of Health has appreciated to the fullest extent the cooperation and assistance rendered by the Water Conserva-

tion Commission and stands willing and ready to cooperate on any further mutual problem within its scope of technical ability.

(Report of Kenneth Lauster, Sanitary Engineer with the State Department of Health, Bismarck, dated October 8, 1942).

BANK OF NORTH DAKOTA

Since the organization of the State Water Conservation Commission, the Bank of North Dakota has assisted the Commission in many ways.

Through the purchase of the entire issue of the Series F Bonds of the Lewis and Clark Irrigation Project in McKenzie County in the amount of \$27,000, the bank, through its manager, has shown its faith in the development of North Dakota through water conservation.

This state-owned bank also acts as trustee for all issues and proposed issues of bonds which have been undertaken up to this time. The bank also, through the manager of the land department, has assisted the Commission by appraising a number of properties acquired by the state through the Commission, on which irrigation is in process of development.

It is true that due to a period of abundant rainfall, it will be necessary to do considerable educational work in connection with an irrigation program. The bank records indicate the dire results of a series of droughts such as those of 1934 and 1936, which to some extent could have been averted by conservation practices.

(Report of Geo. E. Brastrup, Manager, Land Department. For F. A. Vogel, Manager, Bank of North Dakota, dated Oct. 15, 1942).

GREATER NORTH DAKOTA ASSOCIATION

Early in the history of this association interest in water conservation for the state of North Dakota was indicated through engaging John F. Stevens, famous engineer on the Panama Canal, to interpret to the state the first report by the Army Engineers on the Missouri River Diversion. There had been an unfavorable report, but Stevens gave hope that it might be amended, as it has been.

Many thousands of dollars have followed the first thousand paid to Mr. Stevens to keep the interest sustained and to educate the citizens of the state. The association serves as a state chamber of commerce, made up of local and group associations. It believes the greatest work to be done is to educate the people of the state as to the possibilities of irrigation to stabilize agriculture.

Through its magazine, "The North Dakotan," 6,000 copies of which are distributed through the state; through its representatives at national meetings for water conservation; through its organization of the Western

North Dakota Reclamation Association which two years ago became a statewide organization; through its activity in connection with the State Planning Board; through a continual educational campaign about irrigation, illustrated recently with slides and moving pictures; through the North Dakota Resources Board, with a representative at Washington; in season and out, continually the gospel of water conservation and use in order to have a stabilized production of crops and livestock has been proclaimed. Only in this way can there be a stable economy for this state.

(Condensation from the report of B. E. Groom, Secretary, Greater North Dakota Association, Fargo, dated Nov. 3, 1942.)

TRI-STATE WATERS COMMISSION

The Tri-State Waters Commission was created in 1937 by a compact between North Dakota, South Dakota and Minnesota. It has nine members, three from each state. The role of the Commission is advisory only, in that it attempts to correlate plans and prevent unnecessary duplication of efforts. Its activities center in the drainage basin of the Red River of the North, where there is need of control of floods and the conservation of available water for use as a domestic supply and for dilution of sewage.

The water program and the status of the projects are fully covered by the current report of the Commission, which may be obtained from Robert L. Bard, Executive Secretary, St. Paul, Minnesota, or from the North Dakota State Water Conservation Commission. An outline of the program is included here:

Pembina and Tongue Rivers: Preliminary examinations for flood control. Possibility of storage of water on the Pembina just above Walhalla, and on the Tongue west of Cavalier.

Park River: Proposed flood levees east of the town. A dam and reservoir west of the town would supply municipal water for Park River and Grafton.

Forest River: Surveys of a reservoir and dam site and foundation investigations at the dam site have been completed. Unfavorably reported by the Division Engineer. An appeal for extension of time was granted.

Goose River: Proposed to erect a dam about 80 miles from the mouth of the river for flood control and water supply. Survey and investigations submitted and an unfavorable reply received. Request for extension of time granted.

Sheyenne River-Baldhill Dam: Proposed project would include the construction of a large reservoir several miles upstream from Valley City for flood control and stream flow regulation. Also channel im-

provement would be necessary. Report has gone forward with all studies and surveys completed. No action yet.

Missouri River Diversion: This includes much more than the Red River Valley but both plans; the Army Engineers and the Bureau of Reclamation; would benefit the east as well as the west.

Roseau River, Minnesota: A project for flood control largely independent of the Red River problem, but diversion of the flood waters directly to the Red River is considered.

Red Lake-Red Lake River and Clearwater River, Minnesota: A regulated stream flow on both rivers will supply the needs not only of Minnesota cities, but Grand Forks as well during periods of deficiency. Surveys and investigations are complete and have been submitted to the Division Engineer.

Comprehensive Survey of the Red River of the North Drainage Basin: A multiple-purpose project to coordinate and evaluate for all three states the plans for the development of the drainage basin of the Red River. Conserving the meager water supply of the basin is a necessity to be met by creating storage reservoirs and then distributing during periods of drought. Surveys have been made and hearings held. The report will be submitted late in 1942.

Lake Traverse-Bois de Sioux Flood Control and Water Conservation Project: This is the first project to be completed in the program of the Red River Project. It consists of (1) the White Rock Dam, (2) the Reservation Highway Dam, (3) the Bois de Sioux channel improvement, and (4) the Browns Valley Dike.

The excessive rains of the spring of 1942 have shown what planned flood control and water conservation can do. By holding and controlling the flood waters, it is estimated that some 42,000 acres of agricultural land were saved from being flooded during the spring seeding time. Computing this saving on the basis of \$12.20 cost per acre on 42,000 acres gives in crop savings \$502,400 saved in the first year this flood control project was operated.

(Taken from the report by Robert L. Bard, Executive Secretary, dated Sept. 28, 1942.)

APPROVAL OF LARGE AAA DAMS

According to Section 9, Chapter 256, Session Laws 1939, "no dam exceeding ten feet in maximum height, or capable of impounding more than thirty acre feet of water, shall be constructed in the State, either in a water course or elsewhere, without prior written approval of the Commission."

Occasionally dams to be constructed under the agricultural conservation program involves the construction, by a farmer, of a dam 10 feet or more in maximum height. The construction of dams of this size

is carefully considered by the engineering department of the state AAA office. Most of these dams are for stock watering purposes.

After the State AAA office has approved the proposed dams, the Agricultural Conservation Association in the county where the dam is to be built submits to the Commission the necessary estimates, specifications and pertinent data with a request for approval of the dam. Twenty-seven dams have been approved in ten different counties as follows:

McKenzie	3	Adams	1
Dunn	1	McLean	1
Emmons	6	Mountrail	6
Grand Forks	1	Slope	1
Morton	6	Grant	1

No dams have been disapproved after sufficient data was secured explaining them. We have not found it necessary to make special inspection, but usually work the inspection in along with other duties in the county.

MAINTENANCE OF EXISTING DAMS

The problems of finding sufficient funds for labor and material to keep the existing dams over the state in repair, is becoming more and more difficult. The dams were built by Federal agencies during the dry periods of the middle thirties to conserve water for farmers, stockmen, municipal use, conservation of wild life, and for recreational purposes.

The 1941 Legislature appropriated \$4,000.00 for the two-year period to be used in engineering, supervising and purchasing materials and supplies. The Works Projects Administration cooperated by furnishing the labor required and some funds for material and supplies in repairing dams.

This program worked out fairly well with the cooperation of the Works Projects Administration. However, the principal obstacle encountered in repairing large structures has been the present limited funds available for each project. At present the State Water Conservation Commission has a limit of \$300.00 for each project. This amount is inadequate to provide sufficient funds to purchase material for large repair jobs. The State Game and Fish Department has cooperated in the purchase of material and supplies for a number of the larger repair jobs. Several service organizations and public clubs have also cooperated by furnishing funds for the reconstruction and repair of local structures, where funds were not available for the required material.

Following is a list of repair projects, showing expenditures. In addition, there have been a number of surveys, investigations and reports made on other projects throughout the state.

STATEMENT SHOWING EXPENDITURES ON REPAIRS AND MAINTENANCE OF EXISTING DAMS DURING 1941 AND 1942, INCLUSIVE

Project No.	Name of Dam	DESCRIPTION	Location	EXPENDITURES		Total	CONTRIBUTIONS			Total
				N. D. Water Cons. Comm. Engineer. Construct.	\$		Wild Life Federation	State Game & Fish	Private Clubs, etc.	
217	Park River		Park River	82.73	30.15	82.73				82.73
240	Warwick		Warwick	68.84	198.99	198.99				525.99
241	Dodge		Vaahiti	231.34	278.04	278.04	251.00		51.00	478.04
245	Soland		Hazen	46.70	248.75	248.75	100.00			348.75
247	Finley		Finley		277.24	277.24				277.24
249	Mott		Mott	36.39		36.39				36.39
250	Paulson		Plaza	4.35		4.35				157.61
252	Fertile Twp.		Parshall	25.50	153.26	153.26				23.50
253	Jackson		Charbonneau	3.44		3.44				1.34
254	Walhalla		Walhalla	82.17		82.17				82.17
256	Strand River		Fryburg	164.78		164.78				164.78
257	Green River		Dickinson	17.94		17.94				17.94
258	Verona		Verona	9.80		9.80				9.80
259	Kulm		Kulm	11.00		11.00				11.00
260	Olson		Wilton	77.10	41.75	118.85				118.85
261	Heart River		Glen Ullin	908.79		908.79				908.79
263	Dickinson		Surveys Only	649.55		649.55				649.55
264	Braddock		Braddock	12.65		12.65				12.65
265	Logan Center		Grand Forks Co.	39.55		39.55	300.00			339.55
266	Tolna		Tolna	16.43	314.62	331.05	400.00			731.05
267	Bathgate		Bathgate		25.00	25.00				25.00
268	Halverson		Stout Co.		100.00	100.00				100.00
269	Kordville		Kordville	30.20		30.20				80.20
271	Pelcock		Ellendale		50.05	50.05	50.00			100.05
272	Richland Co.		Wahpeton	74.08	873.37	947.45				947.45
273	Fuller Lake		Hope	33.65		33.65				33.65
281	Sarnia		Michigan	12.20		12.20				12.20
308	Lake Ardoek		Ardoek	43.95		43.95				43.95
309	Riggins		Minnewaukan	12.99		12.99				12.99
310	West Bay		Minnewaukan	13.01		13.01				13.01

Project No.	Name of Dam	DESCRIPTION	Location	EXPENDITURES			CONTRIBUTIONS				Total
				N. D. Water Coms. Engineer.	Comm. Construct.	Total	Wild Life Federation	State Game & Fish	Private Clubs, etc.	Total	
313	Boyesen	.....	Bowman	67.08	.....	67.08	.....	.....	.....	.....	67.08
315	Valley City	.....	Valley City	46.28	.....	46.28	.....	.....	.....	.....	46.28
316	Lisbon	.....	Lisbon	80.08	12.30	92.38	.....	582.58	.....	.....	674.96
317	Hebron	.....	Hebron	118.90	.....	118.90	.....	.....	350.00	.....	468.90
318	Larson	.....	Sheyenne	9.35	.....	9.35	.....	.....	.....	.....	9.35
320	Bohlman	.....	New England	84.93	.....	84.93	.....	.....	.....	.....	84.93
323	Shirk	.....	Watford City	.....	5.00	5.00	.....	.....	.....	.....	5.00
325	Agnes Twp.	.....	Grand Forks	83.77	.....	83.77	.....	.....	.....	.....	83.77
332	Sand Creek	.....	McKenzie Co.	24.48	.....	24.48	.....	.....	.....	.....	24.48
338	Timber Creek	.....	Arnegard	83.53	.....	83.53	.....	.....	.....	.....	83.53
339	Charbonneau	.....	St. John	.....	50.00	50.00	.....	.....	.....	.....	50.00
341	Center	.....	Center	126.32	.....	126.32	.....	.....	.....	.....	126.32
				\$1,602.57	\$2,452.38	\$4,054.95	\$ 125.00	\$1,933.58	\$ 401.00		\$6,514.53

TOTAL NO. OF DAMS 42

WATER RIGHT FILINGS

From December, 1940, to December, 1942

Five water right filings were made by the State Water Conservation Commission and the State Engineer as shown in the following tabulations:

State Water Conservation Commission Water Filings

Water Right Filing No.	Name of Applicant	Lands to Be Irrigated	Source of Supply	Amount of Water Claimed in Second Ft.	No. of Acres	Date of Claim
245	Leonard E. Prince Regent, No. Dak.	N $\frac{1}{2}$ of NE $\frac{1}{4}$, SE $\frac{1}{4}$ of NE $\frac{1}{4}$ of Section 13 Township 134, Range 95	Cannonball River	0.70	27.5	12-13-40
246	Walter Welford Pembina, No. Dak.	N $\frac{1}{2}$ of NE $\frac{1}{4}$, NE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Section 9 Township 163, Range 52	Pembina River	0.70	57.1	2-14-40
247	Leonard G. Gabbert New England, No. Dak.	SW $\frac{1}{4}$ of SW $\frac{1}{4}$ of Section 3 N $\frac{1}{2}$ of NW $\frac{1}{4}$ of Section 10 Township 135, Range 97	Cannonball River	0.375	29.7	2- 3-41
248	D. D. Mars, City Auditor Dickinson, No. Dak.	NW $\frac{1}{4}$, SW $\frac{1}{4}$, SE $\frac{1}{4}$ of Sec. 3 NE $\frac{1}{4}$, SW $\frac{1}{4}$, SE $\frac{1}{4}$ of Sec. 4 NE $\frac{1}{4}$ of Section 9 NE $\frac{1}{4}$ of Sec. 10, Twp. 139 Range 96	Heart River	1.7	835	6-30-41
249	Drake and Newcomer Radcliff, Iowa	S $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 33 Twp. 136, Range 74 N $\frac{1}{2}$ of NW $\frac{1}{4}$ of Section 4 SE $\frac{1}{4}$ of the NE $\frac{1}{4}$, NE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Sec. 6, Twp. 135 Range 75	Long Creek	0.36	68.6	4-24-42

TABULATION OF BOND ISSUES
Bonds Authorized But Not Issued

Project	Series	Year Issued	Year of Maturity	Amt. of Issue	Int. Rate Per Cent	Guarantee Fund
Cartwright Irrigation Project	B	1938	1968	\$ 50,000	3	Printed—Never sold—cancelled.
Sioux Irrigation Project	D	1939	1969	25,000	3	North Dakota Rural Rehabilitation Corporation—Never printed.
Lewis and Clark Drainage	E	1940	1971	25,000	3	North Dakota Rural Rehabilitation Corporation—Never printed.
Bismarck Land	G	1940	1970	16,500	4	Bank of North Dakota. Rescinded—

Bonds Issued and Outstanding

Project	Series	Year Issued	Year of Maturity	Amt. of Issue	Int. Rate Per Cent	Guarantee Fund	PURCHASER and HOLDER
Lewis and Clark Irrigation	A	1938	1949	\$ 25,000	3	.....	North Dakota Rural Rehabilitation Corporation—Later re-deemed by Series I bonds.
Lewis and Clark Irrigation	A	1938	1968	125,000	3	.....	North Dakota Rural Rehabilitation Corp.
Grantier Irrigation	C	1938	1948	2,000	3	.....	Bank of North Dakota.
Lewis and Clark—Land	F	1940	1970	27,000	4	5,400.00	North Dakota Rural Rehabilitation Corporation—cancelled.
Lewis and Clark Irrigation	I	1941	1951	30,000	3	.....	Workmen's Compensation Bureau.
Lewis and Clark Irrigation	I-B	1942	1961	39,000	3	7,800.00	

Bonds outstanding—Series "C", "F", "I-B" Total \$68,000.00

**1939 APPROPRIATION
FINANCIAL STATEMENT
of
STATE WATER CONSERVATION COMMISSION
From July 1, 1939 to June 30, 1941**

INCOME

Legislative Appropriation	\$ 30,000.00	
Collections State Advisory Board & Miscellaneous	100.43	
Water Right Application Fee	10.00	
Payment for Hay and Pasture Lease ..	20.00	
Income for Lewis and Clark Experiment Farm (4)	739.26	
Refunds on Dams (to be used for Dams only)	427.00	
	\$ 31,296.69	
Repayments from Private Projects	\$ 182.75	
Repayments from Rural Rehabilitation Corp.	55,318.03	
	\$ 55,500.78	
TOTAL INCOME		\$ 86,797.47

EXPENSES

Account	Chargeable to Administration	Charge to Project
Administration Salaries	\$ 13,305.38	\$ 3,090.29
Administration Travel and Expense	1,168.96	26.96
Commissioners Travel and Expense	1,390.79	19.21
Engineers Salaries	4,324.19	9,555.87
Engineers Travel and Expense	79.00	1,428.82
Fieldmen's Travel and Expense	1,168.55	-----
Fieldmen's Salaries	2,057.69	-----
Supplies Office and Field	567.06	32.89
Furniture and Equipment office and field	420.63	25.00
Telephone and Telegraph	550.27	80.69
Printing and Advertising	875.67	136.47
Project Expense	-----	43,423.09
Membership in National Associations	100.00	-----
Workmen's Compensation	373.96	-----
Charges to Lewis and Clark Experiment Farm (4)	460.46	-----
Miscellaneous	356.43	368.61
	\$ 27,199.04	\$ 58,187.90
TOTAL EXPENSES		\$ 85,386.94
Balance in hands of State Treasurer July 1, 1941		\$ 1,410.53
Charges on Projects, above project collections	\$ 2,687.12	
Outstanding Accounts, November, 30, 1940	22,129.30	
Charges on Projects from November 30, 1940 to July 1, 1941	177.55	
Outstanding accounts, June 30, 1941	\$ 24,993.97	

**1941 APPROPRIATION
FINANCIAL STATEMENT
of
STATE WATER CONSERVATION COMMISSION
From July 1, 1941 to November 30, 1942**

INCOME

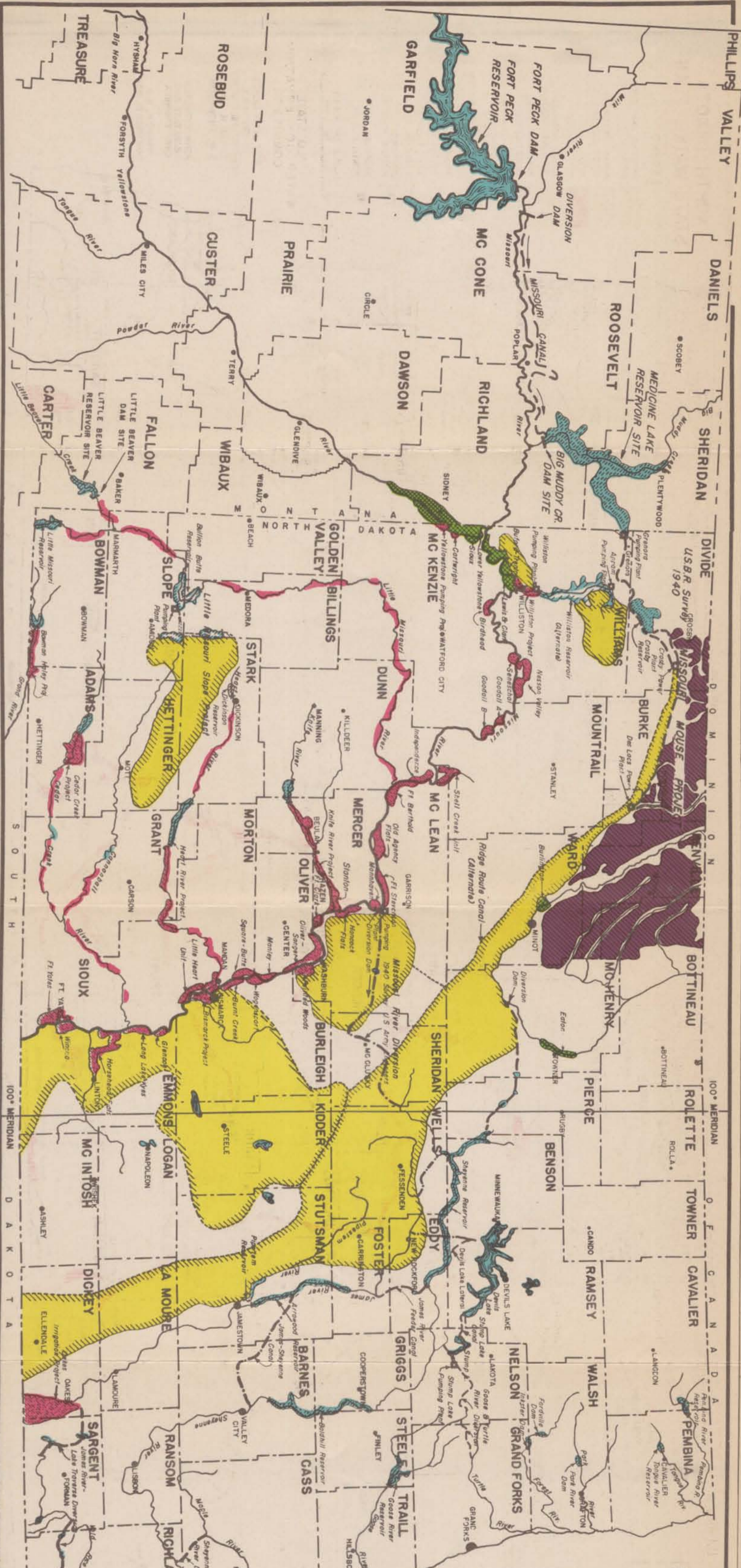
Legislative Appropriation	\$ 25,000.00	
Balance 1937 Legislative Appropria- tion Dec. 1, 1940	2,942.81	
Balance 1937 Beneficiary Returns	343.07	
Balance 1939 Legislative Appropria- tion July 1, 1941	1,410.53	
Collections State Advisory Board and Miscellaneous	92.90	
Water Right Application Fee	11.00	
Transfer from SWCC Funds to Ad- ministration Fund as allowed by Emergency Comm. 6/8/42	1,450.00	
	\$ 31,250.31	
Repayments from Private Projects	\$ 2,271.67	
Repayments from Rural Rehabilitation Corp.	4,200.18	
	\$ 6,471.85	
TOTAL INCOME		\$ 37,722.16

EXPENSES

Account	Chargeable to Administration	Chargeable to Project	
Administration Salaries	\$ 9,344.66	\$ 2,201.04	
Administration Travel and Expense	378.65	.....
Commissioners Travel and Expense	740.67	.....
Engineers Salaries	4,782.52	1,541.54	
Engineers Travel and Expense	394.18	27.11	
Supplies Office and Field	765.48	.....
Furniture and Equipment Office and Field	169.35	.....
Telephone and Telegraph	380.49	.....
Printing and Advertising	197.98	29.61	
Project Expense .....	.....	8,592.11	
Workmen's Compensation	200.30	.....
Charges to Lewis and Clark Experi- ment Farm (4)	189.45	.....
Charges to Sponsor Share Dams	407.20	.....
Miscellaneous	683.99	297.38	
	\$ 18,634.92	\$ 12,688.79	
TOTAL EXPENSES			\$ 31,323.71
Balance in hands of State Treasurer November 30, 1942			\$ 6,398.45
Charges on Projects, above collections	\$ 6,216.94		
Outstanding Accounts repayable Projects June 30, 1941		24,993.97	
		\$ 31,210.91	
Charged off notes and accounts July 1, 1941 to November 30, 1942			
Final figure awaiting distribution and sale of equipment on projects		9,314.27	
Outstanding Accounts November 30, 1942			\$ 21,896.64

FINANCIAL STATEMENT OF STATE WATER CONSERVATION COMMISSION
From December 1, 1940, to November 30, 1942

No.	Accounts	Appropriation	¼ Approp. held until 1/1/43	Balance Available	Expended from July 1, 1941-Nov. 30, 1942	Balance December, 1 1942
1.	Commissioner's Per Diem	\$ 3,000.00	\$ 750.00	\$ 2,250.00	\$ 1,621.00	\$ 629.00
2.	Administration	25,000.00	6,250.00	23,446.41	23,297.96	148.45
3.	Administration Balance Due 1937-41	4,696.41				
	Construction Bond Guarantee	40,000.00				
	Balance due 1939-41 approp.	35,300.00	10,000.00	65,300.00	1,800.00	63,500.00
4.	Maintenance Existing Dams	4,000.00	1,000.00	3,000.00	1,428.00	1,572.00
5.	Engineering and Soil Survey	1,000.00	250.00	750.00	477.00	273.00
6.	Little Missouri, Grand, Cannonball, etc.	700.00	175.00	525.00	517.18	7.82
7.	Pembina, Tongue, Park, etc.	250.00	62.50	187.50	60.00	127.50
8.	James, Wildrice Rivers, Lake Traverse	150.00	37.50	112.50		112.50
9.	Invest., Surveys, Designs, etc.	2,000.00	500.00	1,500.00	1,261.43	238.57
10.	Evaluation Economic Benefits	300.00	75.00	225.00	57.94	167.06
11.	Reports and Attendance at Conferences	1,500.00	375.00	1,125.00	1,114.37	10.63
12.	Tri-State Waters Commission	7,500.00	1,875.00	5,625.00	4,082.99	1,592.01
13.	Indep. Investigations and Reports	1,000.00	250.00	750.00	651.19	98.81
14.	International and Interstate Stream	1,500.00	375.00	1,125.00	653.61	471.39
15.	Topographic Mapping	3,000.00	750.00	2,250.00	2,237.34	12.66
16.	Cooperation in Obtaining Water Facilities	3,000.00	750.00	2,250.00	1,986.64	263.36
17.	Designs, Reports and Conferences	500.00	125.00	375.00	291.90	83.10
18.	Salary State Engineer	4,400.00	1,100.00	3,300.00	3,116.61	183.39
19.	Hydrographic Survey	3,500.00	875.00	2,625.00	2,412.52	212.48
	Totals	\$142,296.41	\$ 25,575.00	\$116,721.41	\$ 47,017.68	\$ 69,703.73



NORTH DAKOTA STATE WATER PLAN

LEGEND

- PRESENT IRRIGATED AREAS
- AREAS UNDER INVESTIGATION
- AREAS PROPOSED FOR INVESTIGATION
- RESERVOIR SITES INVESTIGATED
- RESERVOIRS PROPOSED FOR INVESTIGATION
- PROPOSED IRRIGATION CANALS
- PROPOSED ALTERNATE IRRIGATION CANALS
- ARMY, PROPOSED DIVERSION CANALS
- PROPOSED PUMPING PLANTS
- PROPOSED POWER PLANTS

SCALE OF MILES
0 10 20 30

N. D. STATE WATER CONSERVATION COMMISSION
 GOV. JOHN MOSES
 HENRY HOLT
 KENNETH W. SIMONS
 EINAR H. DAHL
 S. W. THOMPSON
 JOHN T. TUCKER
 SECRETARY AND CHIEF ENGINEER
 BISMARCK, N. D.
 DECEMBER 5, 1942