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An Inventory of Montana Irrigation Projects

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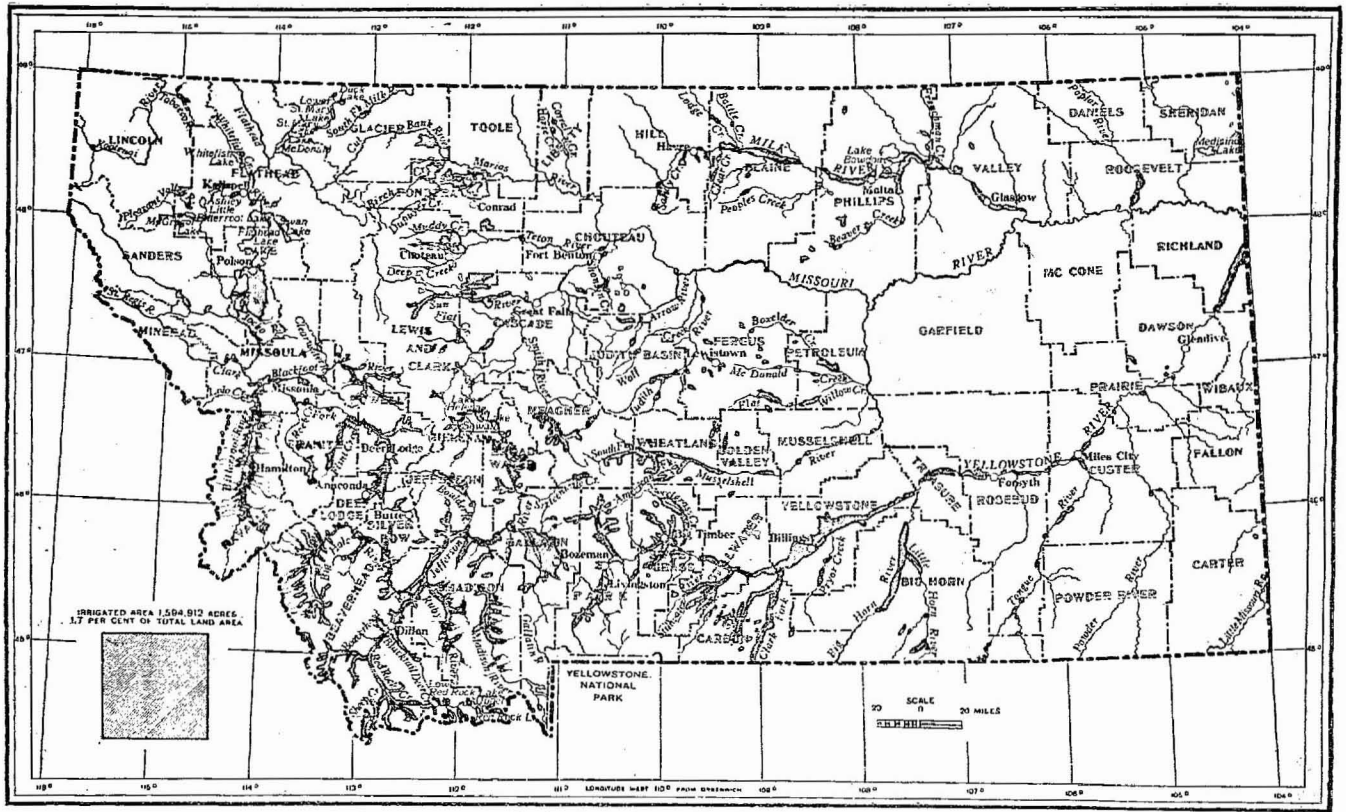

Irrigated Areas In Montana

CONTENTS

An Inventory of Montana Irrigation Projects

By R. B. TOOTELL, Extension Land Economist

Part I---Purpose and Scope of Study

It is felt that very little is known about Montana irrigation projects. Although the Bureau of Reclamation from time to time issues reports on projects under its jurisdiction, little information is available for projects of the Indian Service, irrigation districts and irrigation companies. This bulletin giving the results of comprehensive study of Montana irrigation projects presents information which should be of general interest, and which should serve the following useful purposes:

1. Indicate those projects which offer possibilities for further settlement.

2. Acquaint prospective settlers, who do not have the time and money to visit all or a considerable part of the projects, with valuable facts about the type of farming adapted to these areas, the yield which can be expected, facilities for marketing, cost of water, taxes, etc.

3. Indicate projects which are in need of financial assistance and provide data for determining the nature, extent and merits of these needs.

4. Determine, for distressed projects, how other projects are successfully meeting similar problems.

5. Awaken in the public mind a consciousness of the place which irrigation projects occupy in the agricultural development of Montana.

The data incorporated in the individual project reports were obtained largely by the survey method. Project managers or secretaries were asked specific questions about their respective projects. Reports of the State Examiner were consulted to obtain financial data. These reports were supplemented by the records of county officials who also furnished information about taxes and tax delinquency. The State Engineer supplied much general information. Climatic data were taken from the reports of the United States Weather Bureau. For those projects on which a soil survey had been made, the survey report was used as a basis for statements regarding soil, topography and seeped area.

To reduce to the minimum errors of omission and interpretation a copy of each report was sent for correction and approval to the one from whom information was originally obtained for each project. It is, therefore, felt

that these reports give an accurate cross-section of the irrigation projects in Montana.

No attempt has been made in this publication to analyze the problems of the various types of irrigation projects or to make recommendations for their solution. The author has simply presented the facts as he has found them, providing enough details for the reader to make his own analysis and comparisons upon which to base conclusions.

Part II---Irrigation Districts

NATURE OF IRRIGATION DISTRICTS

An irrigation district is a legal subdivision of the state, very similar in nature and function to a special improvement district. It is a cooperative type of enterprise, almost entirely self-governing, whose greatest strength lies in its power to sell bonds, issue warrants and levy taxes as a means of providing revenue.

The irrigation district laws of this state provide that any individuals representing a majority of both the land owners and the acreage involved who wish to purchase, develop or improve an irrigation system may organize an irrigation district for such purposes. The advantage of such an organization is that it permits the immediate completion of a project and makes possible the repayment of the cost over a period of years. This is less costly and more productive of immediate results than is the piece-meal type of development which usually results from individual effort. Especially is some arrangement like this necessary for the development of storage when normal stream flow is not adequate. Individuals usually lack the finances for such a project and it is ordinarily very uneconomical to provide stored water for small acreages.

Each irrigation district is divided into three areas. Each of these areas elects a commissioner, and the three commissioners manage the affairs of the district. The commissioners must each year present to the treasurer of the county, in which a major portion of the district lands are situated, a list of all members of the district, giving the acreage and the assessment levied against each owner for operation and maintenance, for payment of interest on bonds, for bond retirement and for other purposes. The county treasurer collects such assessments with the general taxes and keeps the money so collected in a separate fund for the district.

The Montana statute specifies that each and every acre of land in the district shall be assessed a like amount for district purposes. This is one of the weaknesses of the present law. In any district the lands vary somewhat in crop producing capacity which in turn affects the ability of land

owners to meet payments. As owners of the poorer lands default in payment, the entire burden of district support falls on the better lands. This has been the cause of serious delinquency in some of the districts. If at the inception of the district, all lands were classified as to their capacity to produce, and if the law permitted the assessing of each class of land accordingly, all land benefitted would contribute something to the support of the district with the result that delinquency would in all cases be reduced, and in some cases entirely eliminated.

Closely associated with the "equal payment" feature is the so-called "blanket liability" clause which specifies that all lands in the district are jointly liable for the indebtedness of the district. So long as there is any district indebtedness, the owners who can make payments must do so regardless of the fact that they already may have paid their pro rata share and more. While this is a desirable feature for the protection of the bondholders and other creditors, it works a great hardship on owners of the better lands in a district which also includes considerable poor land. Court decisions relative to this clause during the past two years have been conflicting. Out of the thought which is being given to this point, it seems likely that a plan can be worked out whereby the interests of both the borrower and the lender will be protected.

BRIEF HISTORY OF DISTRICTS

The irrigation district type of organization is not a new thing. Italy, France and Spain developed neighborhood irrigation systems similar to our districts about the middle of the nineteenth century. Utah, in 1865, passed the first irrigation district legislation in the United States. California followed with similar legislation in 1872, but it was not until the passage of the Wright Act of California in 1887 that the organization of irrigation districts in this country became extensive. At the present time all of the western states in which irrigation is practiced have irrigation district laws embodying, with certain modifications, the provisions of the original Wright Act.

The first irrigation district law of Montana was passed in 1907. This delegated the creation of the district and the supervision of bond issues to the respective boards of county commissioners. Because of certain dissatisfaction with this arrangement, the law was amended in 1909, placing the power to create districts and the authority to control bond issues in the hands of the district courts. In 1919 the state legislature created the Montana Irrigation Commission whose members were the same as those of the Montana Railroad Commission. This Commission was to exercise supervisory control over the creation, bonding and construction of irrigation districts. Districts organizing after 1919, therefore, had the option of coming under the supervision of either the Montana Irrigation Commission or of the district courts. Districts which were organized prior to 1919 could, by petition, come under the jurisdiction of the commission. Thirteen districts

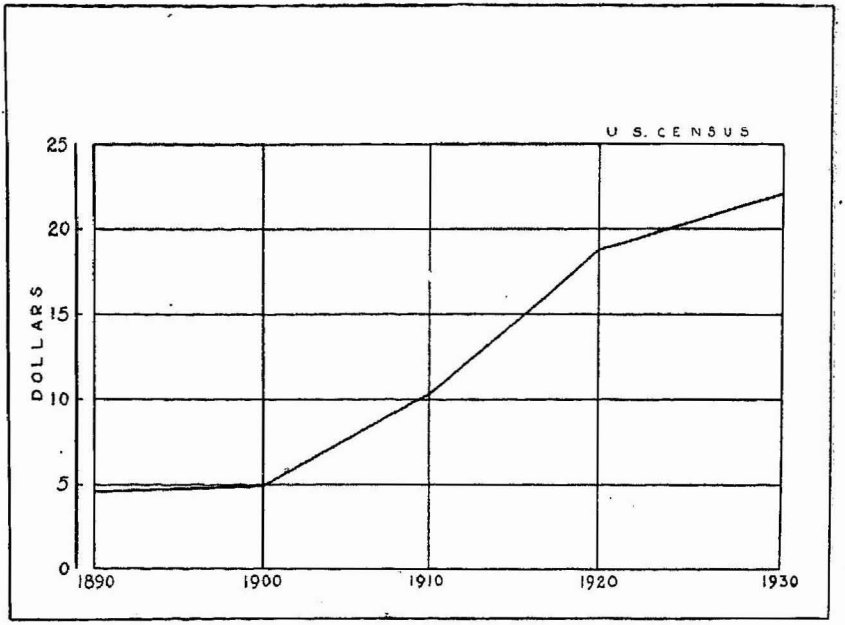

Fig. 1—Investment per acre in Montana irrigation enterprises 1890-1930.

were created in accordance with the provisions of this act before it was repealed by the state legislature in 1929.

Montana irrigation districts have met with varying degrees of success. Some have met all their financial obligations when due without being compelled to make heavy assessments. Some have completely paid off their indebtedness and now make only small levies to pay for operation and maintenance. Some have defaulted on interest and bond payments almost since their beginning. Others have entered into financial readjustments with the creditors, in which considerable of the indebtedness was written off. Still others have so completely failed to meet payments that the counties in which they are located have taken tax title to all the land in the district. The projects which have failed should not stand as an indictment against the irrigation district as an institution for financing and administering irrigation projects. The inclusion of poor land, shortage of water, expensive construction* and a false conception of the irrigation charge which the lands could bear** are far more responsible than is the irrigation district system

*Half the irrigation districts in Montana were created between 1919 and 1921. At that time materials and labor were very high, which resulted in excessive construction cost.

**During 1919 and 1920 prices of farm products were extremely high. This was considered a permanent thing by many people and it gave the impression that irrigated lands would be able to bear an abnormlly high water charge.

itself. Figure 2 shows the rapid growth of irrigation district development from 1910 to 1930. This occurred at a time when there was little or no increase in the total land irrigated, as is evident from Figure 3. The taking over of irrigation company projects by districts was common during this period.

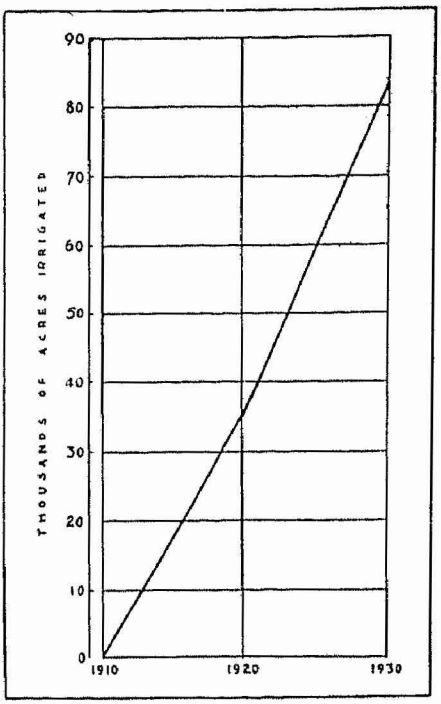

Fig. 2—Irrigation development 1910-1930

ACTIVE MONTANA IRRIGATION DISTRICTS

Districts in this category have been duly organized and have been developed, although at present some of them are virtually inactive.

Active Districts— Northwestern Area

Ashley Lake District — The Ashley lake irrigation district is located a short distance north and west of Kalispell in Flathead County. A branch line connects Kalispell with the main line of the Great Northern Railroad at Columbia Falls about seventeen miles away. Federal Highway No. 2 and other improved roads facilitate travel by car. Kalispell with a population of 5500 is the shopping point for the project and also provides a market for considerable local produce.

The project has an elevation of about 3000 feet. The average frost-free period is about 140 days and normally there is precipitation of about 17 inches. The climate is mild, with extremes in temperature, and high winds much less frequent than east of the mountains. The soil of this project is dark in color, being mostly a sandy loam with clay subsoil. Some alkali has developed in the poorly drained lands. Water is stored in both Ashley and Sedan lakes. Until 1932 the water supply has been inadequate, but storage has been increased and this difficulty overcome.

The gross area of this project is 25,000 acres although only 1640 acres of this have been developed and classed as irrigable. There are 26 farms in the district, varying from 5 to 220 acres in size. Hay and small grain crops claim most of the acreage. Yields are very satisfactory. Potatoes

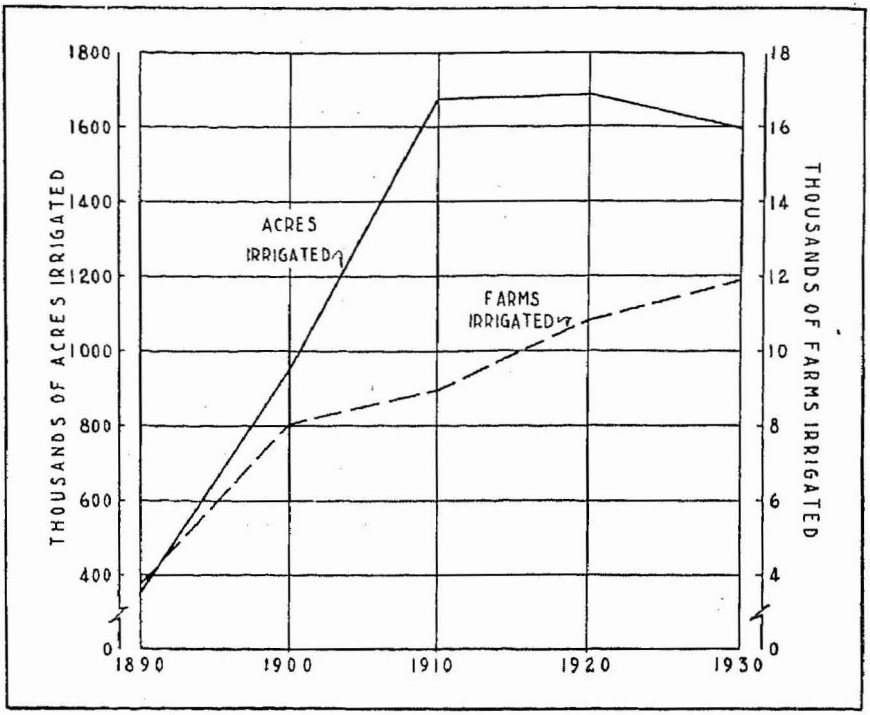

Fig. 3—Irrigated Acreage and Irrigated Farms, 1890-1930

and truck crops are grown to some extent. Diversified farming is being practiced with dairy cattle and poultry on most of the farms.

In 1909 this district was organized to take over the works previously started by the Ashley Lake Irrigation Company. Fifty thousand dollars was paid for the works. Four separate bond issues totalling $91,000 have been authorized and $70,000 of this amount sold. There are at present $31,000 in serial bonds outstanding. Warrants totalling $9258 are also outstanding although money in the treasury and money due from land owners outside the district is nearly equal to this warrant indebtedness. There is considerable tax delinquency on the project at the present time. Since the water supply has been increased it is felt that delinquency will decrease and the project will be a success. The annual district assessment has averaged about $3.40 per acre in the past. Approximately $1.40 of this has been for operation and maintenance while the remaining $2.00 went to pay interest and retire bonds. The general property tax averages about 50 cents an acre additional.

The Bitter Root Group

The ten* projects of this group are concentrated in the heart of the Bitter Root valley, Ravalli County, in western Montana. Hamilton, the county seat, with a population of 1800 is the principal trade center for projects in the southern part of the valley. Corvallis, with a population of 505 lies 6 miles north of Hamilton, while Stevensville, with a population of 691 serves the projects in the lower valley. Creameries and cheese factories are well distributed in the territory. Canning factories are located at Hamilton and Stevensville. Missoula, the largest city in the western part of the state, is only 25 miles from Stevensville and 50 miles from Hamilton. A factory of the Amalgated Sugar Company is located at Missoula. A branch of the Northern Pacific railroad extending up the valley from Missoula to Darby, is within three or four miles of each project. Federal Highway No. 93, a fine graveled thoroughfare, extends the length of the valley.

With its favorable climate the Bitter Root valley is one of the most desirable parts of the state in which to live. High mountains on both sides of the valley reduce the winds considerably. The extremes in temperature experienced east of the continental divide, do not occur here. The average elevation of the irrigated lands is just under 3600 feet. Although the length of the growing season varies somewhat, it averages about 125 days. The average annual precipitation is about 12½ inches. More of this occurs in May and June than in any other two-months period. Fifty per cent of the rainfall actually comes during the growing season, April to September inclusive.

Bitter Root District—The Bitter Root District includes bench lands on the east side of the Bitter Root River, extending from a point several miles above Hamilton to the lower valley north of Stevensville. Over such an expanse of country there is bound to be great difference in soil varying from a silty clay loam to a sandy loam. The subsoil is mostly sandy to gravelly in texture although there are some areas which are underlaid with a heavy clay subsoil. Stoniness and gravel outcrops in some places preclude cultivation, but a further classification of the lands in the district may eliminate such areas from the irrigable acreage. However, most of the land is tillable and is capable of producing good yields of adapted crops. Drainage is good and trouble from seepage is negligible. Water is secured from an extensive mountain lake and is conveyed by a large canal 72 miles in length. The district also has built, and now maintains in excellent condition, an extensive lateral system.

The district includes a gross area of slightly over 25,000 acres. Of this, 18,460 is classed as irrigable and about 15,000 acres are actually under irrigation. There are at present 217 farms on the project averaging about

*Three of these are irrigation companies, further details of which are given in Part V of this bulletin.

80 acres each. The general farming system is illustrated by the following extract from a crop and livestock census taken on the project in 1931:

"The largest acreage was in irrigated pasture, 4,294 acres being accounted for under this heading. Alfalfa hay was next with 4,149 acres. Apples occupied 1,585 acres. There were 879 acres of wheat, 582 of sugar beets, 505 of barley, 429 of oats and a considerable acreage of clover, mixed timothy and oat hay, potatoes, dry beans, dry peas, gardens and the following for canning purposes: Cherries, beans, cabbage and peas occupying more than 225 acres.

"There were in the district at the close of the year 1,500 beef cattle, 2,085 dairy cattle, 11,636 sheep, 3,409 hogs and 16,600 poultry."

Alfalfa yields 2½ to 3 tons in two cuttings on the average, but better farmers obtain three cuttings and secure up to 4 tons. Sugar beets yield 12 to 14 tons, canning peas 1½ tons, wheat 40 bushels, barley 50 bushels, oats 75 bushels, seed peas 18 bushels, apples 300 boxes of marketable fruit and cherries 4,000 lbs.

The crop value in 1931 amounted to about $21.00 an acre on the irrigated land. In addition the gross livestock income was about $15.00 an acre. This was abnormally low because of the hot dry summer and poor prices. In 1930 the average crop income was $31.00, while in 1929 it was $41.00 an acre.

The district was created in 1920 to take over the irrigation system already partially developed by the Bitter Root Valley Irrigation Company. Bonds to the extent of $600,000 were sold. Seventy-five thousand dollars of this was used to purchase the works. Some was used to pay delinquent debts and the balance was required to repair the canal. Four and one-half miles of wooden flume were replaced by earth canal, concrete approaches were put in and the extensive syphons were repaired. It was planned to do additional repair work over a ten-year period and pay the cost from small annual assessments. However an unexpected break in the canal, which cost $65,000 for immediate repair, caused a complete lack of confidence in the project. As a result, a great deal of tax delinquency resulted and matters went from bad to worse. In 1931 the Federal Government, realizing the unfortunate situation of the project, loaned the district $750,000 on easy terms with which to pay off the construction bonds and provide working capital. This money is to be repaid over a period of 40 years with interest at 4 per cent.

Ravalli County has taken tax title to about 5,000 acres of land formerly in the district. The total of delinquent payments on this land is about $20.00 an acre. The terms under which it can be purchased are very reasonable and an attempt is being made to bring these lands back into the district through sale to farmers. The total district assessment is $4.00 an acre annually. Of this, $2.50 is used to pay interest and retire the Federal loan, while the remaining $1.50 is necessary for operation and maintenance. Taxes on an acre basis average about 80 cents to $1.00.

Blodgett Creek District—The Blodgett Creek District is located on the bench northwest of Hamilton. The soils are largely derived from granite. They are classed as coarse stony loam for the most part. The topography is favorable to cultivation and irrigation. Water is taken directly from Blodgett Creek, the district maintaining no lateral system. The natural stream flow is adequate until July 15 most years. Stored water, equivalent to about 6 acre-inches per irrigable acre, is impounded in a natural reservoir near the source of the creek.

The gross area of the district is 1911 acres, nearly all of which is being irrigated. There are 60 farms on the project which vary considerably in size, but average from 20 to 40 acres. The system of farming is quite intensive, with fruit, berries and garden truck being the principal cash crops. Alfalfa cannot be grown successfully without lime but clover yields from 2 to 3 tons per acre. Dairy cows and poultry are kept on most of the farms. Although apples now yield about 350 boxes of marketable fruit per acre and cherries about 4000 pounds, it is known that these yields can be substantially increased.

In 1910 when the district was created a bond authorization of $25,000 was made. Only $20,000 worth of bonds were actually sold, and the last of these were paid in 1929. The district now has no indebtedness. The assessment for 1931 was 10c an acre, and future assessments are not expected greatly to exceed this. Taxes average about $1.10 an acre.

Canyon Creek District—The Canyon Irrigation District is on the bench just across the Bitter Root River west of Hamilton. The land in this project has a gentle slope to the north and east, although the topography is rather uneven. Soils, toward the upper end of the project and near the base of the mountains, are quite stony. Those nearer the river are less stony. They are derived from granite, are largely sandy loam in character and rather shallow. Seepage does not occur to any extent because of the natural drainage afforded. Water is taken from Canyon Creek. In 1931 storage was developed in three small glacial lakes. Prior to that time some shortage of water was experienced after the middle of July.

The gross area of the project was formerly 2490 acres. Within the past few years 985 acres of the stonier land has reverted to the county for tax title and is no longer considered in the district. This gives a gross area of about 1500 acres, with 1200 classed as irrigable and approximately 1000 acres being irrigated at the present time. There are 30 farms in the district varying in size from 5 to 260 acres. The most common size is about 20 acres. This is part of the old orchard district of the valley. Although there are still a great many bearing apple trees, the system of farming has become more diversified, with berries, fruit, clover and dairy cows being included. Yields now commonly obtained are as follows: Apples—300 boxes of marketable fruit to the acre; cherries—3500 lbs.; clover, 2 to 3 tons in two cuttings.

This district was created in 1910 and $20,000 worth of bonds were

sold. These have been retired except for $3500 which the district is protesting. This is the remaining indebtedness against the 985 acres of land which was removed from the district when Ravilli County took tax title to it. The warrant indebtedness of $1700 will be retired by the end of 1933. The district assessment was only 75c an acre in 1931. When the present indebtedness is retired it is expected that an assessment of 25c or less an acre will be adequate. This is possible because the district makes delivery out of the creek, thus eliminating the necessity of a main canal or lateral system. Taxes are about 95c an acre.

Charlos Irrigation District—The Charlos project lies the farthest south of any in the valley, being about 12 miles up the west side of the Bitter Root River from Hamilton. The topography is rather rough and uneven. Soils vary greatly, with rich dark loams predominating in the bottom lands, and with gravelly to stony loams covering the bench lands and slopes. Because of the topography and character of the soil, almost no seepage has occurred. Water is taken from a small stream near the head of which three small lakes provide storage. The supply is adequate except in extremely dry years like 1931.

The gross area of the project is now about 1000 acres of which 750 acres are actually irrigated at present. This is part of a private project embodying several thousand acres, but when the district was reorganized in 1924 the acreage was reduced to the present figures. There are 20 resident farmers on the project, each having approximately 30 acres. The remainder of the land belongs to non-resident owners and is in units of 10 acres. Dairying, the production of garden truck, fruits and berries form the basis of the diversified system of farming followed. Alfalfa does not produce well because of the low lime content of the soils. Clover, which is grown as a substitute for alfalfa, yields from 2 to 3 tons per acre. Cherries average 3500 pounds per acre and McIntosh apples about 250 boxes of marketable fruit. These yields can be materially increased by improved practices.

The Charlos District was created in 1918, but no bonds were ever sold. Warrants were issued to pay for developing the storage system. At the present time the indebtedness is only about 30c an acre. The annual assessment is $1.50 an acre. Taxes average about 75c additional.

Lomo District—The Lomo Irrigation District is located on the west bench above the Bitter Root River just northwest of Hamilton. Soils and topography are similar to that of the Canyon Creek District on the south and the Blodgett Creek District on the north. There are 31 farms in the district, averaging from 20 to 40 acres each. The system of farming followed and yields obtained are the same as in the Blodgett Creek District.

This district, including 940 acres, of which 750 is actually being irrigated, was created in 1923. Farmers in this district are those having only the fourth water right from Blodgett Creek. The district was created only as a means of equally assessing all water users for the operation and main-

tenance of the system. The ditches conveying water from the creek to the farms were constructed about 1895. The assessment per acre for 1931 was only 5c. This may be slightly increased when repairs are to be made but it is always very low. Taxes are about 80c an acre.

Mill Creek District—The Mill Creek District is located west of Corvallis on the bench above the Bitter Root River. Soils of the project are a coarse stony loam of grayish-brown color. The topography is moderately broken and slopes gently to the north and east. Water is taken by gravity from Mill Creek and no lateral system is maintained by the district. A reservoir has been constructed near the source of the creek, providing sufficient water in average years. There is some water shortage in very dry years, but the present dam could be increased in height by about 10 feet to correct this difficulty. The cost of this improvement would not be prohibitive.

Gross area of the district is 2224 acres of which nearly 2000 is irrigated. There are but 12 farms on the project. A few of these contain several hundred acres, but the average size is 80 to 100 acres. Because of the larger size of holdings the system of farming is less intensive than that of other projects nearby. A considerable acreage is in apple and cherry orchards which yield an average of 350 boxes and 3000 pounds per acre respectively. Clover is the most common hay crop, yielding about 2½ tons per acre. Dairy herds are quite common and some beef cattle and sheep are kept on a small scale.

The district was created in 1910. Out of an authorization of $40,000, bonds to the extent of only $25,000 were sold. There are now $5,000 in bonds outstanding which will be due in 1936. The annual assessment is $1.05 an acre, but when the indebtedness is retired in 1936 this will be reduced to an almost negligible figure. Taxes average 95c an acre.

Sunset District—The Sunset District embodies a strip of land approximately one mile wide and five miles long on the south side of Burnt Fork Creek. The lower end of the project extends nearly to Stevensville which is on the east side of the Bitter Root River. Soils* of the upper part of the project are a grayish brown stony loam of good productivity. They are underlaid with hardpan at a depth of about 12 inches. Drainage is good and the soil is quite productive. The soils toward the lower end are a stony sandy loam which in many cases are too stony for cultivation. The topography throughout is moderately even and favorable for cultivation. Water is taken by gravity from Burnt Fork Creek, on which a supplemental storage system is being developed. The supply will be adequate when this reservoir is completed. The district has constructed and now maintains an extensive lateral system.

The gross area of the district is 3025 acres of which 2800 is classed as irrigable and is being irrigated at the present time. There are 70 farms on the project. With the exception of a few large farms the average size

*Data on soils were obtained from the report of the Bureau of Soils, U. S. D. A., entitled "Soil Survey of the Bitter Root Valley Area, Montana."

is from 20 to 30 acres. Sugar beets have been grown in the past, with an average yield of about 12 tons, but few or none are grown at present. The principal crops are alfalfa, small grains and peas. Alfalfa averages 3 tons per acre; wheat, 30 bushels; barley, 50 bushels; and oats, 65 bushels. Green peas are grown to some extent for the cannery at Stevensville, giving an average yield of about 1½ tons. Some seed peas, with an average yield of 20 bushels, are grown. Dairy cows are the principal livestock.

The Sunset District was created in 1917 at which time a bond issue for $20,000 was authorized and sold. There remain $17,000 in outstanding bonds, the last of which fall due in 1948. About $7,000 in warrants are outstanding, making the present indebtedness per acre of irrigated land about $8.50. It will cost about $2500 to complete the storage program, so the district is proposing a $10,000 bond issue to cover this cost and retire outstanding warrants. The present assessment on irrigated lands is $2.00 per acre of which 40c is for interest payment and bond retirement and $1.60 operation and maintenance. The non-irrigable lands are assessed 50c per acre, all of which goes to the bond and interest fund. There has been very little delinquency in payments to date. After the construction is completed and indebtedness is retired it is thought that 50c an acre will suffice for operation and maintenance. Taxes average about 95c an acre.

Clinton District—The Clinton District is located about 20 miles southeast of Missoula. The project is traversed by the main lines of the Northern Pacific and Chicago, Milwaukee, St. Paul & Pacific railroads and by Federal Highway No. 10. The soils are a dark colored gravelly loam. Gravel is sufficient in some places to make cultivation difficult. No trouble is experienced with seepage. Water is taken by gravity from the Hell Gate, or Missoula River. The supply is abundant for the present acreage. The main ditch is 6 miles in length and no laterals were built by the district.

Of the 1000 acres included in the project of this narrow mountain valley, about 600 actually are irrigated. Most of the remaining acreage under the ditch is either not cleared or is river bottom gravel with little soil covering. There are 12 farms on the project. Half of these vary from 30 to 60 acres, while the other half average about 100 acres each. No definite system of farming is being practiced. Alfalfa, small grain crops and potatoes are grown. Small units of livestock add diversity to the farming systems.

The district was created in 1919, at which time bonds for $26,000 were sold. There are now $15,000 in outstanding bonds. Interest on these has been paid when due and all bonds maturing to date have been paid. The annual assessment is $3.20 a year. Most of this is used for the payment of interest and the retirement of bonds. Taxes are about $1.00 on acre.

Glen Lake District—The Glen Lake District is located immediately north of Eureka in the Tobacco Valley of Lincoln County. The main line of the Great Northern Railroad passes within a short distance of the project, and loading points are convenient. Federal Highways No. 93 and No. 2

both pass through the project. Eureka, with a population of 862 is the trade center and a local market for farm products. Spokane is 222 miles distant by rail.

The elevation is approximately 2,600 feet, the frost-free period averages about 124 days and the annual precipitation about 14.5 inches. The soils are rather dark in color and for the most part are a loam or gravelly loam in texture. Topography is uneven, being broken by intermittent stream courses and coulees. Water is diverted from Therrault Creek and stored in both Lick Lake and Glen Lake. Extensive flumes are required to carry the water over the rougher parts of the project. As reorganized it is believed that there is an ample supply of water.

There are 34 farms in the district at present and irrigable area per farm ranges from 5 to 135 acres. A diversified system of farming is practiced with alfalfa, small grains and potatoes being the principal crops. Some livestock is incorporated in the farming system, but the project cannot be classed as highly developed agriculturally. However, with the reorganization which has recently been made, this project seems to offer very good possibilities.

The Glen Lake district, created in 1910 included 4,300 acres of which 4,000 were considered irrigable. In 1915 and 1916 two bond issues totalling $143,000 were sold. In 1923 two more issues for $18,500 were sold, bringing the total up to $161,500. Of these, $125,000 were until recently outstanding and the warrant indebtedness of the district was $14,881. During the spring of 1932 the bondholders effected a reorganization which has vastly improved the desirability of the project. This involved a complete cancellation of the bonds and a writing down of the warrant indebtedness to $10,000, which figure represents the total present indebtedness of the district. Furthermore, the area classed as irrigable has been reduced from 4,000 acres to about 2,659 acres. The indebtedness per irrigable acre, therefore, now stands at slightly less than $4.00. The bondholders have purchased from Lincoln County all the land which was tax delinquent. This land is now available for farms. The annual district assessment is $2.00 an acre, with taxes on land about 50 cents an acre additional.

MISSOULA GROUP

Of the four* Irrigation projects which are included in this group, all but one are located within a short distance of the city of Missoula, in the western part of the state. Missoula, with a population of 15,000 is the trade center for farmers of these projects. At this place is located creameries, warehouses, and the beet sugar refinery of the Amalgamated Sugar Company. The main lines of both the Northern Pacific and the Chicago, Milwaukee, St. Paul & Pacific railroads pass within two miles of each of the

*Three of the four projects here referred to are irrigation companies. Further data relative to each of these appears in Part V of this bulletin.

projects, and shipping points are frequent and convenient. An excellent system of State and Federal highways makes auto travel easy at all times of the year.

The altitude at Missoula is 3223 feet, the growing season about 120 days and the annual precipitation averages 15½ inches.

Missoula District—The Missoula District includes land lying immediately south and west of the city of Missoula. Soils of the project are a dark brown loam of good productivity. The sub-soil is sufficiently porous to provide proper drainage. Water is taken by gravity from the Missoula River near the foot of Mount Sentinel. The supply of water ordinarily is considered adequate, but some shortage occurred in 1931. In the fall of 1931 a well constructed log dam was placed across the river, so an abundant future supply seems assured. The district maintains a system of laterals as well as the main canal. There are 27 miles of ditches and laterals.

The gross area of the project is 3100 acres, all of which is actually being irrigated. There are 265 water users in the district. Although the holdings vary from one city lot to 400 acres, the average size farm is about 10 acres. On the small farms berries, fruits and truck crops are grown extensively. Sugar beets and alfalfa occupy a considerable acreage. Three cuttings of alfalfa usually are obtained, with a total yield of about 3 tons per acre. Sugar beets yield 12 to 15 tons per acre. Dairy cows and poultry constitute the principal livestock. This is an excellent place for one who wishes to engage in part time farming or for one who wishes to retire on a moderate income and produce most of his living.

In 1922 the Missoula Irrigation District was formed to take over an old partnership ditch. No bonds were sold, warrants being issued instead. The total indebtedness of the district is $6,000 or slightly less than $2.00 per acre, payment of which is already provided for in the 1932 budget, on a water charge of $2.65 per acre. General land taxes average about $2.85 per acre.

Active Districts—North Central Area

Bynum District—The Bynum District is located in northern Teton County. Bynum, situated on the Great Falls-Pendroy branch of the Great Northern Railroad, is the principal shipping point on the project. Agawam, a station on a branch of the Chicago, Milwaukee, St. Paul & Pacific railroad serves as the shipping point for the eastern part of the project. An excellent gravelled highway (U. S. No. 87) traverses the district connecting it with Choteau, 15 miles to the south, and Great Falls, 75 miles to the southeast. The latter city is the best market in northern and central Montana.

The average elevation for the project is about 3,900 feet and the annual precipitation is 14 inches. The last killing frost in the spring comes about May 20 and in the fall the first killing frost can be expected about September 10. This gives a frost-free period of about 113 days. Soils of the

project vary considerably. Topography, for the most part, is favorable for irrigation and the water supply is adequate, the project having a storage reservoir of 80,000 acre-feet capacity.

The district, created in 1920, includes 32,362 acres, of which 21,201 is classed as irrigable. Development is recent and the acreage actually irrigated up to 1927 was small. This was increased to 16,000 acres, however, in 1931. There are at present 52 farmers on the project. The farms vary in size, but a 160-acre unit is considered desirable. Alfalfa and sweet clover yield two tons in two cuttings, potatoes about 100 cwt., and small grains do well. The high altitude limits the crops which can be grown successfully, but a rotation embodying small grains and hay is recommended. The project is well suited to the production of feed crops for livestock because of the large amount of range land in the vicinity.

Serial bonds to the extent of $1,000,000 bearing maturity dates from 1930 to 1955 were sold in 1922. This made an original indebtedness of about $48.00 per acre on the land classed as irrigable. Bonds and interest coupons due since January 1, 1931, are in default and there is considerable tax delinquency in the district. The annual district assessment is $4.00 per acre of which $0.40 is for operation and maintenance, and the remainder for interest payment and debt retirement. Taxes average 35 cents an acre additional.

Active Districts—Northeastern Area

Upper Glendive-Fallon District—This district is located on the north side of the Yellowstone river below the town of Fallon. Although the upper portion is in Prairie County, most of the project is in Dawson County. The main line of the Northern Pacific Railroad parallels the project on the opposite side of the river, but a bridge at Fallon makes this accessible. The Chicago, Milwaukee, St. Paul and Pacific Railroad is about five miles from the upper end of the project. Federal Highway No. 10 traverses the project. Glendive, a city of 4500 is only a short distance from the lower end. The Holly Sugar Corporation operates a sugar beet factory at Sidney, 60 miles northeast.

The average elevation is 2150 feet, the frost-free period averages 125 days and the annual precipitation is 11 inches. The land is largely a gently rolling river bottom type and readily irrigable. Soils are moderately light in texture and are very productive.

Water is taken from the Yellowstone River by a unique system in that a steam pumping plant is used, which burns lignite coal mined within a few rods of the plant. This plant was installed about 1910, but was used very little. The Upper Glendive-Fallon district was created in 1920 and the old plant was rehabilitated and brought into service. The gross area of the district is 6120 acres of which 4210 acres are irrigable. There has never been a complete settlement of the project, and matters have gone from bad to worse. At present there are 23 ownerships on the project, but de-

linquencies are heavy. The last assessment paid by a substantial number of the farmers was in 1924. Since then only a few have paid and the plant has not operated for the past five years. The original bond issue of $150,000 is still outstanding.

Active Districts—Central Area

Chestnut Valley District—The Chestnut Valley project is located just south and east of Cascade on the east side of the Missouri River in Cascade County. The Havre-Butte branch of the Great Northern railway parallels the project on the opposite side of the river. Cascade, with a population of 400 is the shipping point. At this place is situated a large flour mill and a creamery. Great Falls, 30 miles distant, provides a desirable market for many farm products. Federal Highway No. 91, connecting Great Falls and Helena, passes through Cascade.

The elevation of this project is approximately 3400 feet. The last killing frost in the spring usually occurs about May 20 and the first killing frost in the fall about September 20, providing a frost-free period of approximately 120 days. The annual precipitation as recorded at Cascade over a period of twenty years has been nearly 18 inches. Topography is mostly flat, broken only by old stream courses. The greater part of the area is river bottom land, the soil of which is largely silty in texture with occasional patches of clay. Most of the cultivated acreage is on terraces which have a sandy to gravelly loam soil. Little actual seepage has taken place, although the level topography of the bottom lands does not permit proper drainage. Water is taken by gravity from the Missouri River and the supply is adequate at all times.

The Chesnut Valley project was constructed in the early nineties and was operated as an irrigation company until 1920 when the present district was created. The gross area of the project is 4500 acres of which 4000 is irrigable. At the time the district was formed, there were 3000 acres being irrigated. At present there are 40 farms on the project, varying in size from 80 to 120 acres. Because of nearness to range, this project seems well adapted to the growing of feed crops and the keeping of livestock. Dairying and general farming are practiced, particularly on the better land. If the proposed sugar beet factory for Great Falls materializes, this should make possible the production of beets to advantage. Alfalfa yields about 2½ tons per acre in two cuttings, beets, which have been tried out on the project, averaged about 12 tons, potatoes yield 100 cwt. per acre, wheat 30 bushels and barley 45 bushels per acre.

The district was originally bonded for $140,000. The lands of the district became tax delinquent and were taken by Cascade County in 1930. According to a recent court decision, all bonded indebtedness was wiped out when the county took title to the lands. To protect their interests, the bond holders purchased the tax litle lands from the county and are now managing the project. Due to the uncertainty involved in the foreclosure

and sale of the district, a considerable acreage of the land once irrigated has not been irrigated the last few years. When reorganization plans are completed, the district should again become well developed agriculturally. When land is sold, the construction charge will be included in the purchase price. Annual assessments for operation and maintenance will be 50c to 75c an acre and taxes about 90 cents an acre.

Judith Basin District—The Judith Basin district is located 25 miles northwest of Lewistown in Fergus County. Danvers, only 2½ miles distant, is a small town on the Chicago, Milwaukee, St. Paul and Pacific Railway. Although Federal Highway No 87F lies 15 miles south, the project is served by good surfaced roads. Lewistown is a good market for some products and is the trade center of the area. Great Falls, which is 100 miles west, is one of the best markets in the state.

The altitude of the project is approximately 3700 feet and the annual precipitation average 16 inches. The last killing frost in the spring occurs about May 12 and the first killing frost in the fall about September 20, making a frost-free period of about 130 days. Nearly all of the land is sufficiently smooth to make irrigation easy. The soil is a rich sandy loam that is highly productive. Water is taken by gravity from Warm Springs Creek. The supply is plentiful and the fact that the water is warm enhances its value for irrigation purposes. Seepage is not a problem.

This district was created in 1919 with a gross area of 4300 acres, of which probably 3600 are irrigable. Only 1500 acres of this have been consistently irrigated. It is claimed that an additional 4000 acres could be put under the ditch at a low cost. At the present time the land of the project is held in rather large units. Alfalfa is the principal crop, with yields from 2½ to 3 tons per acre. Wheat, oats and barley yield very well, and are grown to some extent as feed crops. Some of the holdings on this project might well be subdivided, since units of 160 acres should be a desirable size. Because of the proximity to excellent grazing, it would seem that the farming system followed should center around the production of feed for livestock.

Of the total bond issue of $160,000, only $2000 has been paid. In addition to the $158,000 bonded indebtedness, warrants are outstanding to the extent of $16,442, making the indebtedness per irrigable acre about $48.00. Lands of the project have been acquired by Fergus County because of tax delinquency. As soon as certain legal points are cleared up this project will be either bid in by the bondholders or sold at sheriff sale to private individuals. In either case the indebtedness will be reduced to a point which the land can bear and it should be a desirable place for further settlement.

Active Districts—Southwestern Area

Big Hole District—This project is located just west of Wisdom in the Big Hole Basin. It lies just at the foot of the continental divide at an elevation of about 6,000 feet. The growing season is very short at this high altitude, consequently, hay is about the only crop. The Basin is noted

for its hay production and its great number of beef cattle. There is no feasible railroad shipping point within fifty miles. Roads are fair, being the kind which meet the needs of a range cattle country.

In 1916 the Big Hole District was created to take over the project of the Trail Creek Water Company. The gross area was 9,522 acres, of which 8,500 were designated as irrigable. Water was taken from Trail Creek, but the supply was entirely inadequate for the area included in the project. Bonds tatalling $130,000 were sold and the proceeds paid to stockholders of the Trail Creek Water Company. This proved to be a case of the bondholders simply buying a project, for shortly afterwards the settlers left, paying only $1,500 on the bond principal. This leaves $128,500 in outstanding bonds, which together with delinquent interest brings the total to $287,000. All the land in the district is tax delinquent, $11,000 in delinquent taxes being due the county. Beaverhead County is now selling the land for the taxes against it.

Whitehall Group

Within five miles of Whitehall there are five* irrigation projects of substantial size which have similar climate and marketing and transportation facilities. Whitehall, a town of around 1000 population is in Jefferson County. The main line of the Northern Pacific railroad passes through Whitehall, and the main line of the C. M. St. P. and P. has a depot one mile south. Butte, the largest city in Montana, and an excellent market for many farm products, is only 35 miles to the west. The few sugar beets grown in this territory are shipped to the refinery of the Amalgamated Sugar Company at Missoula, 160 miles distant. A cheese factory is located at Waterloo, near the center of the project. A fine improved highway (U. S. No. 10) connects Whitehall and Butte. The altitude is approximately 4500 feet, the annual precipitation is 12 inches and the frost-free period averages 112 days. The soil varies greatly and will be discussed separately for each project.

Whitetail District—The Whitetail Irrigation District is located just northwest of Whitehall. Topography is excellent on the west side of the project but uneven on the east side. The soil is light in texture and inclined to be stony. Water, which is obtained from a reservoir on Whitetail Creek, would be ample if the reservoir were complete.

Formation of the district was effected in 1921 with 5000 acres of land included. About $113,000 worth of bonds were sold from an authorized issue of $250,000. All of these bonds plus approximately $7,000 in warrants are at present outstanding. Most of the bonds were issued to local people who worked at constructing the dam. Construction was never completed. No ditches were built by the district and some work remains to be done on the dam. About 900 acres of land is irrigated, this being the land under

*Four of the five projects are irrigation companies, complete writeups of which appear in Part V of this publication.

private ditches supplied by old water rights prior to formation of the district. Bonds cannot be sold to complete the project and the unirrigated lands cannot pay levies to retire present indebtedness. A plan is at present under way to reduce the acreage of the district and devlop only the better portion of the project, that lying west of Whitetail Creek.

Active Districts—South Central Area

Big Horn-Tullock District—The Big Horn-Tullock District is located near Big Horn, a small town 20 miles west of Hysham, in Treasure County. This project is on a good highway (U. S. No. 10), and is served by the main line of the Northern Pacific Railway. Billings, the largest market in south-central Montana, having a beet sugar refinery and good marketing facilities, is about 70 miles west.

The elevation is about 2700 feet and the annual precipitation averages about 14 inches, of which a large part comes during the growing season. The last killing frost in the spring occurs about May 1 and the first killing frost in the fall about September 15, making an average frost-free period of 136 days. The topography is for the most part even. The soils are largely silty loam in character and are productive. Water is taken from the Big Horn River, but the supply is adequate only during high water. The original dam washed out in 1921, and since it was not replaced, there has been sufficient water for irrigation only two years since that time.

The district was created in the fall of 1919, with a gross area of 1,697 acres and 1,050 acres classed as irrigable. It is claimed that this 1,050 acres is not an excessive irrigable designation if the dam were rebuilt and the water supply thus increased.

The climate is sufficiently moderate to permit the growing of beans and sugar beets. Beets will yield an average of 13 tons per acre and beans about 15 cwt. Alfalfa produces three cuttings, yielding about 3 tons a year. It is thought that the project should maintain 500 acres of beets and beans and 500 acres of alfalfa. Although grain crops yield well they should be regarded only as feed crops. It is considered that 160 acres, two-thirds irrigated land, should constitute an economical unit and the system of farming should be of a diversified character.

The Big Horn-Tullock District has had financial difficulties. Originally, $75,000 worth of bonds were sold, of which very little has been repaid. There is also a warrant indebtedness of $22,487 and a considerable load of delinquent taxes. The total indebtedness is now $85,487 or $81 per acre of irrigable land. Treasure County took tax title to the district in 1928 and since then has leased it to a farmer who operates the whole thing as a unit. Undoubtedly a readjustment will eventually be made whereby the bondholders will sell out for a small part of the amount they have in the district or else the county will sell the land at sheriff's sale for enough to satisfy the delinquent taxes. When properly refinanced and the dam rebuilt, this should be a desirable location for settlers.

Box Elder District—The Box Elder District is located 5 miles east of Hysham, on the south side of the Yellowstone River. Water for the project is purchased and pumped from the ditch of the Yellowstont Irrigation District. The supply is therefore adequate. There are 1,200 acres in the district, of which 1,000 are irrigable. The topography is reasonably level and the land easy to irrigate. The soil varies from a silt to a clay loam. There are twelve farms on the project, ranging in size from 20 to 400 acres of irrigated land. Beets and alfalfa are the principal crops. Some beans are grown. Considerable livestock is kept and the system of farming is quite diversified. Beets yield about 12 tons, and alfalfa about 3 tons in as many cuttings. Market facilities and climatic conditions are approximately the same as those in the Big Horn-Tullock District, previously discussed.

This district was created in the spring of 1919 and the original bond issue was for $65,000. The county has taken tax title to the land and resold it to the farmers, although some adjustment was made with the bondholders. This eliminates all future payments for original bonded indebtedness and the only assessments will be for aperation and maintenance unless further construction is done. Yearly assessments will probably be around $3.00 per acre, with a 75c property tax.

Columbus District—The Columbus irrigation district includes land lying immediately adjacent to the town of Columbus in Stillwater County. The project is traversed by the main line of the Northern Pacific Railroad and by the Yellowstone Trail (U. S. No. 10). Since Billings is only 45 miles distant, there is a favorable market for farm produce and the distance for shipping sugar beets is not prohibitive.

The elevation at Columbus is approximately 3700 feet. The frost-free period is about 125 days and the annual precipitation about 15 inches. The land is rather rough and broken by frequent gullies. The soil is a light colored heavy clay. Water is pumped from the Yellowstone River at a point a few miles above Columbus.

Land now in the district was first irrigated in 1910 by water from the Stillwater River which was piped across the Yellowstone. In 1918 this pipe was washed out during high water. In 1919 the district was created and a canal constructed to take water from the Yellowstone to irrigate about 1300 acres. Shortly after completion of the canal, seepage developed which endangered the railroad right of way and which resulted in the railroad company obtaining an injunction against the district and the discontinuance of the use of the canal.

Bonds to the extent of $101,000 were sold. None of these have been paid and interest on them is in default. No assessments have been levied since 1923 and all of the land in the district is tax delinquent. The county has sold some of the land, but still holds most of it. Whether the project will be rehabilitated and developed is problematical.

Cove District—The Cove Irrigation District includes a long narrow strip of land lying just below the breaks to the north of the Yellowstone River.

The main canal begins at a point about 12 miles west of Park City in Stillwater County and extends eastward into Yellowstone County to a point about 7 miles northwest of Billings. Park City, with a population of 1000 is on the upper end of the project; Laurel, with a population of 2,600, is one mile south of the approximate middle, and Billings with a population of 16,000 is only a few miles from the lower end of the district. The main line of the Northern Pacific Railway follows the entire length, with the Chicago, Burlington and Quincy cutting across the lower end of the project. Frequent sidings and beet dumps bring shipping points close to all farms. The Yellowstone Trail (U. S. No. 10) a well improved highway, traverses the upper end of the project and at no point is more than two miles distant. Park City and Laurel provide markets for some farm products, but Billings is the principal market. Here is located the large factory of the Great Western Sugar Company, a vegetable cannery, several creameries, bean warehouses and other facilities. Associations are organized for the cooperative marketing of beans, lambs and wool.

Elevation varies from about 3400 feet at the west end of the district to about 3100 feet at the lower end. Annual precipitation averages from 13 to 14 inches. The frost-free period varies somewhat, but averages about 130 days. Soils, for the most part, vary from a river silt to a clay loam. There are occasional outcrops of lighter soils and even gravel. The greater part of two sections lying in what is known as the "cove" is very heavy soil with a strong alkali content. Approximately 1500 acres has a high water table. A survey is contemplated soon which will determine definitely the acreage not suited for irrigation. The topography is, for the most part, favorable for irrigation.

The gross area of the district is 5750 acres which is all classed as irrigable at the present time. About 4,000 acres of this is actually irrigated. There are approximately 100 farms in the district which vary in size from 6 to 450 acres. There is no "most common size" of farm. Agriculture is rather highly developed on the project. Sugar beets and beans are the leading cash crops; alfalfa and small grains are grown for feed. Considerable livestock is kept on the project and, in addition, cattle and sheep from nearby ranges are wintered. A combination of feed crops produced on these farms, with by-products from the beet factory are used to a considerable extent for fattening sheep and cattle during the winter months. Beets yield an average of 15 tons, beans 15 cwt., alfalfa 4 tons in three cuttings, wheat 35 bushels, barley 50 bushels, and oats 60 bushels.

The Cove district was organized in 1922 to succeed the Cove Ditch Company. The main ditch which takes water by gravity from the Yellowstone River is nearly 50 miles long. The first twelve miles of the ditch carry water for this district, plus an additional 3100 miners inches which must be delivered free to an irrigation company formerly owning and operating this part of the canal. The length of the canal and the obligation to deliver free this 3100 inches of water, coupled with the relatively small acreage, makes the cost per acre of irrigable land rather high.

A bond issue of $300,000 was authorized and sold. These were serial bonds bearing maturity dates from 1928 to 1951. Of this there are now $262,500 outstanding. Although bonds are in default for 1931 and 1932 to the extent of $25,000, interest payments have been made and there is no warrant indebtedness. A program of refinancing is being considered. The bond holders have agreed to reduce the indebtedness 30 per cent and to accept a new issue of 4% bonds for the remainder. Delinquent taxes on land in the district aggregate nearly $85,000. Such delinquent lands will eventually be taken by the county and resold. It is planned to create a revolving fund with which these lands may be purchased and returned to the district to bear their pro rata share of the district indebtedness. They will then be sold to private individuals who desire to buy. The present district assessment totals $8.00 an acre annually. Of this $3.50 is for payment of interest on bonds, $2.25 for bond retirement, and $2.25 for operation and maintenance. Taxes average about $1.00 an acre in addition.

Danford District—The Danford Irrigation District is located on the Clark Fork of the Yellowstone about 8 miles southwest of Laurel in Carbon County. A branch line of the Northern Pacific railroad extending from Laurel to Red Lodge traverses the project. The Chicago Burlington and Quincy Railroad parallels the Northern Pacific in the vicinity of the district. A gravelled highway connecting with the Yellowstone Trail at Laurel facilitates transportation. Although Laurel provides a local market for some products, Billings, twenty miles east is the principal market.

The elevation of the project is about 3,400 feet. Although there is no official weather recording station within 20 miles, it is estimated that the annual precipitation is about 13 inches and the average frost-free period approximately 125 days. Topography is for the most part fairly even and favorable for irrigation. The soil is generally of a silt loam although there are occasional spots of gravel and others of very heavy soil. Drainage has never been necessary. Water is taken from the Clark Fork by gravity and is adequate except in very dry years.

About 1900 this project was started as the Mason Ditch Company. Later it became the Danford Ditch Company, and in 1920 was organized as the Danford Irrigation District. Gross and irrigable areas are both given as 1,200 acres. Farms on the project number 21, which vary in size from 20 to 160 acres of irrigated land. Agriculture is highly developed with beets and beans the most important crops. Beets yield an average of 12 tons, beans 15 cwt. and alfalfa, which is grown to some extent in rotation with beets and beans, yields 4 tons in three cuttings. No great amount of livestock is kept on the farms.

All of the $19,000 bond issue sold in 1920 has been retired and the warrants outstanding are negligible. District assessments average $3.00 per acre while the bond issue was being repaid, but in 1931 the levy, now only for operation and maintenance, was only 50 cents an acre. This will vary from year to year as improvements are necessary but it is doubtful if

the average charge will exceed $1.00 an acre. General property taxes are approximately $1.00 an acre more.

Hammond District—The Hammond Irrigation District lies immediately northwest of Forsyth on the north side of the Yellowstone River in Rosebud County. Both the Northern Pacific and the Chicago, Milwaukee, St. Paul and Pacific railroads serve the project which is adjacent to Federal Highway No. 10. Markets for the products grown are Forsyth, Billings and Miles City.

Average elevation on the project is 2,500 feet and the annual precipitation is around 14 inches. The frost-free period is approximately 145 days with the last killing frost in the spring occurring about May 8 and the first killing frost in the fall about September 30. Soils are a silt to a clay loam and moderately productive while the topography is favorable to easy irrigation. Some seepage has occurred but is not a serious problem at present. The system was originally a gravity one, taking water from the Yellowstone River. In 1927 a pumping plant was installed and is now used entirely. The resulting supply of water is ample to meet all needs.

The district was created in 1920 with a gross area of 4,000 acres of which 3,500 acres are irrigable. Practically all of this is irrigated at the present time. There are 22 farms on the project at present and although they vary in size the average is about 175 acres of irrigable land per farm. Alfalfa and beets are the principal crops with beans and small grains being grown to some extent. Alfalfa yields an average of 3½ tons of hay in three cuttings, beets 14 tons per acre, beans 12 to 15 cwt., wheat 40 bushels, barley 50 bushels and oats 60 bushels. A diversified system is largely followed, with feed crops being fed to stock either owned by the individual farmer or stock wintered in the valley.

At the time the district was created in 1920, $63,000 worth of bonds were sold. In 1927 the district was refinanced and this amount reduced to $40,000 which was covered by a refunding issue bearing longer maturity. At this time an additional $61,000 bond issue was sold to pay for the pumping plant and repairs. There are now bonds outstanding to the extent of $96,500 and warrants for $10,000. This brings the indebtedness per acre to slightly over $30.00. The district assessment at present is $4.25 an acre of which $1.75 is for operation and maintenance, the remainder being for interest payment and bond retirement. The district does not maintain a lateral system but delivers water only out of the main canal. County taxes per acre are about $1.30 additional.

Lockwood District—The Lockwood Irrigation District is located immediately southeast of Billings on the south side of the Yellowstone River in Yellowstone County. The project is served by both the Northern Pacific and the Chicago Burlington and Quincy Railroads. Although Billings is the shipping point for most products, the station of Lockwood accommodates the lower part of the project. Roads leading to Billings, and there joining the Yellowstone Trail, are gravelled and are well maintained. The factory of the Great Western Sugar Company, located at Billings, takes all beets

grown on the project. In addition to farm produce actually consumed in Billings, this city of 16,000 population has located in it a plant for canning a variety of vegetables, several creameries and other processing plants. Co-operative organizations have been formed to market beans, wool, lambs and other farm products.

The altitude of this project is about 3100 feet and the annual precipitation averages 14 inches. In the spring the last killing frost can be expected about May 10 and the first killing frost in the fall about September 20, allowing a frost-free period of approximately 135 days. Topography is favorable to irrigation. The soil is a brown loam of high productivity. Seepage is not a problem, nor is it likely to develop. Water is pumped from a secondary channel of the Yellowstone River into two ditches, one requiring a 60-foot lift and the other a 100-foot lift. Some difficulty is experienced in getting an adequate water supply when the river is low, but this is being overcome by diverting more water into the channel from which water is pumped. There are 2600 acres in this project, all of which is irrigated. Farms vary in size from 8 to 120 acres. There are 50 farms in the district. Agriculture on this project is highly developed and a rather intensive system of farming is followed. Sugar beets are the principal crop, with beans being grown to some extent. Truck gardening is common. Few small grain crops are grown except as they fit well into a rotation system. Alfalfa is grown as one means of keeping up the productivity of the land. Some dairying is carried on and, in winter, feeding of beef cattle and sheep from adjacent ranges is made possible because of the nearness to the sugar factory where beet by-products are readily obtained to supplement farm grown feeds.

The Lockwood District was created in 1913. There have been several bond issues, the last of which was sold in 1930, bringing the total to $102,000. At the present time there are $31,500 in bonds and $42,000 in warrants outstanding. A large part of the warrants were issued to pay for electric power, and have not been discounted by the power company. The district started defaulting on bonds in 1929 and to date $16,500 are in default. However, interest on bonds has been paid up to date. A plan is now under way to issue approximately $80,000 worth of 6% semi-annual bonds which will be exchanged for present bonds and warrants outstanding. This will simply extend the time of payment and provide a method of payment which will result in no loss to the creditors but will ease the load on the water users to a point which it is believed they can bear. The district has built up a revolving fund of $2500 which is used to purchase delinquent lands. Five hundred acres have been so purchased and this land is being rented on a cash basis. The total annual charge per acre averages $8.00. Of this $1.50 is for payment of interest and bond retirement. The remainder is for retiring registered warrants and for operation and maintenance. The pumping cost, included above, has averaged slightly more than $3.00 an acre during the past ten years. Taxes average approximately $1.00 an acre in addition.

North Sanders District—The North Sanders district lies immediately north and east of Hysham and includes a gross area of 5,000 acres lying north of the Yellowstone River. Water is taken from the Yellowstone River, but the gravity ditch is effective only during high water. A pumping plant would be necessary to serve the 3,500 acres classed as irrigable.

Topography is fairly even, although the soil is rather heavy in character, being best suited to the production of hay. No extensive irrigation has been done since 1925 and at the present time Treasure county has taken title to nearly the entire acreage. The original bond issue was for $100,000, which was refunded in 1925 and increased to $155,000. No interest or principal has been paid on the bonds.

This project is adjacent to a vast area of grazing land on the north which would make it very desirable for the production of hay. It should be possible to purchase the project either from the bondholders or from the county at a price which would enable it to be rehabilitated and operated on a paying basis.

Red Lodge-Rosebud District—This district is located in Carbon County, and lies about 6 miles northwest of Red Lodge, the county seat. A branch line of the Northern Pacific Railroad connects Red Lodge with the main line at Laurel. Surfaced highways make this project readily accessible by auto. Billings is only 50 miles distant.

The average altitude is slightly more than 5,000 feet. At this altitude the last killing frost in the spring occurs about June 8th and the first killing frost in the fall comes about September 5th making an average growing season of approximately 89 days. The annual precipitation is given by the Weather Bureau as 19.24 inches. The topography is rough which makes irrigation difficult in many places. For the most part the soil is a dark loam which is easy to work when not too stony, and is very productive of crops requiring a short growing season. Drainage has not been a problem up to the present time and the topography of the area probably will prevent it ever being serious. Water is taken by gravity from East Rosebud Creek and the supply is considered ample for all probable needs.

The district was created in the fall of 1920. Approximately 20,000 acres are included as the gross area of the district while the acreage considered irrigable was 9,758 acres. It is planned, however, to reduce the claimed irrigable acreage to 5,500 in the near future. There are 91 farms at the present time and although they vary somewhat in acreage, the average irrigable land per farm is about 60 acres. Only about 1,000 acres per year have been irrigated up to the present time.

The high altitude and short growing season limits the crops which can be successfully grown. Alfalfa hay, in two cuttings, yields from 2 to 2½ tons per acre on the average. Timothy and clover hay yield about the same. Soft wheats are grown to some extent and yields of 40 to 50 bushels are rather common. The hard wheats yield much less and are not

grown in quantity. Seed peas and canning peas are a possibility but are grown to no great extent. Because of the high altitude and crop limitations this project seems best adapted to the production of hay and feed crops with keeping of sufficient livestock to consume these feeds. This is a desirable system also because of the excellent grazing lands nearby.

The financial history of the Red Lodge-Rosebud project has not been a bright one. A total of $418,000 worth of bonds were sold, none of which have been paid. Interest on these bonds has been in default since July 1, 1927. In addition there is a warrant indebtedness of nearly $22,000 against the district. On the basis of 9,758 acres originally classed as irrigable, this is an indebtedness of nearly $45 an acre. District assessments for the past few years have averaged about $4.50 per acre and the taxes about $1.25 per acre on the irrigated land. This is clearly too heavy a burden for lands at this altitude and explains the fact that nearly all the land in the district is subject to tax sale by the county.

At the present time arrangements are being made to refinance the district. The area classed as irrigable will be reduced to 5,500 acres and the bondholders will write off a sufficient amount to make payment of the refunding bonds commensurate with the income producing power of the land.

Victory District—The Victory District includes land on the west side of the Big Horn River and just above its junction with the Yellowstone River in Yellowstone County. The main line of the Northern Pacific Railway and the Yellowstone Trail (U. S. No. 10), pass within a short distance of the lower end of the project.

An average elevation of 2800 feet obtains on the project. The frost-free period is usually about 135 days and the normal precipitation is about 14 inches. The soil is primarily a silt loam, which is reasonably productive. Water is taken by gravity from the Big Horn River. A great deal of difficulty has been experienced with "silting" of the ditches. As a result it has not been possible to irrigate more than a few hundred acres in the last few years. The topography is flat and it is felt that drainage would be a serious problem if the water supply were ever adequate to thoroughly irrigate all the land in the project.

The district was created in 1919 and the canal and works of an irrigation company were purchased. Some land not formerly irrigated was taken into the district and an attempt was made to put it under irrigation. The gross area is 3000 acres with 2800 acres being designated as irrigable. Nothing has been paid on the original bond issue of $52,000. Assessments have not been made since 1928 and nearly all the land is tax delinquent. There are twelve farmers in the district, but most of these are renters.

Active Districts—Southeastern Area

Buffalo Rapids District—The Buffalo Rapids Irrigation District is located on the north side of the Yellowstone River about 20 miles below

Miles City in Custer County. The main line of the Chicago, Milwaukee, St. Paul and Pacific Railroad runs the length of the project. Kinsey, a small town, is the shipping point. U. S. Highway No. 10 parallels the project on the opposite side of the river.

The altitude of this project is about 2,300 feet and the average annual precipitation slightly above 13 inches. The last killing frost in the spring occurs around May 10 and the first killing frost in the fall toward the end of September, allowing a frost-free period of approximately 140 days. The topography is quite level. Soils vary considerably but are predominantly heavy in texture. Water is taken by gravity from the Yellowstone but can be obtained only during high water. Either a new headgate will have to be built or a pumping plant installed to insure the necessary supply.

Creation of the district was effected in 1918. The gross area is 4,000 acres with 3,700 originally classed as irrigable. It is understood that the area now considered of an irrigable nature is 3,200 acres. Development has never proceeded very far because of water shortage. There were never more than 10 farms under the ditch, and at present there are only 8. Alfalfa should be the main crop because of the local demand for hay from stockmen in the surrounding country. The yield of alfalfa is about two tons in as many cuttings, when water is adequate. A farm of 160 acres is considered about the proper unit.

A total bond issue of $123,500 was authorized and sold. None of the issue has been repaid, and interest on bonds have not been paid the past five or six years. Nearly all the land of the district is delinquent and subject to tax title or actually has been taken by the county. At present a representative of the bond-holders is cooperating with the county officials in an attempt to rehabilitate the district.

Cartersville District—The Cartersville District begins just east of Forsyth in Rosebud County and extends down the north bank of the Yellowstone River about 15 miles. It is traversed by the Chicago, Milwaukee, St. Paul and Pacific Railroad which has sidings from 3 to 6 miles apart. The main line of the Northern Pacific Railroad parallels the project on the south side of the river. U. S. Highway No. 10 connects the project with Miles City on the east at a distance of about 35 miles and with Billings on the west at a distance of about 120 miles. Sugar beets are shipped over the Northern Pacific to Sidney which is about 200 miles distant.

The altitude here is 2,500 feet and the annual precipitation about 14 inches. The last killing frost in the spring usually occurs about May 8 and the first killing frost in the fall about September 30, allowing a frost-free period of approximately 145 days. Topography is uniform and the soils are largely a river silt of good production capacity. Water is taken by a gravity ditch from the Yellowstone River. The supply is normally adequate, although in 1931 a pump was installed for a short time to keep up the flow. No difficulty is experienced with seepage.

Gross area of the district is 12,000 acres of which nearly 8,000 acres are classed as irrigable. About 6,000 acres are being irrigated at the present time. Farms vary in size mostly between 80 and 160 acres. Alfalfa, sugar beets, beans and small grains for feed are the principal crops. Yields average as follows: Alfalfa, 3 tons in 3 cuttings; beets, 15 tons, beans 15 cwt.; Wheat, 40 bushels; barley, 50 bushels; oats, 60 bushels.

Corn is grown to some extent, giving a yield of 50 to 60 bushels. A combination of crops are grown in most cases with the feed crops being sold largely to cattle and sheep ranches operating nearby.

When the Cartersville District was created in 1909, bonds were sold to the extent of $335,000. At the present time the indebtedness of the district is represented by outstanding bonds to the extent of $320,000 or $40.00 per acre of irrigable land. It is understood that in 1927 the bondholders took a rather substantial loss when they accepted an issue of refunding bonds. The district assessment in 1931 was $3.40 of which $1.00 was for operation and maintenance. General property tax is an additional 75 cents per acre on an average.

Tongue and Yellowstone District—The Tongue and Yellowstone District includes land lying on the east side of Tongue River and south of the Yellowstone River adjacent to Miles City in Custer County. Miles City, with a population of 7,500 is the shipping point and principal local market. Sugar beets from this territory are shipped to the refinery of the Holly Sugar Corporation at Sidney 150 miles distant. The main lines of both the Northern Pacific and the Chicago, Milwaukee, St. Paul and Pacific railroads serve the project and Federal Highway No. 10 parallels the railroads, providing excellent transportation facilities.

The average elevation is about 2400 feet and the annual precipitation approximately 13 inches. The frost-free period averages about 140 days. Soils are light brown in color and vary from a silt loam to a clay loam. Topography is favorable for irrigation. Water is taken by gravity from the Tongue River about 13 miles above Miles City. The supply is short during dry years and late in the irrigation season. Seepage has not occurred to any great extent.

A gross area of 11,155 acres is included in the project. Of this, 9700 acres is irrigable, and most of this is being irrigated at present. There are about 140 farms on the project, averaging from 60 to 80 acres in size. No definite system of farming is followed although alfalfa, sugar beets and small grain are the leading crops. Some beans, potatoes and corn are also grown. Yields obtained are as follows: Alfalfa, 2 tons in two cuttings; beets, 12 tons; beans, 20 bushels; potatoes, 200 bushels; corn, 30 bushels; wheat, 30 bushels, barley, 45 bushels. Some dairying is being carried on to supply local needs. Many beef cattle from adjacent ranges are wintered on the project.

The district after its creation in 1911 purchased the canal and rights

of the Miles City Canal and Irrigation Company. The original bond issue in 1915 was for $195,000. Another issue of $40,000 was sold in 1920. At present there are outstanding $144,000 of these bonds, the last of which fall due in 1945. This is an average indebtedness of less than $15.00 per irrigable acre. The annual assessment is $3.00 per acre which covers interest, bond retirement and maintenance and operation. Taxes are about 85c an acre. Tax delinquency is very slight and all obligations of the district are met as they occur.

Yellowstone District—The Yellowstone District begins a short distance east of Hysham and extends on the south side of the Yellowstone River to a point 7 miles west of Forsyth in Rosebud County. The main line of the Northern Pacific and U. S. Highway No. 10 traverse the project, making it readily accessible to Forsyth, Miles City and Billings, the principal markets in southeastern Montana.

The average elevation of this project is 2,600 feet and the annual precipitation about 14 inches. The last killing frost in the spring usually occurs around May 8 and the first killing frost in the fall about September 30, thus giving a growing season of approximately 145 days. Soil is largely a silty to a sandy loam with occasional heavy spots. The topography is favorable to irrigation. Some seepage has occurred and some tile drainage has been used. Water is taken by gravity from the Yellowstone River and distributed from a main ditch 30 miles in length. Since a dam was put in the river at point of diversion in 1929 there has been an ample supply of water.

There are 60 farms on the project ranging from 80 to 400 acres in size. Principal crops are alfalfa, beets and beans with small grains grown largely for feed. Yields are as follows: alfalfa hay, 3 to 5 tons in 3 cuttings; beets, 12 to 18 tons; beans, 13 to 16 cwt.; wheat, around 45 bushels; barley, 50 bushels; oats, 65 bushels. Although there is much livestock kept on the project, considerable feed is sold to stockmen who come into the valley to winter.

Gross area of the project is 10,000 acres with 7,500 classed as irrigable. The district was created in 1909, at which time a bond issue of $250,000 was authorized and sold. A second issue was for $150,000. In 1928 the bondholders agreed to a readjustment which left the total indebtedness at $350,000. the new bonds which were issued for this amount do not mature until 1940, but it is believed that these will have to be taken up by a refunding issue of serial bonds. There is also at present a warrant indebtedness of $15,000 which was used to meet coupon payments on bonds. The indebtedness per acre of irrigable land is, therefore, nearly $49.00. District assessments are $5.60 per acre annually of which $1.50 is for operation and maintenance. The district does not maintain a lateral system but delivers water only out of the main canal. The property tax averages about $1.20 per acre in addition.

DISTRICTS CREATED BUT NOT DEVELOPED

Districts given this classification have been duly organized, but no canal or storage development has taken place. Several of these, however, have sold bonds or contracted considerable warrant indebtedness to pay for engineering studies.

Undeveloped Districts—Northwestern Area

DeSmet District—The DeSmet District was created in 1919 with a view to providing irrigation water for about 3000 acres of land northwest of Missoula. The project, which probably would have entailed some pumping was considered unfeasible and abandoned. No bonds were sold and only one district assessment was made. This latter was to pay for engineering investigation.

Talley Lake District—The Talley Lake District, located about ten miles north of Kalispell, was created in 1919. Seven thousand acres were included most of which were considered irrigable. It was planned to build a dam and store water in Talley lake. No construction work was done and the district was dissolved in 1928.

Trout Creek Basin District—The Trout Creek Basin District, located some 10 miles southwest of Phillipsburg, in Granite County, was created in 1924. An area of 2,090 acres was included, of which 1,796 were classed as irrigable. Bonds for $35,000 were authorized, but none sold. No development was done and the project has been abandoned.

Undeveloped Districts—North Central Area

Cut Bank District—The Cut Bank District, located immediately north of the town of Cut Bank in Glacier County, was created in 1920. An area of 17,322 acres was included, of which about 11,000 acres was considered irrigable. It was proposed that water for irrigation be obtained by the extension of a government canal on the Blackfoot Indian Reservation to the west.

Warrants, of which there are still several hundred dollars worth outstanding, were issued to pay for preliminary surveys, but no bonds were ever issued. Construction work was never started.

Toole County District—The Toole County District includes 286,000 acres of land lying north of the Marias River and largely north and east of Shelby in Toole County. Plans called for the irrigating of 200,000 acres by means of water diverted from the Marias River and its tributaries supplemented by storage in four reservoirs. The engineers report showed the cost of the project would be $12,000,000 and it was considered unfeasible.

The district was created in 1919. Three years later a bond issue of $238,000 was authorized and sold. All of this issue was used to pay the cost of engineering work and promotion. No construction was undertaken. To date there are $111,625 in bonds outstanding.

Undeveloped District—Northeastern Area

Brockway District—The Brockway Irrigation District was created in 1919. It was proposed to irrigate a long narrow strip of land lying on the south and east of the Redwater River above Brockway. The area irrigable in this project is 2,740 acres. Water for the project was to consist of flood water that could be stored in reservoirs along the Redwater River and Duck and Ash Creeks during the spring months. A field report of the project was made by the Montana Irrigation Commission, but no bonds were sold and no construction done.

Undeveloped Districts—Central Area

Broadwater District—The Broadwater Irrigation District, located in Broadwater County, was created in 1918. It was proposed that an area of between 8000 and 10,000 acres lying on the east side of the Missouri River and extending from Toston to a line due east of Winston be irrigated. The estimated per acre cost was $32.00. No bonds were sold and the district was dissolved in 1920.

Crow Creek District—The Crow Creek District lies immediately west of Toston in Broadwater County. There was included in the district 52,273 acres of land, of which 40,000 was designated as irrigable. Water was to be taken out of the Jefferson River and conveyed a long distance at great expense. Bonds to the extent of $29,000 were sold to pay for survey work but no construction was ever attempted. At the end of eleven years there are still $26,000 of the bonds outstanding and a warrant indebtedness of $7,736. Although the per acre indebtedness is relatively small, it has been such a burden on these unproductive lands that it has resulted in a great deal of tax delinquency the last few years.

Franklin District—The Franklin District includes about 32,276 acres of land adjacent to Franklin in Golden Valley County. Of this amount, 22,570 acres are considered irrigable. Storage was to have been developed to supplement the normal flow of Careless, Roberts and Swimming Woman Creeks. The project was considered feasible but at present interest is centered more upon the development of this water for irrigation in the Musselshell Valley.

In 1921 the district was created, and in 1923 a bond issue of $39,685 was authorized and sold. This money was used to pay legal and engineering costs. There are at present $29,185 of these bonds outstanding.

Harlowtown-DuRand District—The Harlowtown-DuRand District includes bench lands lying north of Harlowtown in Wheatland County. Approximately 30,000 acres are included in the district, of which nearly 23,000 acres are considered irrigable. Although there is an abundance of good irrigable land, the water supply is not sufficient. The engineering plan made in 1920 called for the construction of storage reservoirs on both the north and south forks of the Musselshell River and on some of its tributaries.

This development, it was assumed, would provide water for irrigating about 16,000 acres. Nearly half the cost of the project was estimated to be for storage development.

The district was created in 1921, but no bonds were sold and no construction undertaken. Although the project is feasible from an engineering standpoint, it will not be economically feasible until prices for agricultural products considerably exceed their average for the past decade.

Helena District—The Helena Irrigation District in Lewis & Clark County was created in 1920. It was proposed that about 16,000 acres of land in the vicinity of East Helena be irrigated by this project. Water was to be pumped from Lake Helena, with an average lift of 180 feet. The return to be derived from the land did not warrant the cost, so no bonds were sold and the project was given up.

Toston District—The Toston Irrigation District embodies an area of 5000 acres lying just east and north of Toston, in Broadwater County. The district was created in 1920 and it was planned to pump water from the Missouri River above Toston. No construction work was done and the slight indebtedness incurred to pay for surveying has been discharged. The district is now in the process of being dissolved.

Ulm District—The Ulm District includes 17,200 acres of land on the west side of the Missouri River between Riverdale and Ulm in Cascade County. The district was created in 1920 and the engineer's report issued the same year. Plans were submitted for irrigating 12,150 acres. Due to the slight fall of the river in this vicinity it is not possible to irrigate the lands of this project by gravity, so it was proposed that two pumping stations be installed in the vicinity of Riverdale to lift the water from the Missouri. The main lift would be about 50 feet with several auxiliary lifts in addition, bringing the average up to 78 feet. Engineers estimates placed the total construction cost at $60.48 an acre, which included $12.21 for drainage. Operation and maintenance was estimated at $7.86 and acre.

In 1920 an $800,000 bond issue was authorized, but only $50,000 of this was sold. The money was used to pay for engineering and administration.

Valley View District—The Valley View District is located on the bench just north of Three Forks, in Broadwater County. It was created in 1920 and embodied an area of 2,694 acres. A survey was made, and indebtedness contracted but never paid, totalled $2,865. No construction work was done. Broadwater County has taken tax title to most of the land. It is questionable if this project will ever be developed unless a very substantial demand develops for irrigated land.

Woods Gulch District—This district, located about ten miles west of White Sulphur Springs in Meagher County, was created in 1920. It was proposed that storage be developed on Woods Gulch and Little Birch Creeks, which would make possible the irrigating of 900 acres. The project was declared unfeasible and the district disolved.

Undeveloped Districts—Southwestern Area

East Bench District—This district was created in 1922. The area to be irrigated is bench land lying east of the Beaverhead River and extending from a point seven miles above Dillon to the boundary line between Beaverhead and Madison counties. A gross area of approximately 25,000 acres is included, of which nearly 14,000 acres are designated as irrigable. Water would be taken by gravity from the Beaverhead River and some storage would be involved. The engineering report indicates that the project is feasible but no bonds have been sold and no construction undertaken. It is proposed to keep the district intact until such time as conditions are more favorable for development.

Madison Valley District—The Madison Valley district was created in 1916 for the purpose of placing under irrigation about 1,900 acres of bench land on the west side of the Madison River between Ennis and McAllister. No development was undertaken by the district organization. In 1919 the land owners formed the West Side Canal Company which developed the project.

South Bench District—The South Bench district organized in 1922, includes about 21,000 acres of bench land south of Three Forks in Gallatin and Madison Counties. Appriximately 15,000 acres were to be made irrigable by the storage of water in Norwegian and Willow Creeks. The construction cost per acre was estimated at $56.47, with an annual operation and maintenance cost of $1.00. Although the land included in the district is productive, it was felt that the project would not be justified under prices for agricultural products obtaining in 1922.

Undeveloped Districts—South Central Area

Bracket Creek District—The Bracket Creek District, located some 10 miles north of Livingston, was created in the year 1920. At that time there was strong sentiment favoring the development of irrigation in Montana. A fine natural storage site prompted the creation of this district but feasibility studies showed that the area to be benefited was too small and the soil not of sufficient high quality to bear the costs. The engineer reported adversely on the project and it was not undertaken. No financial obligation was assumed by the people of the district.

East Side District—The East Side district is located in the vicinity of Belfry in southern Carbon County. Gross area of the district is 13,348 acres and the irrigable area is 7,104 acres. Water was to be taken by gravity from the Clark Fork River and carried through the old Wills Ditch which it was planned to enlarge and extend. The district was created in 1920, and in 1921 a bond issue of $460,000 was authorized. None of the issue was sold, and no development took place. No financial obligations are outstanding.

Grey Cliff District—The Grey Cliff District, beginning about 7 miles

east of Big Timber and extending approximately 7 miles down the Yellowstone, is on the south side of the river. The district was created in 1923 and contained 2,100 acres classed as irrigable. Water, of which there was an adequate supply, would have been taken from the Boulder River. In the neighborhood of $3,500 was spent in making engineering studies and preliminary work but no bonds were sold and the district has been formally dissolved. If the price situation were to become greatly improved, this project might be revived and a pumping plant installed. It is estimated that the cost would be upwards of $70,000. The topography is excellent and soils of fair quality, but it is understood that this would be considered primarily a hay and livestock undertaking.

Hysham District—The Hysham district, consists of a strip of land 6 miles long and approximately 2 miles wide, surrounding the city of Hysham. The district was created in 1913, with a gross area of 7,600 acres of which 6,400 would be irrigable. No development has taken place on the project, although a $300,000 bond issue was once authorized. This would have to be a pumping project, taking water from the Yellowstone in two lifts of 70 and 95 feet respectively. Plans were not completed because the power company has no line to Hysham at present.

Topography, soil and climate are favorable on this project. It is estimated that it could be completed now at a cost of $220,000, or a cost per irrigable acre of about $34.00. It is unlikely that the project will be developed, however, until the price for agricultural products is much more favorable.

Joliet and White Horse Bench District—This district, created in 1919, embodies a gross area of 13,000 acres lying between Joliet and the Yellowstone River in northern Carbon County. The area is made up largely of rolling bench lands, well adapted to irrigation. The net irrigable area is 8,000 acres. It was proposed to use the spring flood waters of Red Lodge and Rock Creeks and the East Rosebud River, supplemented by a storage of about 10,000 acre feet. The project was reported upon favorably by the engineers but the residents of the district decided to delay construction until costs were lower. The drop in agricultural prices which vary shortly occurred discouraged further consideration of the project. A levy of 15 cents an acre was made to pay for engineering determinations which was the only financial obligation incurred.

Upper Yellowstone District—The Upper Yellowstone district, located approximately 15 miles up the Yellowstone River south and west of Livingston, was created in 1920. Slightly less than 4,000 acres were included in the project. Water was to be taken by gravity from the Yellowstone River and the estimated cost of construction was only about $20.00 per acre. Bonds to the extent of $75,000 were authorized, but none sold. It is understood that about ¼ mile of ditch was constructed before the project was abandoned.

Undeveloped Districts—Southeastern Area

Highland Park District—The Highland Park District was created in

1920, contemplating the irrigation of a large acreage of bench land south of the Yellowstone River and lying immediately south and east of Forsyth in Rosebud County. Water would have been pumped from the Yellowstone, but the lift would have been very great. Assessments were levied to pay for preliminary surveys, but the project was declared impractical and abandoned.

DISTRICTS PETITIONED BUT NEVER CREATED

A number of communities which have gone through the procedure of petitioning to have an irrigation district created, have gone no further. Adverse engineering reports, insufficient finances or general lack of interest are responsible. Such proposed projects are here given brief consideration.

Districts Not Created—Northwestern Area

Cooper's Lake District—Boundaries of the proposed Cooper's Lake District included about 20,000 acres of land known as the "Kleinschmidt Flat," located in the Blackfoot Valley in northern Powell County. Water was to be diverted from the north fork of the Blackfoot river into Cooper's Lake, where it would be stored. From here it would be distributed by gravity during the summer season. The first petition filed in 1919, was irregular, but a new one was never filed.

Frenchtown Valley District—The petition of this district was filed with the commission in 1919. This called for the inclusion of 8000 acres in the Frenchtown Valley about 15 miles west and north of Missoula. Water was to be taken by gravity from the Clark's Fork of the Columbia River. Preliminary field work was done by a local engineer who estimated the cost per acre would be about $25.00. The petition was not regular and nothing further was done.

Nine Mile Prairie District—This proposed project is located on the north side of the Blackfoot river just below the mouth of the Clearwater river in Missoula County. About 9,000 acres were included. Water was to be taken by gravity from either the Blackfoot or the Clearwater. The petition filed in 1919 was not regular, but no further petition was filed. Not even preliminary field work was done.

Districts Not Created—Northeastern Area

Brockway-Ash Creek District—Lands in this proposed district surround the town of Brockway in McCone County. The area included was only 237 acres, all of which had been formerly included in the Brockway district previously discussed. It was proposed to develop storage by rebuilding an old reservoir on Ash Creek. Preliminary field work was done but nothing further.

Glendive-Fallon District—The petition of this district, filed in 1919 proposed the irrigation of lands on the north side of the Yellowstone river, between the towns of Fallon and Stipek in Prarie and Dawson counties. The

plan called for generating power by the burning of lignite coal readily available in the locality. Power would be distributed from the generating station to local pumping plants along the river. Engineering investigations revealed the project to be unfeasible in its entirety, but recommended that the upper unit be developed. This was done through the creation of the Upper Glendive-Fallon irrigation district which has previously been considered.

Districts Not Created—Central Area

Fish Creek District—This proposed district included 36,140 acres of rolling bench land on both sides of Fish Creek immediately south and west of Ryegate in Golden Valley County. A gravity system involving the construction of four reservoirs was considered. The preliminary report issued in 1922 recommended that not more than 5000 acres be included in the project because of water shortage. The estimated cost of construction which would permit irrigating this feasible unit was $49.00 and acre.

Newlan Creek District—In 1920 a petition was filed with the Montana Irrigation Commission calling for the inclusion in a district of 1290 acres lying along Newlan Creek about nine miles northwest of White Sulphur Springs in Meagher County. The plan was to divert water from Sheep Creek to Newlan Creek by an old canal, partially constructed at the time. The system was to be entirely gravity. Only a preliminary examination was made.

Silver District—The proposed Silver District comprises two units including 15,150 acres lying between a point eight miles northwest of Helena and the station of Silver in Lewis and Clark County. Approximately half the area included was considered irrigable. Water from Canyon and Little Prickly Pear creeks was to be used, but supplemented by storage. Preliminary field work done in 1921 indicated that the cost would be approximately $47.00 per acre and the engineer's reported the project feasible. However, at the court hearing the petition was dismissed.

Districts Not Created—Southwestern Area

Meadow Farm District—This district included 1037 acres owned by one party who planned to colonize the land after development. The land lies on the south side of the Jefferson River between Three Forks and Willow Creek in Gallatin County. Water was to be taken by gravity from the Jefferson River. Although the petition was filed in 1920, the owner put off having the investigation made and it was never done.

Districts Not Created—Southeastern Area

Cedar Creek District—It was proposed in 1920 that this district be created to irrigate 10,850 acres on the north side of the Yellowstone river below Terry in Prairie County. The plan involved the pumping of water from the Yellowstone river. Lifts of 30, 50 and 150 feet were proposed.

Part III---Federal Reclamation Projects

THE RECLAMATION ACT

The Reclamation Act, passed in 1902, created the Bureau of Reclamation within the United States Department of the Interior. The original purpose of this act was to make irrigation water available for large tracts of arid government land in the west which, without irrigation, wiuld not produce sufficient agricultural products to induce settlers to homestead. The scope of the work undertaken by the Bureau of Reclamation has since broadened to permit the supplying of water to vast acreages already in private ownership. This extension of activity was necessitated by the type of irrigation development needed. At an early date the lands readily accessible to irrigation and using only the natural flow of streams were put under irrigation. This left large areas which could be irrigated, but only by the construction of expensive diversion dams, canals, and in many cases storage reservoirs. The construction of these fixtures required more capital than private parties could provide and demanded a long-time period for payment which offered little inducement to private capital.

As now amended, the Reclamation Act provides that 95 per cent of the receipts from the sale of public land and 52½ per cent of the royalties derived from the leasing of mineral lands in the public domain shall go into the Reclamation Fund. Since this is a revolving fund, all repayments of construction charges from completed projects revert to the fund and are used in the development of other projects. During the last decade, receipts from the sale of public land have made up only a small part of the total receipts accruing to this fund.

The construction program on most of the Federal projects is very extensive and has not been entirely completed. Until the development of the project is complete, the construction charge to be made on each acre cannot be determined. Furthermore, this charge may vary considerably for different classes of land on the same project, since the Bureau of Reclamation has adopted the policy of classifying the irrigable lands and varying the charge and period of payment in accordance with the paying ability of the lands. All construction charges are interest-free. Contracts at present in force call for repayment over a 10, 20, or 40 year period in most cases. Others stipulate that a certain per cent (usually five) of the gross crop receipts from the land shall be paid annually to retire the construction charge against it. Under this system the length of time varies with the yields obtained and the prices received for the farm products.

It is the policy of the Bureau of Reclamation to negotiate with their water users through irrigation districts rather than as individuals. These districts are organized in accordance with the irrigation district laws of the several states.

Each district contracts with the Bureau for the repayment of construction charges and for collection of water tolls and operation and maintenance in most cases. After a certain prescribed amount of the construction charge has been repaid, operation of the project is turned over to the district. When all charges levied for construction are repaid, the construction works become the property of the district. After that time the only assessment against the lands of the district will be for operation and maintenance.

Irrigation districts on Reclamation projects may, under certain conditions, sell bonds and incur indebtedness other than that contracted with the Federal Government. An example of this appears in connection with the Chinook Division of the Milk River project in this state.

The bureau of Reclamation now has twenty-eight projects located in the fifteen arid states of the west. Five of these projects are in Montana. Because of the relatively small number and the wide distribution of these projects, they have not been classified by geographical location but rather are considered in alphabetical order in the following pages.

Huntley Project

The Huntley Project is located on the south side of the Yellowstone River, fifteen miles east of Billings in Yellowstone County. The six small towns of Warden, Ballantine, Huntley, Osborn, Pampeys Pillar and Nibble are located on the project. The Northern Pacific and the Chicago, Burlington and Quincy Railroads serve the project. Excellent gravelled highways make travel by auto easy. Billings, the principal market in this part of the state, has a sugar beet factory, creameries, a cannery, and other processing plants. Settlers on the project have marketing organizations for wool, lamb and beans. At Osborn is located the Project Supply Company, a cooperative which handles produce, coal, grain, etc.

The altitude averages about 3,000 feet over the project. The last killing frost in the spring occurs about May 10 and the first killing frost in the fall about September 20, giving a frost-free period of approximately 135 days. The annual precipitation is about 13 inches. Topography is even with ordinary just enough slope to facilitate irrigation. The soils are typical river bottom silt with occasional clay loams. They are generally heavy in nature. Water is taken from the Yellowstone River, largely by gravity. Two pumping plants near Ballantine lift 100 second feet of water into a high line ditch, which serves about 5,400 acres. There is always an ample supply of water available.

The gross area of the district is 32,500 acres, all but a few hundred acres of which are classed as irrigable. Approximately three-fourths of the acreage has been irrigated the past few years. Agriculture is quite highly developed on the project. There are 638 farms at present, and although they vary somewhat in size, most are 80 acre units. Sugar beets and beans are the main cash crops, while alfalfa and small grains are grown extensively for feed. Beets average 12 tons per acre, beans 21 bushels, alfalfa 2½ to 3 tons in three cuttings. Small grains yield from 25 to 50 bushels. Considerable dairy cattle are kept, while beef and sheep are wintered in large

numbers. The availability of beet by-products and good yields of feed crops make feeding a desirable enterprise.

The Huntley Project was authorized and construction started in 1905. Water was available for irrigation in 1908. The Huntley District was created in 1921, and in 1928 it was given the management and operation of the project under government contract. The construction charge which has been determined, varies from $40 to $68 an acre. Payment has been suspended on the class 5 land.*

Construction charges are payable under one of four plans, which makes the annual payment vary, but the average charge is $1.60 per acre. Operation and maintenance charges are $1.50 an acre on all but class 5 land, which pays 75 cents. Taxes average about another $1.25 and acre.

Lower Yellowstone Project

The Lower Yellowstone Project is located at the extreme eastern boundary of the state with approximately one-third of the land lying in McKenzies County, North Dakota. The city of Sidney, with a population of 2,000, is situated on the project. At this place is located the plant of the Holly Sugar Corporation which provides a market for sugar beets grown in the area. A branch line of the Northern Pacific Railroad extends from Glendive, a division point on the main line 55 miles to the south. The Great Northern Railroad also has a branch line running through the project, making the rail transportation facilities of the project excellent. Imprived highways make the territory easily traversable by car.

The average elevation is 1900 feet. May 15 is the average date of the last killing frost in the spring, while the first killing frost in the fall usually occurs around September 20. This gives a frost-free period of approximately 127 days. The average annual rainfall over a period of twenty-six years has been just under 14 inches. Medium heavy soils of high productivity predominate on the project. Topography is generally even, making the land readily irrigable. Approximately one-fourth of the land has been troubled with seepage or high water table, but drains completed within the last four years have solved this problem. The supply of water is adequate at all times and the average quantity of water required for best results is 1.5 acre-feet per acre.

Agriculture is highly developed on this project. Most of the farms are from 80 to 160 acres in size although there are still a few larger than this. Sugar beets yielding about 10 tons per acre are the principal cash crop. Beans, grown to some extent, average 13 cwt. Potatoes is another popular specialized crop. Alfalfa is grown extensively with an average yield of about 2 tons. Small grains yield fairly well, but should be grown only for feed. A recommended crop rotation consists of corn, beans or potatoes the first year, followed by two years of sugar beets. The fourth

*Class 5 land is made up of good soils, but of excessively rough topography or areas which are cut off from irrigation supply by sloughs, flat clay areas somewhat alkaline, or areas subject to flood conditions.

year, alfalfa should be seeded with some small grain and the land should then remain in alfalfa the fifth, sixth and seventh years. The combination of sugar beet by-products with alfalfa hay and small grain feed crops makes this an excellent location for fattening livestock.

This is a Federal Reclamation project, which was started in 1904. Water was first made available for irrgiation in 1909. The gross area of the project is 58,321 acres, of which 47,450 acres (excluding class 5 lands) are designated as irrigable. A construction cost of $66.00 an acre, including all drainage work necessary, has been decided upon for the lands exclusive of class 5. The contract with the Federal Government provides for repayment of this on the basis of 5% of the average gross crop value during the past ten years on each class of land. From 35 to 100 years will be required to pay the construction charge, depending on the value of crops raised and the class in which the land is placed. No interest is charged by the Government on the deferred payments. The average annual repayment is now about $1.45 per acre. In addition to this the annual cost of operation and maintenance must be paid. This has averaged $1.13 the past five years. Taxes average about 90 cents, making an average total fixed charge against the land of about $3.50.

Milk River Project

The Milk River irrigation project is located in the north central part of the state, lying along the Milk River in Blaine, Phillips and Valley counties. The total length is nearly 150 miles while the width of the valley which is accessible for irrigation varies from three-fourths of a mile to three miles. The main line of the Great Northern railway traverses the entire length of the project, with shipping points located at frequent intervals. The average distance by rail to the Twin Cities is approximately 800 miles, and to Seattle, approximately 950 miles. The Roosevelt highway also extends the entire length of the project, making travel, east and west by car possible throughout the year. Chinook, with a population of 1300 is the county seat of Blaine County, while Malta with 1265 and Glasgow with 2300 are the county seats of Phillips and Valley Counties respectively. Many smaller towns provide a local market for some products and serve the adjacent territories as trade centers and local shipping points. The refinery of the Utah-Idaho Sugar Company is located near the west end of the project at Chinook. Grain elevators, creameries and livestock and potato shipping associations facilitate the marketing of farm products.

The following table gives important climatic data recorded by the United States Weather Bureau for three points representing conditions existing at the upper, central and lower portions of the project:

Location	Altitude	Growing Season	Mean Annual Precipitation
Chinook	2502 feet	128 days	12.76 inches
Malta	2250 feet	126 days	13.88 inches
Glasgow	2092 feet	120 days	13.61 inches

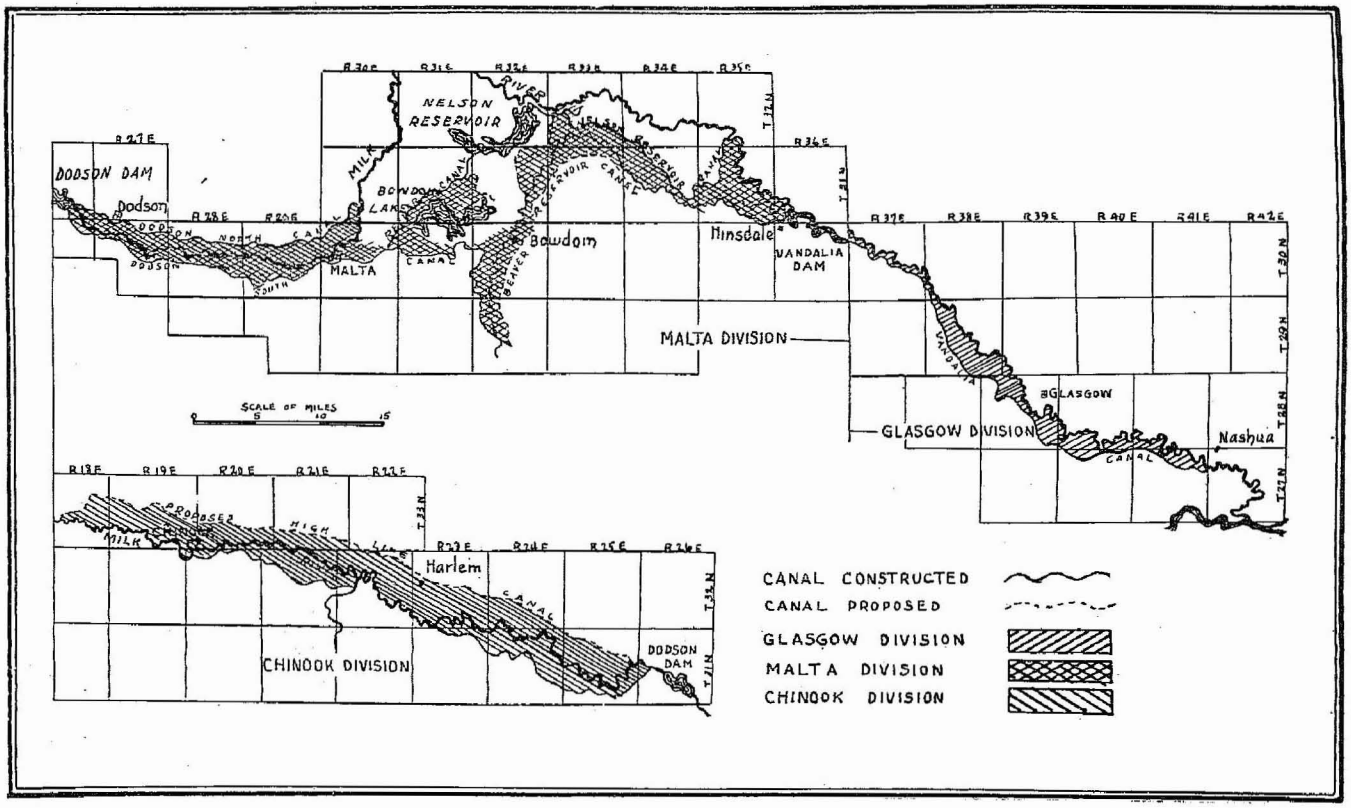

Fig. 4—Divisions of the Milk River Irrigation Project.

Soils of the Milk River Valley present rather wide variations, but for the most part are heavy. The topography is quite uniform, but in some localities is too flat. This makes irrigation difficult and has resulted in improper drainage with accompanying rise in water table and accumulations of alkali. A detailed soil survey of the entire project was made in 1928 by the Montana State College in cooperation with the Bureau of Reclamation.*

The Bureau of Reclamation, United States Department of the Interior, has developed storage facilities for all of the seven districts included in the Milk River project. In addition, the Bureau has constructed the canal and lateral systems of the Malta and Glasgow divisions. Administration of these two districts is in the hands of the Bureau of Reclamation, while the other five districts administer their own affairs. These districts have contracts with the Federal Government only for repayment of their proportional cost of the storage construction.

Water is stored in the Sherburne Lakes Reservoir in Glacier National Park. From here it flows into St. Mary's river and at a point several miles below the dam, is conveyed by a canal 29 miles long into the north fork of the Milk River. The Milk River flows through Canada for 216 miles, returning to Montana at a point north of Havre. Water for irrigation is taken from the river at various points below by means of low diversion dams. Although construction of the storage system was started in 1906, it was not until 1917 that stored water was available to supplement the natural flow for irrigation. The water supply is considered adequate except in extremely dry years.

Original plans of the Bureau of Reclamation contemplated the supplying of water to approximately 122,000 acres in the Malta and Glasgow divisions and 97,500 acres in the Chinook division. At the present time storage water can be supplied to about 41,000 acres of the Chinook division served by private canals while the Bureau has provided facilities for irrigating 87,930 acres within the Malta and Glasgow divisions.

A classification of lands in the Malta and Glasgow divisions of the project was made in 1931. Lands designated as "class 6" were considered nonirrigable and were relieved from the payment of construction costs. Class 5 lands were temporily suspended from payment of construction charges. Lands in both the classes, permanently or temporarily suspended amounts to 51,226 acres. This leaves a total irrigable area of 103,597 acres in all divisions. Of this, approximately 41,000 acres was irrigated in 1931.

Pertinent facts relative to each of the districts of the Milk River project are given in the separate sections which follow.

Chinook Division

The Chinook division is the upper division of the Milk River project. It includes five irrigation districts which were created to negotiate contracts with the government and to administer their respective units. The districts in the Chinook division do not own and maintain a lateral system. They

*"Soil Survey of the Milk River Area, Montana" by William DeYoung. (unpublished).

own the main canals and make delivery of water only from canals, the farmers themselves being compelled to construct laterals for conveying water to their farms.

It has been previously stated that the districts of the Chinook division have contracted with the Federal Government to pay their pro rata share of the storage development cost. After writing off approximately 35 per cent of the original amount, the government has agreed to accept $14.05 an acre, applicable to 31,848 acres of irrigable land which it is felt can bear construction charges. Payment of this begins in 1932, and is to extend over a period of 40 years with no interest being charged. This will make the annual charge per acre only 35¼ cents.

An "extensive" type of irrigation farming has been practiced in the past on this division, as evidenced by the number of farms which are 160, 320 and even 640 acres in size. Within the past few years there has been some tendency to reduce acreage. For the areas of lighter soil type, where a diversity of crops can be grown, units of 40 to 120 acres are considered practical. For the heavy soil areas which are subject to flooding and where native blue-joint hay is about the only crop grown, larger units are no doubt justifiable. More land is devoted to the production of native hay than any other crop. This is because the large areas of heavy soil type are not adapted to any other crop. There is little native hay on the better soil areas. Alfalfa hay claims nearly as large an acreage, with wheat, barley, flax, sugar beets and oats following in the order given. Average yields obtained for these crops follow: native hay .7 tons, alfalfa hay 2½ tons, wheat 25 bushels, barley 35 bushels, flax 10 bushels, sugar beets 11 tons and oats 50 bushels. Alfalfa and beets are replacing more of the native hay acreage each year and more livestock is being incorporated in the farming system. Either dairy cattle, beef cattle, sheep, hogs or a combination of two or more of these, are found on most farms.

Significant data, peculiar to each of the districts in the Chinook division, are given below:

Fort Belknap District—This district which includes most of the irrigable land lying just west of Chinook, was created in 1920. It includes a gross area of approximately 9000 acres. Originally 7675 acres of this were classed as irrigable, but as the result of a recent land classification, 3851 acres have been temporarily suspended from payment of charges because of seeped or otherwise unproductive lands. This leaves a present irrigable area of 3824 acres of which about 3000 acres are now irrigated. There were 46 farms using irrigation water in 1931. There is great need for drainage at the present time, not only to reclaim lands temporarily suspended but to prevent further seepage. Finances, however, are not available to do the necessary work.

In 1923, bonds to the extent of $75,000 were sold. These mature serially from 1928 to 1947 and bear 6 per cent interest. At present there are $65,000 in bonds outstanding. Warrants totaling nearly $12,000 are also

outstanding. While according to the "blanket liability" provision of the Montana irrigation district law, each acre in the district must bear an equal part of this indebtedness, the owners of 3824 acres classed as non-irrigable will not be able to make payment with the result that the 3851 acres of class 1 to 4 lands will bear the burden. This will amount to about $20.00 per acre for district indebtedness. Adding to this the $14.05 Federal contract, makes a total indebtedness of approximately $34.00 per acre of irrigable land. Annual district assessments for bond retirement, payment of interest and for operation and maintenance are $2.50 an acre. To this must be added 35¼ cents an acre for payment to the government, making a total water charge of $2.85¼. Taxes average about 50 cents an acre in addition.

Alfalfa Valley District—This district is located just east of Chinook and north of the Milk River. It includes a gross area of 4050 acres of which 3651 acres was originally considered irrigable. Only 18 acres of this was suspended as a result of the recent land classification, so the net irrigable area is 3633 acres. Slightly over 2200 acres of this is now being irrigated. In 1931 there were 26 irrigated farms in the district. About 15 per cent of the acreage is seeped, but no drainage system has been constructed.

The district was created in 1920, and in 1923 bonds totaling $35,000 were sold. These are 6 per cent bonds, maturing serially from 1928 to 1945. About $28,000 in bonds are now outstanding, with a warrant indebtedness of about $2000 in addition. The indebtedness per acre of irrigable land, including both district and Federal, is therefore, about $22.35. The total annual district levy is $2.25, which added to the government assessment makes $2.60¼ an acre. Taxes average about 50 cents additional.

Paradise Valley District—The Paradise Valley district is on the south side of the Milk River. The town of Zurich is just north of the center of the district. A gross area of 11,548 acres is included, of which 10,211 acres were formerly considered irrigable. The land classification resulted in the suspension of 3195 acres, which leaves 7017 acres as actually irrigable and capable of making payments. Forty-eight farms in the district actually irrigated about 4785 acres of this in 1931. About 19 per cent of the acreage is classed as seeped land, but as is the case of most other districts in the Chinook division, no drainage works have been constructed.

The district was created in 1922, at which time a bond issue of $120,000 was sold. The bonds bear 6% interest and mature serially from 1927 to 1946. There is, to date, $103,000 of this outstanding. The warrant indebtedness, however, is negligible. District and government indebtedness is about $28.70 an acre on the irrigable lands. Account must also be taken of the interest which must be paid annually until the bonds are retired. An annual assessment of $2.25 an acre is made for district purposes, which combined with the government charge of 35¼ cents makes a total of $2.57¼ per irrigable acre. Taxes are 50 cents additional.

Zurich District—This district is situated on the north side of the river, and includes the irrigable land extending both east and west of Zurich for several miles. A gross area of 12,217 acres is included. Of this, 8,581 acres were until recently classed as irrigable. Since the recent suspension of 1436 acres, 7145 acres now make up the irrigable area. In 1931 there were 53 farms which irrigated about 4775 acres of this. Considerable seepage has occurred here, but a large open drain has been installed. This has corrected a good deal of the difficulty, but more drainage construction is needed.

The Zurich district was created in 1920, and in 1923 a bond issue of $280,000 was sold. This was a serial issue bearing 6 per cent interest. There are at the present time $245,000 in bonds and $22,555 in warrants outstanding. The district indebtedness is, therefore, $37.50 an acre exclusive of interest and the total indebtedness is $51.55 an acre In 1931 the district assessment was $4.50. Of this only 41 cents was for operation and maintenance, the balance being for bond retirement and the payment of interest. Adding the 35¼ cent payment which must be made in the future will bring this to $4.85¼ an acre. Taxes average about 50 cents an acre for the irrigable lands.

Harlem District—The Harlem district lies just north of the Milk River and south of the Zurich district in the vicinity of Harlem. Gross acreage of the district is 12,770 acres of which 11,516 were originally considered irrigable. There has been a suspension of 2598 acres, which leaves the net irrigable area at about 8918 acres. There were in 1931, 50 farms in the district, irrigating a total of 7641 acres. Seepage is a problem in some localities. The district owns a drag line and has constructed some open surface drains, but more of this is needed. The necessary water supply is assured by two 50 c. f. s. electric pumps which lift water from the river east of Zurich.

The district was organized in 1922, and in 1925 bonds totaling $100,000 were sold. These are 6 per cent serial bonds, the last of which mature in 1952. Finances of this district are rather unique in that most of the bonds were purchased by the farmers themselves. There are at present $86,100 in bonds and $13,855 in warrants outstanding. The district indebtedness exclusive of future interest payments, amounts to $12.30 an acre for the land actually irrigable, which after all, is the land that must ultimately bear the charge unless some of the temporarily suspended land is reclaimed. To this must be added the pro rata storage contract of $14.05, bringing the total to $26.35 per irrigable acre. The district assessment in 1931 was $2.50. This included interest, bond retirement and operation and maintenance. Adding the 35¼ cent Federal assessment beginning in 1932, will bring the total to $2.85¼. Taxes were about 50 cents an acre.

Savoy-Coburg Extension—The original plan of the Bureau of Reclamation called for the supplying of water to this area. The proposed line of the main canal would extend the present terminus of the Zurich canal,

which is about four miles east of Harlem, east along the foothills beyond Savoy and Coburg. The area includes 11,307 acres of irrigable land similar to that in the Harlem and Zurich districts. At present some flooding and irrigation by pumping is done here.

Additional storage would have to be supplied to make possible the carrying forward of this project. Although storage would be possible by means of development of the so-called "chain of lakes," the present low prices for agricultural products and the resulting lack of demand for land, preclude the liklihood of this development being carried out for some time.

Malta Division

Malta District—There is but the one irrigation district on the Malta division. This includes two units which have partially separate sources of water supply. The upper unit begins four miles west of Dodson in Phillips county and includes irrigable lands lying on both sides of the Milk River to a point just east of Malta. Here the river swings north rather abruptly. The irrigable land in the east part of this unit all lies south of the river and evtends to the vicinity of Bowdoin. The lower unit of the Malta division begins south of the river in the vicinity of Ashfield and extends east to Hinsdale.

Water for the upper unit is diverted from the Milk River near Dodson. The Dodson North Canal and the Dodson South Canal convey water from the common point of diversion to the lands lying on their respectivve sides of the river. The Dodson South Canal also conveys water through the Nelson Reservoir to the lower unit of the division. The supply of water is adequate except in very dry years.

A land classification of this division, made in 1931 for the purpose of determining those lands which could bear construction charges, resulted in the following distribution:

Classes of Land	Acres
1	4804
2	5639
3	5014
4	9574
5	31259
6	2381
Total	58671*

Class 1 includes well-drained, light textured soils, of smooth topography. These soils are suitable for the production of any crop permitted by the climate of the area and are especially adapted to diversified farming. Class 2 is made up of light textured soils, but of uneven topography so

*This includes only lands in the district organization. There are several hundred acres in the division which are not subject to the jurisdiction of the district.

that irrigation is more costly. Much of this land can become Class 1 land by leveling. It is suitable for diversified farming. Class 3 soils are somewhat heavier than the former and are distinctly restricted in the range of crops that may be grown. There is a tendency for these soils to "bake" after irrigation. Some of the Class 3 lands are of low productivity because of slight alkali accumulations or seepage. Grain, hay and alfalfa seed yield well on this soil. Class 4 land includes the heavier soils but only those capable of producing fairly good yields of alfalfa hay and seed. It is difficult to obtain good stands of alfalfa owing to the tendency of this soil to bake hard after irrigation, thus killing young plants. Class 5 land is made up of good soils but of excessively rough topography or areas which are cut off from irrigation supply by sloughs, flat clay areas somewhat alkaline, or areas subject to flood conditions. Class 6 includes areas which are considered permanently non-irrigable, either because of topography and location or because of excessive alkaline soils.

The above table shows that only 25,031 acres, or less than 50 per cent of the land in the district, is now considered able to bear the charges. As part of the 31,259 acres of Class 5 land is drained or otherwise reclaimed, it will be able to carry a part of the total construction charge and the cost of district operation and maintenance.

In 1931 there were 341 farms in the district. Of this number only 214 used irrigation water and the total area which they irrigated was 14,358 acres. Most of the farms include from 160 to 320 acres, and the system of farming is very "extensive" for irrigated land. Native hay accounts for upwards of half the cropped acreage, while wheat claims nearly one-third. Alfalfa hay and alfalfa seed rank next, with small grain feed crops and sugar beets following. Average yields obtained for the various crops are as follows: Native hay .7 tons, alfalfa hay 2 tons, wheat 20 bushels, barley 30 bushels, oats, 50 bushels, sugar beets 11 tons and potatoes 160 bushels. Yields can be increased as a more intensive system of farming becomes established. Large numbers of sheep and beef cattle are either kept on farms in the district or brought there for wintering.

Type of soil affects the size of unit and the crops which should be grown. On the better soils, which are capable of diversified crop production, 40 to 160 acres are considered proper units. This will have to be increased for the poor soils areas. Livestock of some kind should be the enterprise around which the system of farming is organized in most cases.

Although surveys and construction had been under way for some years, it was not until 1912 that water was available for irrigation on the Malta division. The systems of canals and laterals were built by the Bureau of Reclamation. These are well constructed and are generally in good repair. The Malta district was created in 1924, but as yet has not taken over the maintenance and aperation of the system. Its function so far has been to facilitate the making of contracts between the Federal government and the water users, and to collect operation and maintenance charges.

Since this division was built entirely by and is now being managed by the Bureau of Reclamation, the district has no bonded or warrant indebtedness. Contracts between the district and the bureau stipulate $57.00 an acre as the amount which the Class 1 to 5 lands must eventually pay, although the class 5 lands are now temporarily suspended. This includes the charge for canal and lateral construction, and in addition, the pro rata share of storage development cost. The $57.00 is to be paid, without interest, over a period of 40 years beginning in 1932. This means an annual payment of $1.42½ per irrigable acre. The operation and maintenance cost is 50 cents for each irrigable acre, plus $1.00 per acre foot for water actually used. In addition an assessment of 25 cents an acre is made for a revolving fund which is to be used for the purchase of tax certificates and titles to delinqquent lands, and 5 cents an acre is required for district administration. Assuming the average purchase of one acre foot of water per acre, the total water cost per acre beginning in 1932 will be $3.22½. Taxes average about 40 cents an acre for irrigable land.

Glasgow Division

Glasgow District—The Glasgow district is the only district in this division It lies south of the Milk River, beginning at Tampico and extending south and east to Nashua. A diversion dam in the Milk River near Vandalia puts water in the Vandalia canal which makes deliveries throughout the entire length of the division. Except in very dry years the supply of water is adequate.

An accurate idea of the soils in this division can be obtained from the following classification made of the lands in 1931:

Classes of Land*	Acres
1	339
2	1521
3	2739
4	5907
5	6264
6	225
Total	16,995**

It is apparent from this table that 10,506 acres are considered sufficiently productive to carry their share of construction costs. At a later date some of the 6264 acres temporarily suspended may be reclaimed to an extent that they can be charged their pro rata amount.

Of the 148 farms on the division in 1931, only 56 used the irrigation water of this system. The total amount which they irrigated was 6,031

*See explanation of land classes below table, page 50.

**This does not include several thousand acres of irrigable land in the division which is not included in the Glasgow district.

acres. The system of farming practiced here is much more extensive than on the Malta division just previously discussed.

The Bureau of Reclamation also built the canal and lateral system of this division and water is delivered to each farm. The district was created in 1926 and as in the Malta division, serves only as an intermediary between the Government and the water users. The construction charge for the Class 1 and Class 5 lands of this division is also $57.00 an acre, payable over a 40 year period without interest. The operation and maintenance charge is 65 cents an acre for all irrigable land, plus $1.00 an acre foot for water actually used. A revolving fund assessment of 10 cents an acre and a district administration charge of 15 cents is also made. For land which uses one acre foot of water per year, the total charge will be $3.32½ an acre. Texas average 40 cents an acre additional.

Sun River Project

Fort Shaw District—The Fort Shaw district is one unit of the Sun River Federal Reclamation project. It is located on the south side of the Sun River approximately 25 miles west of Great Falls in Cascade County. The Great Falls-Augusta branch of the Great Northern Railroad extends the full length of the project. A fine gravelled road parallels the railroad making no point on the project more than one hour's drive from Great Falls, the second largest city in Montana and a good market for farm products.

An average elevation for this district is about 3600 feet. The last killing frost in the spring averages about May 20 and the first killing frost in the fall about Sept. 15, giving a frost-free period of something like 120 days. Weather records over a long period show an annual precipitation of 11 inches. Soils vary from a silt loam to a heavy clay loam with occasional patches of gravel. Topography is even in most places with just enough fall to make irrigation easy. Some seepage has taken place toward the lower end of the project, but all the land is classified. No drainage has been done nor is any contemplated in the near future. Water is diverted from Sun River at a point 14 miles west of Simms. An ample supply is assured by a series of storage reservoirs which empound water for this and the Greenfields district.

The irrigable area of this district is at present given as 13,902 acres of which about 7500 has been irrigated, on an average, over the last ten years. There are about 200 farms on the project, most of which are either a 40 or 80 acre size. Dairying and poultry raising are carried on extensively and some feeding of lambs and beef is being done. The principal crops are alfalfa hay and small grains for feed. Potatoes are the principal cultivated crop although the acreage of beets has been growing the last few years. Average yields are as follows: Alfalfa 2 tons in as many cuttings, sweet clover 1½ tons, sweet clover seed 3.5 bushels, potatoes 200 bushels, sugar beets 11 tons, barley 30 bushels.

The Fort Shaw division was authorized, and construction started in 1906. Water was available for irrigation in 1909. The district was created and the management of the distribution system turned over to the district in 1919. The construction charge has been fixed at $34.63 an acre and is payable to the Federal Government annually at the rate of 5 per cent of the average gross crop value during the past ten years on each class of land. Operation and maintenance charges are 85 cents an acre and taxes average 50 cents an acre. There is only a small amount of delinquency to date under this plan.

Greenfields District—The Greenfields District is a unit of the Sun River Federal Reclamation project It is located west of Great Falls at an average distance of about 30 miles. The lands are in Teton and Cascade Counties. The project is traversed by the Great Falls-Agawam branch of the Chicago, Milwaukee, St. Paul and Pacific Railway. The Great Falls-Pendroy branch of the Great Northern Railway runs along the northern and eastern boundaries of the district. The principal town and shipping point is Fairfield, which has a population of 150. The Yellowstone-Glacier Park highway, a well-built and well-maintained gravelled thoroughfare extends the entire length of the district. Great Falls, with a population of 30,000 provides a good local market.

The elevation over most of the area is 3,800 feet. Weather records show that the last killing frost in the spring occurs about May 20 and the first killing frost in the fall about September 15, making an average frost-free period of approximately 120 days. The annual precipitation is about 12 inches. For the most part the soil is a brown, gravelly clay loam to silt loam of good productivity. There is some heavier clay loam soil and a few gravel out-crops, but these less desirable soils are in the minority on that part of the project at present under irrigation. The topography is very even and favorable for irrigation. Seepage has given some difficulty although there are at present about 30 miles of drains. More will be built in 1932 and as required in the future. Water is diverted from Sun River near the mouth of the canyon, a point about 45 miles west of Fairfield. An abundance of water is assured by means of three storage reservoirs which are used jointly with the Fort Shaw district.

The gross area of this project is 128,840 acres. Of this, 90,206 acres are classed as irrigable, although only about half this area is equipped with canals and structures which permit irrigation at the present time. The remaining irrigable acreage, while not having as favorable soil or topography as that at present under irrigation, is considered feasible and will be developed as there is need for it. The area actually irrigated is increasing each year, in 1931 reaching 23,928 acres. There are about 325 farms in this district. Although varying somewhat most of them are either 160 or 200 acres in size. A diversified type of farming is being followed. A crop rotation plan recommended consists of alfalfa or sweet clover for several years, followed by potatoes, beets or peas, and this in turn followed by a small grain crop for feed. Alfalfa yields 2 tons per acre in two cuttings,

sweet clover 1½ tons, sugar beets 12 tons, potatoes 200 bushels, seed peas 22 bushels and small grain feed crops 30 to 40 bushels. Because of the large amount of range land adjacent to this project, it is well located for the growing of winter feed for livestock, which is the principal industry.

Construction was started on the Greenfields division in 1913 and water actually was made available for irrigation in 1919. The district was created in 1925 and the system was turned over to the district for operation in 1931. The construction charge has not yet been determined but it is estimated that it will exceed $90 an acre. No construction charge is being made at the present time, but when the amount is determined it will be paid at the rate of 5% annually of the gross per acre crop income based on an average of the preceding ten years. This would have been 75 cents an acre in 1931. No interest is charged by the Federal Government on the deferred payments. Operation and maintenance charges are 65 cents an acre and taxes about 30 cents an acre.

Part IV---Federal Indian Service Projects

NATURE OF INDIAN SERVICE PROJECTS

Irrigation systems have been constructed on five Indian reservations in the state for the purpose of irrigating certain of the lands allotted to the Indians. It is hoped that the assurance of a crop, which accompanies irrigation, will encourage the Indians to do more farming and become more nearly self-supporting.

The Bureau of Reclamation has cooperated with the Indian Service in building these projects. Once constructed, however, the administration is entirely in the hands of the Indian Service. Funds for the construction of these projects come as a direct appropriation from Congress rather than from public land sales and other specified sources as with the Reclamation funds.

Blackfeet Indian Project

The Blackfeet Indian Project is located in Glacier and Pondera counties directly east of Glacier National Park. The main line of the Great Northern Railroad traverses the northern part of the project. Federal Highway No. 2 parallels the railroad along the northern part while Federal Highway No. 87 traverses the western part. Browning and Cut Bank with populations of 1,000 and 800 respectively are the principal towns.

Average elevation is 3900 feet, precipitation averages 11 inches and the frost free period is about 112 days. Topography is broken by occasional ravines but the benches are uniform and readily irrigable. Soils are mostly of glacial origin. The higher benches usually are of gravelly loam, while

the lower benches and slopes are more apt to be a silt loam or clay loam. There are four sources of water supply, namely, Badger, Blacktail and Birch Creeks and the Two Medicine River. The supply is adequate to irrigate all land included in the proposed development. The seeped area is negligible and no drainage is yet considered necessary.

A census taken in 1930 indicates that there were 70 farms on the project, including both Indian and white farmers. The acreage per farm is rather large and the system of agriculture is poorly developed. Approximately half the farmed acreage is in hay, divided about evenly between wild hay and alfalfa. Nearly an equal acreage is in wheat, with oats taking the reminder. Accurate average yields for the five-year period, 1927 to 1931 inclusive, were kept by the project manager. These are as follows: Alfalfa 1½ tons, wild hay 1 ton, oats 40 bushels, wheat 20 bushels. It should be mentioned that these yields do not represent the productivity which the project is capable of, if better farming practices were followed. There is a large acreage of excellent range land adjacent to the project. It could be utilized to better advantage than at present if more winter feed were being grown in the area.

In 1908 construction was begun on the Blackfeet project and various developments have been made since that time. The total proposed project includes 6 units with an irrigable area of 118,500 acres. Four of these units have been partially developed to the extent of placing 21,565 under constructed works. The more important of these are the Two Medicine and Badger-Fisher units. Around 6,000 acres are irrigated annually. The final construction charge has not yet been determined, but 50 cents an acre annually is being collected to retire this. Operation and maintenance cost is $1.00 an acre. Taxes average 40 cents an acre additional.

Crow Indian Project

The Crow Indian Irrigation Project is located in Big Horn County in the south central part of the state. The Chicago, Burlington and Quincy Railroad, extending south from Billings and into Wyoming, serves the territory, although the western part of the project is some distance from a shipping point. Federal Highway No 87 E follows approximately the same course as the railroad. Hardin, a city of 2,000 is the largest trade center, while Lodge Grass and Wyola, situated toward the upper end of the project, are the largest of several small towns in the area. Beets are shipped south to the refinery of the Holly Sugar Corporation at Sheridan, Wyoming, 90 miles distant.

The elevation averages about 3,100 feet, while the frost-free period is about 140 days and the annual precipitation 15 inches. Soils vary a great deal but are for the most part dark in color. Loams to clay loams constitute the main soil types. The topography is very favorable for irrigation. Water for irrigation is taken from the Big Horn River and its tributaries which flow through the Crow Indian Reservation. The supply is considered adequate for the area at present under constructed works during periods of normal precipitation.

In 1893 construction of the project was begun. There are 13 separate irrigation systems included in the project. Approximately 63,400 acres are classed as irrigable, and of this amount it is estimated that 51,000 acres are now under constructed works. From 15,000 to 20,000 acres are irrigated annually. So far the average per acre construction cost is $39.00. There may be some variation from this when construction is completed. The annual charge for construction repayment varies with the unit and with certain other factors. The maximum charge for this is $2.09 an acre. This falls off to as little as 5 cents an acre under other conditions. An operation and maintenance charge of $1.20 an acre is made on Government operated units. Taxes average about 90 cents additional.

In 1930 there were 385 farm families on the various units of the project, including both Indian and white farmers, as well as owners and lessees. Dividing this number into the acreage annually irrigated gives from 40 to 50 acres of irrigated land per farm. Alfalfa hay, yielding slightly more than 2 tons per acre, claim about one-fourth of the cropped land. Wild hay, yielding approximately one ton per acre, utilizes about 20 per cent of the cropped area. Barley ranks next, with beans and oats following closely. Sugar beets are grown to some extent. Yields of these latter crops now being obtained follow: Barley 20 bushels, beans 10 cwt., oats 25 bushels and sugar beets 12 tons. There is no doubt but what the lands of this project are more productive than the yields indicate. About equal numbers of cattle and sheep are maintained. Hogs also constitute an important class of livestock kept. Conditions are favorable for a diversified type of livestock production in combination with the growing of beans and beets as cash crops.

FLATHEAD INDIAN PROJECT

(Data Applicable to All Units)

The Flathead Indian Project is located south of Flathead Lake in Lake County. This is in the northwestern part of the state. A branch line of the Northern Pacific Railroad extends from Dixon north to Polson, traversing all but one unit of the project. Federal highway No 93 follows the approximate course of the railroad thru the project. Polson, a city of 1500, is at the north end. Pablo, Ronan, St. Ignatius and Arlee are towns lying south of Polson and serving as local trade centers and shipping points. Missoula, with a population of 15,000 is less than 30 miles from the most southern unit of the project. Sugar beets from this area are shipped to the refinery of the Amalgated Sugar Company at Missoula. A cream marketing association and a livestock marketing association, in addition to local creameries are available to farmers on the project. Elevation averages about 3000 feet over most of the projects. The frost-free period is about 125 days while the annual precipitation is 16 inches.

Construction was started on the Flathead project in 1907. The entire project contemplates the ultimate irrigation of 124,500 acres. Of this

amount, about 112,000 acres are now under constructed works, while between 40,000 and 50,000 acres are irrigated annually. Farms average about 80 acres in size and most of the farmers are white people. Alfalfa is the leading crop on all three units of the project. Nearly 22,000 acres were in this crop the past three years. Pasture claims the second largest acreage, with small grains and sugar beets next in the order named. Yields of these crops vary somewhat between the three units, so average yields will be stated separately for each district at a later point. The system of farming is for the most part quite diversified. Dairy cows and hogs are the most frequent livestock combination found, while there are some sheep and a substantial amount of poultry kept. Sugar beets have been grown extensively only in the last few years, but they are the leading cash crop. Small grains, seed peas and red clover seed are also sold as cash crops.

There are three geographical divisions or units known as the Camas Division, the Mission Valley Division, and the Jocko Division. White land owners within the irrigation project have three Irrgation Districts organized under Montana State Laws. These districts are the Flathead Irrigation District, which includes the Camas division and part of the Mission Valley Division areas; the Mission Irrigation District which includes lands of the Mission Valley Division not included in the Flathead Irrigation District; and the Jocko Valley Irrigation District which embraces lands in the Jocko Division only. No trust patent Indian allotments are included and there are many fee patented tracts whose owners have elected not to include their lands in any of the districts.

The Flathead and Mission Irrigation Districts have entered into contracts with the United States for the repayment of construction and other costs. For the present the project is managed by the United States. Management of the project will be turned over to the respective districts having repayment contracts after the construction program is finished and the project finally completed.

Jocko Valley District—The Jocko District is in the extreme southern part of Lake County and embraces the greater part of the white owned lands in the Jocko Division of the Flathead Project. The main body of land included, surrounds the town of Arlee, while a smaller area lies a few miles north and west adjacent to the town of Dixon. The gross area of the district is 6332 acres all of which is classed as irrigable and about 5000 acres of which are actually irrigated.* The Jocko River and Finley creek are the sources of water. The supply is estimated as being 35% deficient during extremely dry years like 1931. No storage is at present provided, and additional construction is indefinite. Parts of both units have a gravelly subsoil. The soil of the Arlee division is also quite gravelly, requiring rather heavy applications of water. In the vicinity of Dixon the soils are more silty in character and less water is needed for crop production. Topography is favorable for irrigation.

*The Jocko Division contains approximately 13,300 acres of irrigable land of which 13,000 is under constructed works.

The system of farming practiced is diversified, and very similar to that of the other districts. Alfalfa yields average 3 tons, sugar beets 9 tons, seed peas 25 bushels and red clover about 150 pounds of seed. Small grains yield only moderately well.

The Jocko District was created in 1926 but to date has not yet entered into a repayment contract with the Federal Government. Construction charges to date as set by public notice of November 1, 1930, are $40 an acre. This is to be paid in 16 installments, without interest, the first 5 at 5% of the cost and the remainder at 7%. The first $2.00 payment is now due, and the first of the remaining 15 payments will be due December 1, 1935. The minimum operation and maintenance charge is 50 cents an acre and the maximum charge is $1.00. Taxes average 50 cents an acre in addition.

Flathead District—The Flathead District includes parts of two divisions of the irrigation project. The larger of these includes the land between the foothills of the Mission Range and the Flathead River, and extending from just south of Flathead Lake to Post Creek in the vicinity of the National Bison Range. The other unit includes the land surrounding the town of Camas, about 10 miles west of the main project. Gross area of lands within the Flathead district is 80,000 acres. Approximately 73,000 acres are under constructed works and a little more than half this amount is actually irrigated. The water of several creeks are used and the seasonal flow is supplemented by several relatively small reservoirs. The supply is not entirely adequate in very dry years, but additional work is in progress which will increase the supply. Topography of the lands in this district is rolling and inclined to be rough. The eastern border, at the foot of the Mission Range is somewhat rocky. The main body of the area, however, has a rather heavy silty soil. Little difficulty from seepage has yet been encountered.

The type of farming practiced is quite diversified. More than 65 per sent of the acreage irrigated is in forage crops and pasture, the remainder being used for small grains, sugar beets, seed peas and potatoes. Yields obtained on an average are as follows: Alfalfa 3 tons, beets 10 tons, seed peas 20 bushels, medium red clover seed 200 pounds, wheat 35 bushels, barley 40 bushels and oats 50 bushels. A livestock combination of dairy cows and hogs is very common, while there is some winter fattening of beef cattle. Few sheep are kept on farms.

The Flathead district was created in 1926. The construction expenditure to November 1, 1930 was approximately $45.00 an acre, and the ultimate charge, when construction is completed, is expected to be $65.00. Repayment of this was to have begun in 1931, but an extension of 5 years was granted. Payments starting in 1933 will be at the rate of 2½ per cent of the construction charge or $1.12 an acre on the present $45.00 basis. Operation and maintenance charges are 75 cents an acre and taxes average 50 cents an acre.

Mission District—The Mission District lies immediately south of the Flathead District and extends on south to the foot of the divide just north of Ravalli. The area within the district is 13,133 acres, 90% of which is under constructed works. About 8500 acres are actually being irrigated. Water for irrigation is provided by several creeks which are supplemented by the development of storage. There are some shortage of water in 1931, but construction work now in progress is expected to assure an ample supply. Soils vary somewhat over the project, but there is a predominance of heavy silty soils and clay loams. The topography is rolling, but for the most part, does not seriously hinder irrigation.

The system of farming practiced is almost identical with that followed in the Flathead District which was discussed just previously. Yields are also the same.

The Mission District was created in 1926 and repayment contract agreed upon. Expenditure for construction and annual charges for construction, maintenance and operation and for taxes are the same as for the Flathead District.

Fort Belknap Indian Project

The Fort Belknap Indian Project is located along the Milk River in Blaine and Phillips counties in the north central part of the state. The main line of the Great Northern Railroad and the Roosevelt highway traverse the project, providing excellent transportation facilities. Harlem, Savor and Dodson are principal trading centers on the project. Chinook, a city of 1,300 where the Utah-Idaho Sugar Company has a refinery, is 30 miles west. Havre, the largest city in northern Montana, is 50 miles west.

Average elevation of the project is 2,300 feet. The frost free period is about 125 days and the annual precipitation averages 14 inches. Water is secured from the Milk River and tributary streams on the Fort Belknap Reservation. The supply is adequate for the acreage at present under construction works, during years of normal precipitation. Soils in the Milk River Valley are largely a heavy loam to clay loam which are productive when irrigated. Topography is flat, and unless discreation is used in irrigation there is danger of trouble from improper drainage. Soils on those projects lying along the foot of the Little Rockies are lighter and grade to sandy loams. Here topography though somewhat rolling, permits irrigation with little difficulty.

Construction was started on this project in 1893. The area ultimately irrigable is estimated at 25,285 acres. There are now 16,975 acres under constructed works. The construction cost to date has been $23.00 an acre, but the final cost cannot be determined until the development program is complete. No assessment for construction repayment nor for operation and maintenance is levied against Indian allottees. An operation and maintenance charge of $1.00 an acre annually is made to those who lease land. Land owned by the Indians is not subject to tax, but any which may be owned in the future by white people will pay a tax of approximately 45 cents an acre on the basis of present rates.

About 12,000 acres of land are cropped annually. Native hay, which is largely blue-joint, accounts for considerably more than half the total. Alfalfa hay is easily second in rank with wheat, oats, sugar beets and potatoes following in the order named. Average yields for the three years 1929 to 1931 inclusive are as follows: Native hay 1 ton, alfalfa hay 1.75 tons, wheat 6 bushels, oats 17 bushels, potatoes 95 bushels and sugar beets 7.5 tons. This was an extremely unfavorable three year period so the yields are very low.

A census of agriculture taken on the project in 1929 revealed that there were 1,807 cattle, 1,383 horses, 193 hogs, 2,500 fowls and no sheep. No land on the project is owned by white people with the exception of 360 acres owned by St. Pauls Mission, although there are several white lessees. This explains to quite an extent the fact that more development argiculturally has not taken place on the project.

FORT PECK INDIAN PROJECT

The Fort Peck project includes four separated areas or units in the Forth Peck Indian Reservation which lies immediately north of the Missouri River in the northeastern part of the state. The main line of the Great Northern Railroad touches three of these units, and a branch of this railroad serves the fourth. Loading points are located at frequent intervals and there are number of small towns along the way. Poplar and Wolf Point, with respective populations of 2000 and 2,200, are the leading trade centers. Federal Highway No. 2 parallels the railroad and makes travel east and west by car possible the year round.

Average elevation is about 2,000 feet. The frost free period is ordinarily about 135 days and the annual precipitation 13½ inches. Soils vary widely over this elongated area. Since most of the area is bottom land, a great deal of the soil is a heavy silt loam. This grades into a sandy loam in some places and in others to a heavy clay or gumbo. Topography is excellent for irrigation. Water is taken from the Milk River and other Missouri River tributaries. The supply is not adequate as developed at present.

Construction began on the Fort Peck project in 1908. Four separate units have been developed or partially developed to date. The total irrigable area included in the system is now considered as 36,000 acres, of which 22,794 acres are classed under constructed works. About 2,500 acres of this is now being irrigated. The final construction charge has not been fully determined since development is not completed. To date it varies from $30 to $55 per irrigable acre. An annual charge of 50 cents an acre is made for the retirement of this. The operation and maintenance charge is $1.00 per acre for all lands upon which application for delivery of water is made. Taxes on the irrigated land average about 50 cents an acre.

There were 23 white farmers and 13 Indian formers on the project in 1931. The system of farming is not highly developed. Ninety per cent of the cropped acreage is in hay, the remainder being used to produce

barley and oats for feed. Alfalfa accounts for a little more than half the hay acreage, yielding an average of 1½ tons a year in two cuttings. Wild hay yields about one ton. Barley and oats average about 40 bushels. A considerable amount of range livestock is kept by farmers on the project.

Part V---Irrigation Companies and Associations

Under this heading is included the irrigation projects which are controlled by the water users themselves combined in some organized form of cooperation under the state laws other than irrigation districts. Far more Montana lands are irrigated by enterprises of this kind than by any other excepting private and partnership enterprises.

Nature of Companies and Associations

There are several points of difference between irrigation companies and irrigation districts. While irrigation companies may sell bonds as a means of deriving revenue for construction and operation, they seldom do this. Their usual procedure is to sell stock or shares to the water users. The money obtained from the sale of shares is ordinarily used for the original construction. The shares then serve as evidence of a right to a certain per cent of the water available annually or to a specified amount of water. In some cases the shares representing a right to water are transferrable, while in others, the water appertains to the land and the shares cannot be sold unless the land to which the shares were originally issued is sold.

It must be clearly kept in mind that an irrigation company does not have the power to tax. Irrigation districts do have this power.

Irrigation companies usually have a board of directors or board of trustees, elected by the members of the company. This board manages the affairs of the project which includes levying assessments annually to cover operation and maintenance costs, and in some cases, for the retiring of indebtedness.

A comparison of the annual water cost on projects of companies and of districts will show that in almost all cases, the company assessments are less. There are several reasons for this. In the first place, most of the companies have been organized a great many years and have lands included in their projects which are readily accessible to irrigation. This explains to a great extent the increased investment per acre which is shown in Fig. 1, page 8.*

*The increase in the general price level from 1890 to 1930 is, of course, also reflected in Fig. 1.

In most cases short gravity ditches, or even headgates along the stream channel are all the construction they have. It is the exception rather than the rule for companies to build and maintain a lateral system. The situation is just reversed with irrigation districts. The cost of materials and labor was less when most of the company projects were constructed. Not only was this true, but the company usually paid cash which they derived from the sale of stock to the water users. While the stockholders may have borrowed money to purchase their stock, this is not reflected in the business of the company. Ordinarily, then, the ditch company assessment is only for operation and maintenance of a rather inexpensive system, while the irrigation district must levy an assessment to cover maintenance and operation of a much more expensive system and in addition make provisions for bond retirement, interest on indebtedness and perhaps for a delinquent land purchase fund. These additional assessments will be necessitated until the indebtedness is retired, at which time the district may collect only for operation and maintenance.

It has not been possible to include in this study all of the irrigation company projects. An attempt was made to include all of those which irrigate more than 1000 acres, but time and resources available did not permit securing data from some.

PROJECTS IN MONTANA

The only classification attempted in the following presentation is by geographical division of the state.

Companies and Associations—Northwestern Area

Grass Valley French Ditch Company—The project of the Grass Valley French Ditch Company is located about 8 miles west and north of Missoula. It occupies an old lake bed, the soils of which are a heavy dark loam of good productive quality. Water is taken by gravity from the Missoula River at a point about 6 miles west of the city. The supply is entirely adequate. The company has only a short main ditch, but maintains in addition several laterals.

Practically all of the 4500 acres included in the project is being irrigated. There are about 25 farmers in the company, each having in the neighborhood of 150 acres. Hay is the principal crop grown. Timothy and clover yields about 2½ tons and alfalfa 3 tons in two cuttings. Sugar beets have been expanding on the project, and an average yield of 13 tons is obtained. Small grains, grown primarily for feed, yield well. Dairying is practised to quite an extent, while a number of the farmers have beef cattle. A small amount of fattening of livestock is done, using by-products from the sugar factory to supplement home-grown feeds.

The company was formed in 1906 with an issue of 4500 shares, or one share per acre. The water cost averages $1.00 to the acre and taxes are about $1.20 an acre

Orchard Homes Ditch Company—The Orchard Homes Ditch Company supplies water for irrigation to the northern part of a suburban settlement called Orchard Homes, immediately west of Missoula. Soils of this project are a rich loam with gravelly sub-soil. Water is taken by gravity from the Missoula River near the Higgins Avenue bridge. The supply is considered plentiful at all times.

Approximately 600 acres is served by this company. The units average from 5 to 10 acres in size and are occupied largely as residence farms by people who work in Missoula, or who have additional sources of income. Fruit, berries, truck crops, dairy cows and poultry are the principal enterprises.

Stock, of which there are 1300 shares, appertains to the land. Each share entitles the holder to 1 inch of water so there is available approximately two inches of water per acre. The water charge is $1.50 an inch, or $3.00 an acre Taxes are about $2.85 an acre additional.

Rattlesnake Irrigation Company—This project is located in a canyon immediately northeast of Missoula. The soil is largely a dark brown gravelly loam. Water is taken from Rattlesnake Creek, and the supply is usually adequate.

The project was developed about 1895, with something less than 1000 acres being irrigated. Some fifty water users own stock in this company. Although there are a few larger farms on the project, most of them are from 3 to 10 acres and are farmed by people who take this means of supplementing their main source of income. Fruit, garden truck, flowers, poultry and dairy cows are combined in a small way on most of the farms.

It is understood that no regular assessment is made for water. The shareholders cooperate in keeping up the ditches by contributing work. Only when special repairs are required is it necessary to make an assessment. Taxes are about $1.90 an acre.

Supply Ditch Company—The project of the Supply Ditch Company starts 12 miles south of Stevensville and extends to a point 5 miles north of Stevensville on the east side of the Bitter Root River in Ravalli County. The land irrigated by this system lies south and immediately east of the Union Ditch project. The soils vary widely from those having a high water table to those with excellent drainage. For the most part they are a moderately heavy loam, brown in color, and quite productive. Gravel and stone outcrops in places somewhat hinder cultivation.

There are 4400 acres of irrigated land under this ditch. Forty-seven stock holders have farms in the system. Farms vary somewhat in size, but average from 70 to 90 acres. Alfalfa, small grains and sugar beets are the leading crops. Canning peas and seed peas are grown rather extensively although they make up a comparatively small part of the total acreage. Alfalfa yields about 3 tons, sugar beets 12 tons, green peas 1½ tons, seed peas 20 bushels, barley 45 bushels, and oats 65 bushels. Considerable dairy cattle and other livestock is kept, making the system of farming rather highly diversified.

The Supply Ditch Company was organized in 1897. The purpose of organization was to enlarge and extend the Wood-Parkhurst Ditch, a private system which is still being operated as such. The water, which is taken by gravity from the Bitter Root River at a point about two miles northwest of Corvallis, is divided; 5/7 going to the stock holders of the Supply and the remaining 2/7 to the Wood-Parkhurst system. There is always plenty of water available. Delivery is made only out of the main canal.

In 1928 a bond issue of $12,000 was sold. Only $4,500 of this remains unpaid, and this is now being discharged at a rate which will insure payment by 1934. The present assessment is $1.25 an acre, but when the indebtedness is discharged, 50c should be sufficient for operation and maintenance. Taxes are about $1.50 an acre.

Surprise Ditch Company—The Surprise Ditch Company takes water out of the Bitter Root River just below Hamilton. The major part of the land irrigated is in the vicinity of Corvallis. This is all river bottom land, varying greatly as to soil character. Brown sandy loam soils with some stone outcrops predominate. Topography is level and drainage for the most part is fair. High water table gives some trouble but perhaps to a lesser extent than on many lands of the valley floor. The supply of water is considered adequate. The company maintains four sub-canals in addition to the main canal, but does not have an extensive lateral system.

Approximately 4000 acres is irrigated by this system. There are about 90 farms on the project. Many of these, particularly near Corvallis, are very small and there are few of more than 40 acres. Sugar beets are perhaps the leading crop, with yields of 12 to 14 tons most common. Alfalfa hay, yielding about 3 tons per acre, is grown in rotation with beets and small grains. Potatoes are grown rather extensively on the better land, with an average yield of 150 cwt. Fruits, head lettuce and other garden crops are grown primarily on the smaller units. Dairy cattle and poultry are the principal livestock, although some other stock is kept on a small scale.

The Surprise Ditch Company was organized in 1897. There are 83 shares, each representing 50 inches of water, or approximately one inch to the acre. The company has only a negligible indebtedness. The water charge was 20c an acre in 1931, which represents about an average assessment. Taxes are about $1.50 an acre.

Union Ditch Company—The Union Ditch Company project parallels the east bank of the Bitter Root River from a point four miles below Corvallis north to Stevensville The soil is a moderately heavy loam to silt loam, varying considerably, but being perhaps the most productive of the valley floor. The topography is very level, with the result that drainage is only fair and some difficulty is experienced with high water table. Water is taken by gravity from the Bitter Root River, the supply being adequate. Delivery is made only out of the main canal, as the company itself has not constructed a lateral system.

There are 1860 acres of irrigated land in the project. The land is in 25 farm units which average about 70 acres each, although there is considerable variation in size. The principal crops are alfalfa, small grains and sugar beets, with canning peas and seed peas being grown to some extent. Average yields are about as follows: Alfalfa 2½ to 3 tons, barley 45 bushels, oats 65 bushels, beets 12 tons, green peas 1½ tons and seed peas 20 bushels. Dairying is carried on rather extensively and much diversified livestock is kept.

This project was completed in 1889 and has been in continuous operation since that time. Much of the work on the main canal is done by the stock holders which makes necessary a charge of only 25 cents an acre annually. Taxes average about $1.50 an acre additional.

Companies and Associations—North Central Area

North Chinook Irrigation Association—The project lies northwest of Chinook, in Blaine County, at an average distance of 12 to 15 miles. Chinook, with a population of 1300, is a county seat town and the principal trade center for farms in the area. Here is located the refinery of the Utah-Idaho Sugar Company as well as other marketing facilities. The main line of the Great Northern Railroad and Federal Highway No 2 both pass through Chinook.

Lands in this project are at an elevation of about 2600 feet. The frost-free period is approximately 125 days and the average annual precipitation 12.5 inches. Topography is level to rolling. The soils are mostly a light brown loam to clay loam which yields satisfactorily under irrigation. Water is taken from the West Fork Creek. The spring run-off is utilized directly for irrigation and is also diverted into a reservoir of approximately 7000 acre feet capacity where it is stored for later season use. Although the flow of water was almost negligible in 1930 and 1931, there is normally a heavy run-off.

The irrigable area involved in this project os about 7000 acres. However, only about 2200 acres of this has been put under irrigation up to the present time. It is claimed that the capacity of the reservoir could be doubled by raising the dam some three feet. Enlargement of the intake would also permit the securing of more early season run-off water which could be used to particularly good advantage on hay land. Farms on the project are rather large, with hay and grain being the principal crop.

This organization was started in 1905 at which time water rights were filed and work begun on ditches. The reservoir was built in 1910. There are 1030½ shares of stock with a $10.00 par value. Stock was sold on the basis of 30 shares to 160 acres The assessments average about $75 for 160 acres, or just under 50 cents an acre. Taxes on the irrigated land are about 40 cents an acre.

Havre Irrigation Company—The Havre Irrigation Company project begins at the North Montana Experiment Station 6 miles southwest of

Havre and extends northeast nearly to the city. Havre, a city of about 5,000 population is the county seat of Hill county. The main line of the Great Northern railroad and Federal Highway No 2 pass through Havre in an east and west direction. The Havre-Butte branch of the railroad comes in from the southwest. The Utah-Idaho beet sugar refinery is located at Chinook about 20 miles east. A diversity of market facilities are located at Havre.

Elevation at this project is slightly over 2500 feet. The annual precipitation is 13.5 inches, while the average frost-free period is recorded as 130 days. The topography is level to rolling, being largely bottom land. Soils of the bottom lands are classed as Laurel loams, being light in color and moderately heavy in texture, while the higher lands are Scobey loams, which are darker in color and lighter in texture. Water is taken from Beaver creek at the Experiment Station. There is a reservoir some two miles below which has a capacity of 600 acre feet. To a certain extent this project is a flood water proposition, utilizing the spring run-off largely Further storage could be developed at a very reasonable cost, according to information readily obtainable.

Slightly less than 2000 acres is under the ditch at present, most of this being irrigated when the water supply is sufficient. The development of additional storage would add about 1000 acres. There are 12 farms which have stock in the company. These farms average about 125 acres of irrigated land each, and most of them are supplemented by considerable dry land. The farming system is fairly diversified, with alfalfa hay the leading crop. Considerable of this hay is sold to dairymen near Havre. Alfalfa yields about 2 tons in two cuttings. Alfalfa seed, and feed grain crops, giving moderately good yields, claim the remainder of the acreage.

This company was organized in 1904. There are about 3000 shares of stock outstanding. On an average, nearly two shares is owned for each acre irrigated. The water cost averages about 35 cents an acre. Taxes on irrigated land in this locality are 50 cents an acre.

Rock Creek Irrigation Association—The Rock Creek project is located on the north side of the Milk River in the vicinity of Hinsdale in Valley County. The main line of the Great Northern Railway and U. S. Highway No. 2 parallel the project, making transportation an easy matter. Hinsdale is the local trading point, while Glasgow the county seat with a population of 2,300, is about 30 miles east. The altitude here is approximately 2,100 feet, while the growing season averages 120 days and the annual precipitation about 13.6 inches. Topography is rather flat, and the soil is mostly a heavy type.

This project is rather unique in that it is essentially a large flood irrigation system. The flood waters of Rock Creek, an intermittent stream draining a large area, are utilized. The canals which carry the diverted flood water and the cross or check dykes are very large which enables the controlling and proper utilizing of a great amount of water when it comes.

Normally two good floodings are possible. The first of these is possible when the melting snow run-off occurs, usually in March or early April. The second is possible when the spring rains occur in May and June. This flood water is spread over the land and held to a depth of several inches by a system of contour dykes. The land is thus thoroughly soaked twice and sufficient moisture is stored in the soil to produce good crops. Occasional heavy rains later in the summer may be used to some extent and there are some years when Rock Creek runs water which may be used as late as July 15.

Approximately 9,600 acres are included within the project. Nearly all this lies so that it can be flooded. Normally there is sufficient water to irrigate 7,000 acres. However, in 1929 this was reduced to 5,000 acres and in 1931 to about 3,500 acres. Bluejoint hay is the principal crop, which yields just under one ton to the acre. Some alfalfa hay and grain is grown on the lighter soil types.

The project was organized in 1902. There are eleven stockholders, some of which are absentees who rent their land. Nine ranchers operate on the project. The wintering of cattle and sheep is their main activity. There are 60 shares of stock, one share representing each 160 acres. The average assessment has been 10 cents an acre over the last 20 years. Taxes on this land are about 30 cents an acre.

The Teton Cooperative Reservoir Company—The reservoir owned by this company is located five miles west of Bynum in Teton county. It has a safe capacity of at least 80,000 acre feet. Water is taken from the Teton River through a canal five miles long, to fill the reservoir.

The Teton Carey Act project which was organized in 1909 constructed the reservoir on a much smaller scale than at present. This was done to supply water to the old Carey Act project in the vicinity of Brady. When the Bynum Irrigation District was developed, the reservoir company was reorganized and the capacity of the reservoir greatly increased to serve as primary source of water for the Bynum District. There are 1,000 shares of stock in the Teton Cooperative Reservoir Company. Of these, the Bynum District owns 804 shares and The Brady Cooperative Irrigation Company 128 shares. The remaining stock is held by private individuals. Annual assessments which are made for operation and maintenance of the reservoir are $2.00 per share.

The Brady Cooperative Irrigation Company—Lands in the Brady project completely surround the town of Brady in Pondera County. The Great Falls-Shelby branch of the Great Northern Railroad and a state highway traverse the project. The elevation at Brady is about 3500 feet. Precipitation averages 12 inches, while the frost-free period is about 125 days. The soils are largely a light brown colored clay loam. Topography is very favorable for irrigation, most of the land having a rather gentle slope. The project is not troubled with alkali or seepage.

Wheat is the principal crop grown, utilizing probably 80 per cent of

the entire area of 6,000 acres. About 10 per cent is in alfalfa while the remainder is in native grass pasture, gardens, etc. Most of the wheat land is irrigated in the fall. Only when water is very plentiful do the farmers irrigate their wheat during the growing season. The average wheat yield obtained in this manner is 30 to 35 bushels per acre. Alfalfa hay averages about 1½ tons per acre. Some dairy cows and diversified livestock are kept on most farms, although there is only one large livestock ranch on the project.

The Brady Cooperative Irrigation Company, organized about 1918, took over part of the old Teton Carey Act project which came into existence in 1909. There are 500 shares of stock in the company. These are owned by 25 farmers who average about 20 shares each. When the usual amount of water is available each share calls for delivery of enough water for irrigating about 12 acres. This company owns 128 shares of stock in the Teton Cooperative Reservoir Company. Water is delivered from the Bynum Ditch into the Muddy Creek. It is in turn diverted into the company canal about 10 miles west of Brady. The average assessment for irrigation company stock is $15.00 a share. Most of the money from this assessment goes in turn to pay the assessment on the reservoir stock which the Brady Cooperative Irrigation Company owns. Water costs the farmers of this project, therefore, about $1.25 an acre annually. Taxes average about 50 cents an acre.

The Eldorado Cooperative Canal Company—This project lies immediately south of the Bynum Irrigation District in Teton County. The Great Falls-Agawan branch of the Chicago, Milwaukee, St. Paul and Pacific Railroad passes over the east end of the project while the Great Falls-Pendroy branch of the Great Northern Railroad and Federal Highway Number 87 traverse the west end. The elevation in this locality is about 3900 feet. An annual precipitation of 14 inches occurs, while the frost-free period averages 113 days. Soils of this project are quite gravelly and there is a considerable area of seeped land. While there is a very large area under the canal, the average irrigated is around 3000 acres. Water is diverted from the Teton River at a point about eight miles southwest of Bynum. The Eldorado Company has an adjudicated right to 3425 inches. With the exception of a few private rights, this is the oldest water right on the Teton. The supply is therefore, usually adequate.

Most of the land in this project is owned by five large cattle and sheep operators. By far the greater part of the acreage is in native grass hay which yields about one ton per acre. The grain which is grown is fed rather than sold as a cash crop. There are 1370 shares of stock each representing 2½ inches of decreed water. The annual assessments are $1.00 per share or about 50 cents an acre for the land actually irrigated. Taxes average about 50 cents an acre additional.

The Farmers Cooperative Canal Company—Lands irrigated by this company lie between the Eldorado and the Burton ditches near Farmington

in Teton County. Transportation facolities and climate conditions are practically the same as for the Eldorado project just previously discussed. Water is taken from the Teton River at a point about 12 miles west of Farmington. The company has a right, dated 1897, for 3000 inches of water. Since this is the latest of the company rights in this locality, the supply of water is not always adequate even though the company has a small reservoir to supplement the late season flow. There is a great deal of gravelly soil in this project. In addition there is a stretch of seeped land about a mile wide and two and a half miles long which produces only native grass hay. Some alkali is found here, but it is not a serious problem.

There are fifty farmers who won stock in this company. The greater number have but one share, although a few have four, five or more which gives an average of two shares per farm. This means that on an average the farms have about 75 acres of irrigated land. This is ordinarily in combination with some dry land acreage. Due to lack of range in recent years there has been very little livestock kept on the project. Wheat is the principal crop grown with 20 to 30 bushels per acre being obtained. The relatively small amount of alfalfa grown yields from one to one and a half tons per acre.

The Farmers Cooperative Canal Company was organized in 1898. There are 100 shares of stock outstanding, each of which covers a right to 30 inches of water. The average assessment is $25 per share, which amounts to something like 70 cents per acre. Taxes are about 50 cents an acre.

The Teton Cooperative Canal Company (Burton Ditch)—The Teton Cooperative project is located south and east of the Farmers Cooperative project on the Burton bench north of Choteau in Teton County. The upper end of the project is approximately south of Farmington, while the lower end extends about five miles north east of Choteau. Climatic conditions, markets and transportation facilities are approximately the same as for the two projects just previously considered. Water is taken from the Teton River approximately south of Bynum. The company has a right for about 3000 inches, the date of which is older than the Farmers Cooperative company but later than the Eldorado company. They have no storage reservoir and in very dry years some shortage of water occurs. The soils are gravelly toward the west end, with a very heavy type prevailing over the lower part of the project. The topography is rather gently sloping.

About sixty farmers own stock in the company, which irrigates a little less than 3000 acres. The average irrigated land per farm is about 50 acres. Wheat is the principal crop, with a yield of 30 bushels being average. Some alfalfa is grown, yielding about 1½ tons per acre. Livestock is kept on a rather small scale, being rather diversified in nature.

The Teton Cooperative Canal Company was organized in 1892. There are 60 shares of stock, each representing five inches of water. Annual assessments are from $20 to $25 per share, making the average water cost per acre about 60 cents. Taxes are about 50 cents additional.

Valier, Montana Land and Water Company—The Valier project is located in the central part of Pondera County which is at the eastern base of the Rocky Mountains in the northern part of the state. Conrad, a city of 1400 population, lies at the lower end of the project. The Shelby-Great Falls branch of the Great Northern Railway contacts the project at Conrad. A local railroad from Conrad to Valier extends nearly the entire length of the project, with frequent shipping points available. Federal Highway No. 87 cuts across the western end of the project and there is a well improved road connecting Conrad with Great Falls, a distance of approximately 75 miles.

Elevation of the project averages about 3600 feet and the annual precipitation is about 12 inches. The frost-free period averages about 120 days. Soils* are of glacial origin, but there is considerable variation. For the most part the soils are dark brown in color and are a moderately heavy loam. Topography is generally favorable for irrigation. The natural flow of Birch and Dupuyer Creeks is utilized, supplemented by a combined storage of 142,000 acre feet in Lake Francis and the Birch Creek Canyon reservoir. Water is therefore entirely adequate. Delivery is made to each farm by an extensive lateral system maintained by the company. A small amount of seepage has occurred, and water stock for 2100 acres so effected has been removed.

Gross area of the project is 115,000 acres of which 80,000 are irrigable. Approximately half the irrigable acreage is actually being irrigated. This is due, in part, to the many large holdings which cannot be properly farmed under irrigation by the farmer with only average capital. Farms at the present time vary between 120 and 240 acres and there are 365 farmers on the project. Hay and small grains are the principal crops although some sugar beets are being grown. Alfalfa and sweet clover yields average about 2½ tons; wheat, 30 bushels; barley, 45 bushels; oats, 60 bushels; and sugar beets, 11 tons. Most farmers have dairy cattle, hogs or small bands of sheep which lend diversity to their farming program. Some winter feeding of beef cattle and sheep from adjacent range lands is practised.

The Valier Carey Act Project was started in 1909. Development and management is in the hands of the Valier Montana Land and Water Company. The original contract with the Carey Act Board provides that the perpetual water right be sold for not more than $40.00 per acre. The original contracts provided for the payment of this in 14 years but the period has since been lengthened to 21 years. Operation and maintenance charges are $1.00 per acre and taxes average 75 cents. Land with a paid-up water right can be purchased under the system at an average price of $50.00, amortized over a 21-year period.

*A detailed report on the soils of the Valier Project is available. See Montana Experiment Station Bulletin No. 217.

Companies and Associations—Central Area

Lebo Lake Irrigation Company—This project is located about ten miles southwest of Harlowtown in Wheatland County. The main line of the Chicago, Milwaukee, St. Paul and Pacific Railway passes through Harlowton, a city of 2,000 population. The altitude at this point is 4300 feet. The frost-free period averages about 95 days and the annual precipitation approximately 12 inches.

About 4000 acres is irrigated in this project. The soil is a dark loam with occasional outcrops of gravel and stone. The water supply consists of the normal flow of Lebo Creek supplemented by that stored in Lebo Lake. This storage reservoir is filled in the spring by means of a canal which diverts water from the American Fork of the Musselshell River. The supply is adequate except in extremely dry years.

There are about 12 water users on the project. Most of these are ranchers who use this land only for growing winter feed. Because of the abundance of grazing land in the vicinity, this is an excellent cattle and sheep country. Alfalfa hay claims nearly the entire acreage. Two cuttings are obtained and the yield averages about 2½ tons per acre.

In 1903 a company was organized which constructed the dam and the diversion canal. They had 1000 shares of stock with a value of $25.00 each. In 1920 the dam was raised to make possible the irrigating of an additional 200 acres. The stock is owned by the water users who cooperate in maintaining the works. The cost of water under this system is almost negligible. Taxes average about 45 cents an acre on the irrigated land.

Montana Ditch Company—The project of the Montana Ditch Company is located along the Missouri River immediately north of Townsend, in Broadwater County. The main line of the Northern Pacific railway contacts the project. U. S. Highway No. 10 N makes travel by car either north or south possible throughout the year. Helena, the state capitol, is only 35 miles distant. Townsend, the county seat, with a population of 840, is the local shipping point.

The levation of the project is about 3800 feet and annual precipitation about 10 inches. Although temperature data are not recorded at Townsend, the data obtained at recording stations in the same county would indicate a frost-free period of about 110 days. Soils of the project are dark, grading from a loam to silty loam in texture. Water, of which there is always an abundance, is taken to gravity from the Missouri River. Most of the acreage is devoted to producing hay. This is fed primarily to beef cattle and sheep which range on the adjacent foothill and mountain lands. Alfalfa yields about 3 tons in two cuttings and wild hay yields about 1½ tons.

The company was organized in 1901 with a capital stock of $44,000. Forty-four shares were issued and are now outstanding. Each share entitles the holder to 1/44 of the water in the ditch. Shares are each assessed $5.00 per acre per month to meet operating and maintenance costs and to retire

indebtedness. Since there are 5,000 acres of irrigated land in the project, the average land per share is about 114 acres. Water is used for about 5 months ordinarily so that the average water charge per acre is less than 25 cents. Taxes average about 75 cents per acre. The present indebtedness is only $7500. This is secured by a note of the company.

Montana Reservoir and Irrigation Company—This project is located in the Helena Valley about six miles northeast of the city of Helena. The land included lies along the west and north shores of Hauser Lake. Helena, the state capitol and a city of 12,000 population, affords a good local market for a variety of produce. The main line of the Northern Pacific Railroad and the Havre-Butte branch of the Great Northern Railroad serve the area. Excellent surfaced highways extend in three directions out of Helena.

Elevation of the project is just under 3,800 feet. The frost-free period averages 140 days and the annual precipitation is about 13 inches. Water is pumped from Lake Hauser from three different levels, the average being 110 feet. Since this lake is fed by the Missouri River, the supply is ample at all times. Topography is moderately rolloing to smooth and the farming land is largely a sandy loam soil type.

The project is especially adapted to a diversified type of farming. Alfalfa is the principal crop, while small grains, potatoes, and sugar beets are also grown. Yields of all crops adapted to the locality are very satisfactory. Dairy cattle, hogs and poultry are an important part of the farm business in most cases. Some livestock feeding is done, with satisfactory results being obtained.

A total area of 10,000 acres is included in the project. Nine thousand acres of this is irrigable, and approximately 5,000 acres are being irrigated at the present time. While the greater part of the land is in private ownership, considerable is owned by the Montana Reservoir and Irrigation Company, a subsidiary of the Montana Power Company. This company supplies the water at a cost of $1.75 an acre foot. Taxes on the irrigated land average about 75 cents per acre.

Sun River Valley Ditch Company—This project is situated in the lower Sun River Valley, between the towns of Sun River and Vaughn. Lands in the project are traversed by the Augusta-Great Falls branch of the Great Northern Railway and by Federal Highway No. 87. Great Falls with a population of about 30,000 is only 15 miles distant and affords a good market for a variety of products.

The average elevation of the project is about 3400 feet. The annual precipitation is about 12 inches and the frost-free period averages 125 days. Topography is excellent for irrigation. Soils are moderately dark in color. They incline to the heavier types, with silt loam and clay loam prediminating. Water is taken by gravity from the Sun River. The company has an adjudicated right to sixty-seven second feet, which is with one exception the oldest right on the river.

There are approximately 3500 acres of irrigable land under the canal, of which about 2500 acres are actually being irrigated. The water supply is ample to serve 5000 acres, and the canal could be extended across the Muddy Creek at Vaughn to cover about 1500 more at a very reasonable. cost. Eighty-one shares of assessable stock have been issued to the landowners on the project, and water is pro-rated according to the amount of stock held by the individual owners.

In 1931 the company sold at par $6000 in bonds. Proceeds from this were used to clean and enlarge the canal and make other improvements. The bonds are serial and are to be retired at the rate of $1000 each year. An annual assessment of $20.00 a share is made to retire the bonds, pay interest and cost of maintenance and operation. This $20.00 assessment on 81 shares means only $1620, or less than 50 cents an acre for the irrigable area. Taxes average about 65 cents annually.

Winnett Irrigation Company—This project is located 2 miles north and west of Winnett in Petroleum County. Winnett, having a population of 500, is the county seat and the shipping point for the project. A branch line of the Chicago, Milwaukee, St. Paul and Pacific Railway connects Winnett with Lewistown, to the west about 60 miles. A well improved road also extends between these two points.

The elevation is 3000 feet on an average. A frost-free period of 150 days, and an annual precipitation of just under 13 inches are average for the area. The topography of the land is for the most part favorable for irrigation. Soils at the lower end of the project are mostly a loam to sandy loam. These of the upper part, however, are developed over shale and considerable difficulty is encountered with alkali. Water for irrigation comes originally from Ford Creek. Flood waters from this stream are diverted by a canal to two reservoirs where it is stored for summer use. When the reservoirs are kept in repair there is sufficient water except in vary dry years.

Irrigable area of the project is given as 12,000 acres. Of this, only 1000 acres is actually irrigated. The project was constructed in 1915 and paid for by local people who hoped to sell sufficient land to repay the cost of the system. The original cost of development was $20 an acre. The water charge is 50 cents an acre annually and taxes are about 65 cents an acre. Influenced by the presence of only fair soils and an uncertain water supply, combined with low prices for agricultural products, very little agricultural development has taken place. Not more than half a dozen farmers are actually using the water. Alfalfa hay and alfalfa seed are the principal crops grown. Because of the vast amount of range adjacent to the project, hay for winter feed is in demand.

Companies and Associations—Southwestern Area

Gallatin Group

Projects in this group include the greater part of the irrigated lands in the Gallatin Valley, which extends east and west through the central part of Gallatin County. Bozeman, a city of approximately 7,000, is near the eastern or upper end of the valley. Gallatin Gateway, Belgrade, Manhattan, Logan, Three Forks and Willow Creek are progressive towns which

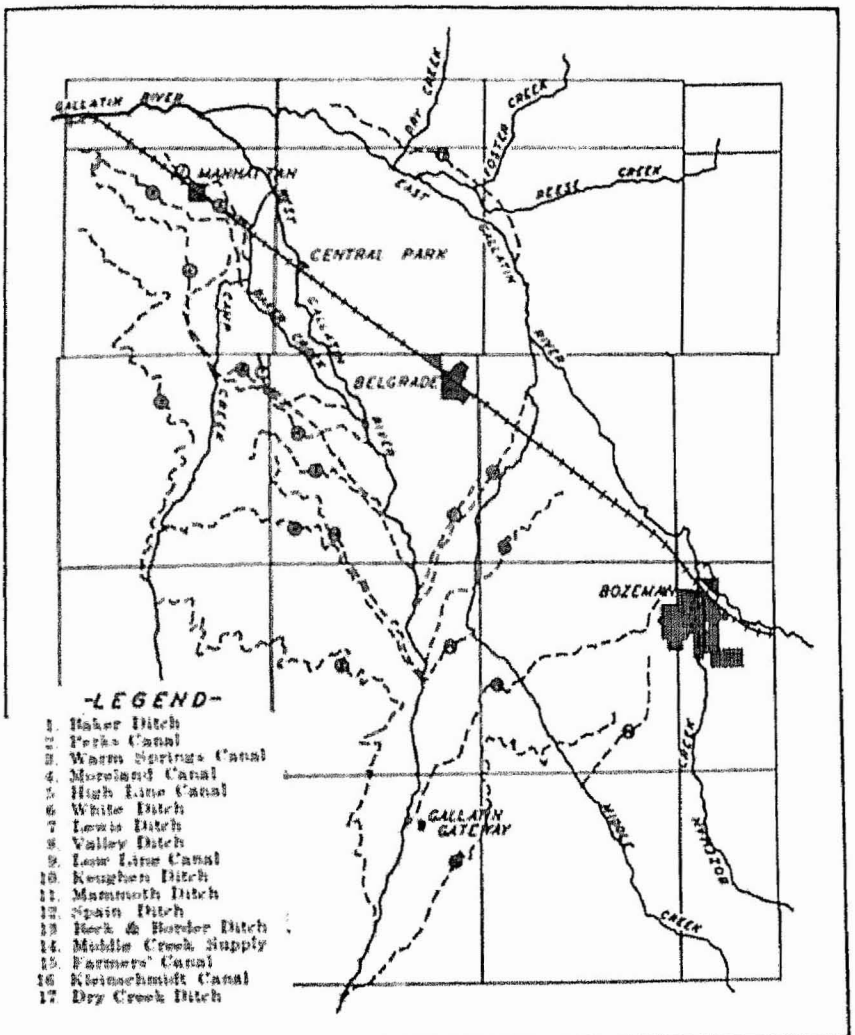

Fig. 5—Canals and Supply Ditches, Gallatin Valley

serve the central and lower parts of the valley. Yellowstone Park is less than 100 miles south. Montana State College is located at Bozeman.

The main line of the Northern Pacific Railway extends the entire length of the valley, with several branch lines making shipping facilities near to all. The main line of the Chicago, Milwaukee, St. Paul and Pacific touches the lower part of the valley at Three Forks. Branch lines for hauling both passengers and freight extend up to Gallatin Gateway and through Bozeman north to Menard. Federal highway No. 10 extends the entire length of the valley.

The farmers of the Gallatin Valley are well organized, having a livestock shipping association, canning crops association, sheep association, dairy herd improvement association, poultry association, Farm Bureau and farmers oil company. An extensive seed pea and canning pea industry is established in this valley. A large well-equipped cannery, which takes peas and a limited acreage of beans, is located at Bozeman. Seed pea houses, extensive flour mills and creameries are also located here, while similar marketing facilities, on a smaller scale, are found in other towns of the valley. Sugar beets are shipped to Missoula, some 220 miles west.

Farm lands under irrigation vary from an altitude of 5,000 feet in the upper valley to about 4,400 feet in the vicinity of Three Forks. The frost-free period varies from 90 to 130 days, with something over 100 days being the average. Precipitation varies from about 18 inches in the upper valley to approximately 10 inches in the lower portions. The great variation within a distance of only 35 miles is due to local conditions which result from the surrounding mountains.

Soils* in the upper valley adjacent to the mountain slopes are largely deep dark loams of high productivity. Farther out on the valley floor the soil becomes lighter in color and gravel is found nearer the surface, although the areas which are too gravelly for profitable farming are somewhat localized. High water table is a problem along the north central part of the valley, but land irrigated under the various canals hare considered is not subject to high water table to any great extent. In general the soils of the Gallatin Valley are among the most productive in the state.

This is one of the oldest farming sections of Montana. Agriculture is highly developed and a diversified type of farming is practiced. Beef or dairy cattle are found in substantial numbers on a great many of the farms, while "farm flocks" of sheep are found on others. Hogs and poultry are kept on nearly every farm. Alfalfa claims perhaps the largest part of the irrigable acreage. Yields vary from two to four tons in two cuttings, with two and one-holf to three tons being considered the average yield over a period of years. Peas, both for canning and seed purposes, use many thousand of acres of these lands each year. Yields vary within wide limits,

*A detailed soil survey has been made of this area by the Montana Experiment Station in cooperation with the Bureau of Chemistry and Soils.

but a fair average for seed peas is 25 to 35 bushels per acre while canning peas average 2,500 to 3,500 pounds. Both winter and spring wheat are grown extensively under irrigation with yields around 35 bushels as an average. Average yields for barley and oats respectively are 45 and 60 bushels. Irrigated pastures, particularly in the higher water table areas, are common and have a high carrying capacity. Farms are somewhat larger in size than is usual where land of this quality is placed under irrigation.

The area is particularly adopted to dairying and substantial expansion along this line will no doubt occur within the next few years. A producer owned and controlled cooperative creamery has recently been incorporated and it is hoped to establish a creamery in the near future. Abundant cold, running water, cool climate, comparative freedom from flies, succulent irrigated pastures, and superior hay are all favorable to dairying.

Most of the water used by these ditch companies comes from the West Gallatin River and its tributaries. This water has all been adjudicated and in years when there is a water shortage, farms having the most recent rights do not have sufficient water. During years of normal precipitation there is not a water shortage in the Gallatin Valley.

Baker Ditch Campany—Land irrigated under the Baker ditch lies immediately adjacent to the townsite of Manhattan on the west, north and east sides. Water is taken from the West Gallatin River, Baker Creek and Camp Creek. The decreed right is for 2,000 miners inches under date of 1898. In all but very dry seasons the supply is sufficient.

There are eleven water users in this company. The acreage irrigated by each varies somewhat, but the average is close to 200 acres. Very few peas are grown on these farms, while alfalfa hay and permanent pasture are considered the best adapted crops. Although a diversity of livestock is kept on most of the farms, dairy cattle predominate in this locality.

The Baker Ditch Campany was organized in 1913. There are 2,000 shares of stock with a par value of $20.00. Assessments vary slightly from year to year but the average is 15 cents a share, or the same amount per acre. Taxes on land average 65 cents an acre.

Dry Creek Irrigation Company—This project lies immediately north of the East Gallatin River in the vicinity of Belgrade and Manhattan. The company has 1,300 inches of decreed water from the East Gallatin which is taken into the ditch about six miles due north of Belgrade.

Fifteen farmers own stock in the company. While the share holdings vary from 10 to 200 per farm, the average is slightly under 100 shares. Alfalfa, spring wheat, barley and seed peas are the principal crops. These give yields about equal to the average for the valley. Beef cattle are the principal livestock kept, although the farming system is quite diversified.

This company was organized in 1907, with 1,300 shares of stock. The average water assessment per acre is 35 cents, while land taxes are about 40 cents an acre.

Farmers Canal Company—The canal belonging to this company takes

water from the West Gallatin River immediately west of Gallatin Gateway townsite. It then follows a northeasterly course toward the city of Bozeman, terminating just northwest of the city limits. The company has a total of 10,700 inches of decreed water, almost all of which is under date of 1890 to 1892 inclusive.

Slightly more than 10,000 acres of land is estimated as being irrigated in this system. There are seventy-five water users in all. Acreage irrigated in each farm varies somewhat, but the most common size farm is about 160 acres of irrigated land. This is one of the very best farming sections of the valley. Peas, both for seed and for canning purposes, are grown extensively here. Yields of peas, as well os of alfalfa and grain crops are above the average for the valley. There are some rather large beef and dairy farms in the area and nearly all of the farms have some livestock.

The Farmers Canal Company was organized in 1891. There are 100 shares of stock, each with a par value of $500. Each share represents approximately 100 inches of water. The average per acre assessment for water is 20 cents. Taxes on land average about $1.10 an acre.

High Line Canal Company—The High Line Canal takes water from the West Gallatin River about three miles south of Gallatin Gateway. After approximately paralleling the river on the west side for about seven miles, it swings west several miles and from there proceeds north to a point about seven miles southwest of Manhattan. The main canal is approximately 20 miles long and the three branch canals which are a part of the system bring the total to 35 miles. The total appropriation of this company is 5,900 inches, 3,400 of which is 1890 water and the remaining 2,500 inches is under date of 1901.

About 6,000 acres of land is irrigated in this project. There are 50 water users, whose average irrigated area is slightly more than 100 acres. The land is rather rolling in topography and the soil varies rather widely, although it is quite productive. Wheat perhaps claims the greatest acreage, although peas, alfalfa and feed grain crops are included in the cropping system. Some of the farms include a considerable dry land acreage. Livestock of various kinds is present on most of the farms.

The High Line Canal Company was formerly a part of the West Gallatin Irrigation Company which was organized some time during the 90's. In 1909 the farmers using this ditch formed a separate organization known as the High Line Canal Company. In 1930 they reincorporated under their present name. There are 4,571 shares of stock in the company which represent 5,123 inches of water. This stock is assessable and the average assessment is about $1.50 per acre annually. At the time of reorganization in 1909 holders of water rights were given the choice of trading in their old stock for the new or of simply retaining their original water right and paying $2.00 an inch per year to have their water delivered through the company ditch. Farmers having rights to 777 inches of water chose the latter alternative. Land taxes on this project average from 55 to 60 cents an acre.

Keughen Ditch Company—The Keughen Ditch diverts water from the West Gallatin River just southwest of the Bozeman Hot Springs. The canal then takes a northwesterly course on the west side of the river for about 8 miles. A total of 2,813 inches of water is decreed to land under this ditch. The dates of the several rights are as follows: 1874—338 inches, 1882—1,531 inches, 1885 to 1894—954 inches. This company has one of the best water rights in the valley.

Approximately 3,000 acres of land is irrigated in this project. This is owned by fifteen individuals who have stock in the company. Nine of the fifteen have six shares each, which means that most of the holdings are very large for irrigated farms. Alfalfa, wheat and peas are the leading crops, with yields running about the same as the average for the valley. Beef cattle are the most common class of livestock found in this locality.

The Keughen Ditch Company was organized in 1902, There are 60 shares of stock outstanding, each of which represents just under 50 inches of water. Assessments average about $10.00 a share or from 20 to 25 cents an acre. Taxes on land average approximately 50 cents an acre.

Low Line Canal Company—The Low Line Canal takes water from the West Gallatin River about one and one-half miles above Shed's Bridge. It then runs just above and within a very short distance of the Keughen Ditch for about five miles. From here the Low Line swings due west, irrigating considerable acreage in the Church Hill community. This company has a 5,900 inch right, of which 3,400 is 1890 water and 2,500 inches is dated 1901.

Nearly 6,000 acres of land are irrigated by this system. There are 57 water users, 33 of which have less than 75 shares. The remainder is in larger holdings, with 100 to 200 shares being the most common size. Since each share represents approximately one acre of irrigated land, this means the farms are fairly large. Crops and yields are about the same as those under the High Line Canal.

The Low Line Irrigation Company was formed in 1909 by a group of farmers who formerly were in the West Gallatin Irrigation Company In 1924 they refinanced the project and reincorporated as the Low Line Canal Company. There are 5,438 shares of stock outstanding. The water cost per year is from $2.50 to $3.00. This relatively high cost is due to some expensive construction and repair work which is being paid for over a period of years. Taxes average 50 cents an acre additional.

Mammoth Ditch Company—The Mammoth Ditch diverts water from the West Gallatin River about one and one-half miles below Shed's Bridge. From here it runs due north and through the townsite of Belgrade. This company has perhaps the best water right in the valley. Of the 2,940 inches of decreed water, 2,361 inches are 1866 water and 579 inches are 1884 water.

Particularly toward the lower end of this project there is considerable gravelly soil and the water requirement is high. There is perhaps a total of 2,000 acres of land actually irrigated. Alfalfa, which is the principal crop, does well when it becomes established and is given frequent irrigation.

On the deeper soil areas, grain crops give good yields. Twelve stockholders, having from one to fifteen shares each, use this water.

The Mammoth Ditch Campany was organized in 1904. There are 52 shares of stock, each carrying the right to delivery of 50 inches of water. The par value of these shares is $500.00. Assessments average $10.00 a share or about 20 cents an acre. Taxes on land are about 75 cents an acre.

Middle Creek Ditch Company—The canal constructed by this company takes water from Middle Creek at a point about four miles south and three miles west of Bozeman. The canal, about five miles long, extends northeast to the College Farm. The water right of the Middle Creek Ditch Company is for 2900 inches, to date of this water being 1897. During dry years a shortage of water occurs late in the summer.

Approximately 3,000 acres of land is irrigated from this canal. The soil is largely a dark loam underlaid with gravel. A major part of the acreage is devoted to hay, while feed grain crops and peas are grown quite extensively. Wheat is grown only to a limited extent. Yields are perhaps slightly above the average for the valley. There are 55 farmers who have stock in the company. While there are a few small water users near Bozeman, 160 acres is the most common amount of irrigated land per farm.

The Middle Creek Ditch Company was organized in 1888. There are 60 shares of stock, each representing 50 inches of water. Assessments average $10.00 a year per share or 20 cents an acre. Taxes in this locality average about $1.10 an acre.

Middle Creek Supply Ditch Company—This company was organized for the purpose of building a canal which takes water from the West Gallatin just above the Bozeman Hot Springs and conveys it to Middle Creek at a point about one and one-half miles east and the same distance north of the point of diversion. Less than three miles of canal are required. The water is then diverted from the creek channel by the various users. A right to 3,326 inches of water under date of 1872 belongs to this company.

Approximately 3,000 acres are irrigated by the shareholders in this company. Twenty water users are involved, these irrigating from 50 to 350 acres each. The majority of the farms within this project have about 200 acres of irrigated land. Alfalfa, wheat and peas are the principal crops, with yields of these crops being about average for the valley. A diversity of livestock is maintained on most of the farms.

This company was organized in 1889. There are 17½ shares of stock, each of which is assumed to carry the right for sufficient water to irrigate 200 acres. The average water cost is less than 10 cents an acre annually while taxes are about 60 cents an acre.

Moreland Canal Company—The Moreland Canal diverts water from the West Gallatin River about three miles southwest of Belgrade. The canal extends on the west side of the river in a northwesterly direction to a point about three miles west of Manhattan. The water right of this company

is dated 1882. It calls for a gross delivery of 1,918 inches, with a net delivery of 1,500 inches.

About 1,500 acres of land are irrigated from the Moreland Canal. There are twelve water users who have from 83 to 160 inches of water each, with an average of perhaps 120 inches. For the most part, the soil is of good quality and yields are equal to the average for the valley. Some sugar beets are grown, with a yield of 14 tons being obtained. Beef cattle are the predominant type of livestock in this area.

The Moreland Canal Company was organized in 1882. There are 1,500 shares of stock outstanding. The average yearly water assessment is about 75 cents per acre. Taxes on land are about 60 cents an acre additional.

Mystic Lake Ditch Company—This project lies some five miles south of Bozeman. Water is diverted out of Bozeman Creek just inside the mouth of Sour Dough Canyon, and carried to farms north and west two or three miles. Water has been decreed to the company as follows: 600 inches of 1866, 400 inches of 1868 and 300 inches of 1872. Most of the farmers in this company also own stock in the Bozeman Creek Reservoir Company which has developed storage in Mystic Lake at the upper end of Bozeman Creek. There are 10 shares of ditch stock, each representing 100 inches of water and there are 20 shares of reservoir stock. The reservoir stock normally entitles the holder to 100 inches of water for 15 days. The city of Bozeman has four shares of this stock, the remainder being owned by 11 farmers. There are 10 farmers in the ditch association.

Upwards of 2000 acres are irrigated in this system. The farms are rather large and a considerable amount of livestock is kept on most of them. Hay claims the greatest acreage, with yields slightly above the valley average. Peas and grain crops, which are grown to some extent, give very good yields. Water assessments both in the ditch company and the reservoir company combined do not usually exceed 10 cents an acre. Taxes average about 70 cents an acre on land in this part of the valley.

Perks Canal Company—The Perks Canal takes water from Camp Creek about two miles west of Central Park. From here it runs north, crossing the Northern Pacific track, and then runs parallel to the track into the Manhattan townsite. The entire length of the canal is only about three miles. The company has 983 inches of decreed water, all of which dates back to 1868.

Approximately 1,200 acres of land are irrigated from this canal. The smallest stockholder has five shares while the largest has 179. Farms are, therefore somewhat smaller than the average for the valley. Dairying is the principal livestock enterprise, while peas and wheat are grown to some extent as cash crops.

The Perks Canal Company was organized in 1868. There are 1,200 shares of stock, each share representing about one acre of land. The average yearly assessment is 15 cents a share. Taxes average 75 cents an acre.

Spain-Farris Ditch Company—This company ditch takes water from the

West Gallatin about one mile below Shed's Bridge. The canal runs approximately parallel to Middle Creek, terminating two miles due east of Belgrade. Water decreed to the company totals 4,789 inches. Of this, 1,200 inches are an 1886 right while the remainder is largely 1890. A shortage of water is not unusual on this project.

Twenty-seven farmers are shareholders in this company. They average from 150 to 200 shares, each of which represents an inch of water. The soil under this system is inclined to be gravelly and, therefore, requires a good deal of water. Alfalfa does very well in this soil when once established and properly watered. Grain crops are grown with fair success, but there are but few peas. A diversified type of farming, with considerable livestock in the system, if found here as elsewhere in the valley.

The Spain-Farris Ditch Company was organized in 1906. There are 4,789 shares of stock, or a share for each unit. Water assessments average 30 cents an acre, while taxes are about 80 cents an acre.

The Valley Ditch Company—Water is diverted into the Valley Ditch from the West Gallatin River about two miles below Shed's Bridge. The canal then runs northwest about half way between the Keughen and the Moreland Canals on the west side of the river. The company has rights to a total of 3,018 inches of water. Under date of 1882 they have 543 inches, while the remainder dates from 1890 to 1904. Ordinarily the water supply is ample. This is due in part to the fact that there is considerable waste water return from land irrigated above.

Approximately 3,000 acres are irrigated in this project. There are fourteen water users in the company who irrigate from 80 to 400 acres of land each. The average, however, is about 200 acres. Soils over most of the area are dark loams of good productivity. Alfalfa hay and peas are the principal crops grown, while there is a considerable acreage of wheat and feed grain crops. Yields are perhaps a little above average for the valley. Beef cattle hold a dominant position in the livestock system.

The Valley Ditch Company was organized in 1906. There are 70 shares of stock, which divided into the total decreed water, gives about 72 inches per share. The average assessment is about $3.00 a share, making the average per acre cost of water less than 10 cents. In addition to this, some work is done on the canal by the various shareholders. Taxes are about 45 cents an acre on an average.

Warm Springs Canal Company—The Warm Springs Canal heads along Baker Creek about two and one half miles southeast of Manhattan. The canal then extends northwest to within about a mile of Logan. In addition to the water from Baker Creek, about an equal amount is taken from Warm Springs Creek. The total water right is for 2,200 inches, all of which is an 1889 right. There is a sufficient supply for the 2,200 acres which this right is supposed to cover.

Twenty farmers are stockholders in this company. Although there is some variation, the average holding is about 100 inches of water each.

Alfalfa hay is the leading crop. Peas and sugar beets are grown to some extent. Yields are about equal to the valley average. Beef cattle are the major class of livestock, although dairy cattle are kept on several of the farms.

The Warm Springs Canal Company was organized in 1920. Stock is issued on the basis of one share for each inch of water. The average water cost is about 75 cents an acre. Taxes are about 75 cents an acre also.

West Gallatin Canal Company (Kleinschmidt Ditch)—The Kleinschmidt Ditch takes water from the West Gallatin River right at the mouth of the canyon, about five miles south of Gallatin Gateway. The canal follows a northeasterly course to a point about two and one-half miles northeast of Gallatin Gateway. From here it swings rather abruptly east some four miles, terminating within two miles of Bozeman. The company right is for 6,040 miners inches, 3,000 of which is 1883 water and the remaining 3,040, 1901 water.

Approximately 6,000 acres are irrigated from the Kleinschmidt ditch and there are fifty farmers in the company. The irrigated area per farm varies from 25 to 400 acres, but the average is somewhere around 115 acres. Most of the land under this ditch is very productive, yields being slightly above the valley average. Although alfalfa hay probably claims the most acreage, peas are grown extensively. Either dairy or beef cattle are kept in substantial numbers on nearly all the farms.

The West Gallatin Canal Company was organized in 1901. There are 40 shares of stock, each carrying a right to water for about 150 acres. Yearly assessments average $50.00 a share or about 30 cents an acre. Taxes average slightly over $1.00.

Jefferson Canal Company—This project is located in the Jefferson Valley and includes the irrigated land lying on the west side of the river from a point 10 miles above Whitehall down to that city. The topography of the narrow valley floor is quite even. The soils are largely a brown silt loam with gravel sub-soil. Some outcrops of gravel occur. Water is taken by gravity from the Jefferson river. The company has a right to 1600 inches and can secure 500 inches more if necessary. The supply is therefore abundant.

Sixteen hundred acres of irrigated land is the total included in the project. There are 29 water users in the company. Farms average from 100 to 160 acres with approximately 50 acres of irrigated land each. Cash crops are not grown to any extent, although the sugar beets and potatoes which are grown yield on an average 11 tons and 100 cwt. per acre respectively. Dairying is carried on rather extensively, but other livestock are kept only on a small scale. Alfalfa, the principal feed crop, yields about 2½ tons in two cuttings. Small grains give only fair yields.

This company, which is owned by local farmers, has no indebtedness. The annual charge for water is $1.00 an acre. Taxes average 90 cents an acre additional.

Norweign Ditch Company—This project is located almost immediately south and east of Harrison, in Madison County. A short branch of the Northern Pacific railroad connecting Sappington and Norris cuts through the project which lies some ten miles south of the main line. A good highway connects Harrison, a town of perhaps 100 people, with the Yellowstone Trail. The altitude here is just under 5000 feet. Precipitation averages from 14 to 16 inches and the frost-free period is approximately 100 days. The topography is moderately rolling and soils, which are dark in color, grade from a silt loam to a sandy loam. Water is taken from the headwaters of Willow Creek near Potosi Hot Springs and conveyed across a divide by gravity into Norweigan Creek. The company has a right for 1200 inches of water, 200 inches of which is dated 1865 and the remainder, 1872. In dry years there is some shortage of water after the middle of the summer.

From 1000 to 1200 acres is irrigated in this project. This is divided among about ten farms, most of which have considerable dry land in combination with the irrigated land. Alfalfa hay, yielding on an average of two tons in as many cuttings, is the principal crop. Some grain crops are grown, although mostly for feed. Beef cattle are the principal class of livestock raised. The annual water cost is only about 25 cents an acre, while taxes average perhaps 60 cents allitional.

Parrot Ditch Company—The Parrot Ditch Company project is located on the south side of the Jefferson River. The lower end of the project is 6 miles east of Whitehall, while the project extends on up the river above Waterloo. The land under irrigation is both bottom land and low benches which are moderately level. The soil is a rather dark color, varying in texture from a light to a heavy silt loam. Water is taken by gravity from the Jefferson above Watrloo. Several water rights are involved some of which are old rights, while others are more recent. Although the supply was short in 1931, there is ordinarily sufficient water. Seepage is no problem.

There are 4000 acres irrigated by this system. Farms, of which there are 38, are much larger than the average found on most irrigation projects. The average size of unit is about 320 acres of which about 100 acres is irrigated. Several farms with private ditches are scattered throughout the project. The system of farming followed is mainly that of livestock production. Some dairying is done, while beef cattle and sheep are both kept on the farms and brought to the project for wintering. There are numerous tracts of state and railroad grazing lands tributary to the project that can be rented at a reasonable rate, while the project is almost surrounded by forest reserves which offer special opportunities for stock raising. Alfalfa hay yielding 2 to 3 tons per acre in two cuttings, claims the greater part of the acreage. Wheat yields average 35 bushels and barley 45 bushels per acre. A few beets are grown, with yields averaging about 11 ton. Potatoes are grown to some extent commercially, giving yields of 100 to 125 cwt. to the acre.

In 1916 an old power development system was converted into the present Parrot Irrigation Project. Two classes of stock are issued, namely, "B" and "C". The former is held by farmers at the upper end of the project and the class "C" stock by farmers toward the lower end. Assessments against these shares are in the ratio of 2:3. That is, for every two dollars assessed against "B" stock, there is three dollars assessed against the "C" stock. One share of stock, entitling the owner to one miner's inch of water is outstanding for each of the 4000 acres. Assessments vary from 40 cents to $1.00 per inch, continuous flow, the latter amount representing the usual assessment of the class "C" stockholders. Taxes average about 60 cents an acre on the improved irrigated land.

Pipestone Ditch Company—The lands irrigated by this company are mostly situated on the bench immediately north and west of Whitehall. The topography is reasonably even, with sufficient slope to facilitate irrigation. The soil is mostly a decomposed granite which is moderately light in texture. Some outcrops of gravel are present. Water is supplied by the direct flow of Pipestone Creek, the company having a right to 1100 inches. In years of normal precipitation this amount is adequate, although in dry years some shortage occurs. Some of the larger farms have water rights, in addition to water which they purchase from the company. None of the land is troubled by seepage.

Nearly all of the 1000 acres included in the project is at present irrigated. There are 7 water users in the system, nearly all of which have rather large holdings of land. Dairying and stock raising represent the principal type of farming followed. Hay is, therefore, the principal crop. Alfalfa yields average about 2½ tons per acre. Some potatoes are grown commercially, a yield of 125 cwt. per acre being common.

The company has no indebtedness. There are 6000 shares of stock, each share of which is annually assessed 3 cents on an average. Assuming that each of the 1000 acres has the same number of shares this would make a water charge of 18 cents an acre. Taxes average 60 cents an acre additional.

Pipestone Reservoir Canal Company—This project is located on the bench just west and south of Whitehall. Railroad sidings on or adjacent to the project are convenient shopping points. The topography is rolling and somewhat broken. Soils are largely a grayish brown material of granite origin which is somewhat gravelly and stony in spots. The water requirement for successful crop production is, therefore high. The normal flow of Pipestone creek is supplemented by a reservoir of 500 acre feet capacity. Further storage is considered possible at a reasonable cost. Water supply is, for the present acreage cultivated, adequate except in very dry years like 1919 and 1931. The soils and topography are such that no trouble is experienced from seepage.

The gross area of the project was originally 6000 acres, but this was reduced in 1922 to 4000 acres. Practically all of this can be irrigated al-

though only about half that amount is being irrigated at present. There are now 16 farms on the project, these falling into about equal groups of 40, 80 and 160 acres in size. There is an opportunity for developing an equal number of addditional farms, although the new ones would have somewhat less productive soil and there is some question as to whether the water supply, as developed at present, would be sufficient. Alfalfa and small grain crops are grown primarily. Some seed peas have been grown as a cash crop, and potatoes have proven very successful. Yields being obtained are as follows: Alfalfa 2 tons in two cuttings, wheat 20 bushels, barley 35 bushels, peas 18 bushels and potatoes 100 cwt per acre. Only a small amount of livestock is kept by the farmers, dairy cows being the predominating type.

Stockholders of the Jefferson Land and Water Company were the original promoters of the project in 1914. This group later assumed the present name. Of the 4000 shares of stock (one share per acre), 2280 are owned by eastern capital and 1720 shares by local parties. Farms were divided into units of 40, 80 and 160 acres, most of them fenced hog-tight and many of them provided with buildings by the company. Nearly all were sold in the years 1915 to 1917 inclusive at an average price of about $100 an acre. With the fall of agricultural prices in 1921, many of the farms were abandoned by those who had purchased on contract. The present assessment for water is $1.00 an acre and taxes average about 60 cents.

Water Users Reservoir Company—This company is successor to the Red Rock Irrigation and Reservoir Company. The reservoir is located in the Centennial Valley along Red Rock River in the extreme southwestern part of the state. The Oregon Short Line Branch, connecting Butte with Idaho Falls, traverses the lower part of the valley and affords shipping facilities. U. S. Highway No 91 follows approximately the course of the railroad. Lima and Dell are small towns in the Centennial Valley. Dillon, the county seat of Beaverhead County, is some fifty miles north.

Elevation varies from about 7,000 feet in the upper Centennial to 5,143 feet at Dillon. For the most part, hay is the principal crop grown. Irrigated meadow pastures comprise a rather large acreage. An abundance of grazing land, in private and public ownership and on the National Forest, lies adjacent to the irrigated lands. Cattle and sheep ranching is carried on extensively, and for the most part on a large scale basis.

The property of this company consists of a reservoir, located on the headwaters of the Red Rock River, which stores some 57,000 acre feet of water. The reservoir was constructed to supplement the normal flow of the Red Rock and Beaverhead Rivers, along which is located about 70,000 acres of irrigated ranch lands owned by individuals. Not all of these land owners have stock in the reservoir, although the 50 who do, own a substantial part of the irrigated land along the two streams.

The company paid $150,000 for their property, giving a note to cover the amount. This was to be retired at the rate of $10,000 annually. To

date, approximately half the principal has been paid. Low prices the last two or three years have caused some delinquency of payments, although the situation is not serious. There is no county tax delinquent land in the project.

West Side Canal Company— The West Side Canal Company project is located in Madison County on the west side of the Madison River between McAllister and Ennis. A branch line of the Northern Pacific Railroad extends up the valley to Norris, about 15 miles below the lower end of the project. A fair highway passes through the valley.

The elevation at this point is roughly 5000 feet. An annual precipitation of about 15 inches occurs and the frost-free period is about 100 days. The land is moderately level, being rather easy to irrigate as far as topography is concerned. Soils are largely a gravelly loam with some heavier soils being found in the lower areas. Because of the gravelly nature of the soil, a good deal of water is necessary for successful irrigation. Water is taken by gravity from the Madison River and the supply is plentiful. Very little seepage has occurred although the water table is rather high in the larger depressions.

About 1200 acres of land is irrigated. Water supply and topography would permit the irrigating of several hundred acres more. Eleven farmers are the stockholders of this company. Because of the high altitude there is a decided limit to the crops which can be grown. Alfalfa hay, yielding 2 tons per acre in two cuttings, is the main crop. Oats are grown to some extent for feed with an average yield of 40 bushels being obtained. Beef cattle and sheep raising constitute the chief activities in this area and there is always a demand for feed crops.

One share of stock is issued for each miners inch of water. It was originally believed that an inch to the acre was sufficient, but nearly twice this amount is used on the gravelly soils. The water assessment is 25 cents an inch annually, making the per acre charge about 50 cents. Taxes average 60 cents an acre additional.

Companies and Associations—South Central Area

Big Ditch Group

This group of three ditch companies, the Big Ditch Company, the High Ditch Company and the Snow Ditch Company are so closely related that it is impossible to consider them in all their phases as separate units. The Big Ditch diverts water by gravity from the Yellowstone River at a point 7 miles west of Park City in Stillwater County. It extends east from here down the north side of the Yellowstone nearly to Billings, in Yellowstone County. At a point about 5 miles east of Park City, the High Ditch diverts water from the Big Ditch by gravity and continues eastward, lying approximately midway between the ditch of the Cove District and the Big Ditch.

The average distance from the High Ditch to the Cove ditch on the north and to the Big Ditch on the south is approximately half a mile. At a point about 8 miles west of Billings, the Snow Ditch diverts water by gravity from the Big Ditch. It extends in a southeasterly direction for three or four miles and then forms two forks, one of which continues east for some three miles and the other nearly south for about an equal distance. There is a total of approximately 35,000 acres of irrigable land under this system of three ditch companies.

The history of this system of ditches is interesting. In 1882 the Minnesota-Montana Land and Improvement Company built the present Big Ditch. In 1900 the Big Ditch Company was organized to purchase the ditch. I. D. O'Donnell, often referred to as the "father of irrigation in Montana," was the first superintendent. In 1898 the High Line Canal Company was granted a 20-year charter, and immediately began construction of the High Line Canal. In 1928 the name was changed to the High Ditch Company. About 1902 the Snow Lateral Ditch Company was organized and the Snow Ditch constructed. In 1928 this company changed its name to the Snow Ditch Company.

Of the 35,000 acres of irrigable land in this system, 25,000 are served by the Big Ditch Company and approximately 5,000 acres by each of the other two. Water has been plentiful for the most part, but to insure it being a certainty, a concrete skeleton dam with removable wooden flash boards was built across the Yellowstone River just below the headgate a few years ago. There is no question now about getting an adequate water supply under this system. The soils found in the three projects are practically the same For the most part they grade from a silt loam to a heavy clay loam, although there are areas of a lighter sandy type and still others which might be classed as gumbo. Seepage has occurred on all three units. The least difficulty has been experienced under the High Ditch, while the greatest seepage has occurred under the Snow Ditch which has not only the problem of its own sub-surface water, but that of the High and the Big Ditches, situated above it. For the most part, drainage works have been constructed as seepage developed, so most of the area effected has been virtually reclaimed.

Although the finances of these project were kept separate, the financial organization is closely inter-related. The Big Ditch Company has 6400 shares with a par value of $10. They are held on a basis of 32 shares requiring 2 inches of water per share for each 160 acres. The annual operating and maintenance charges are about $96 on 160 acres, or 60 cents per acre. The indebtedness of this company, when considered on an acre basis, is practically negligible. The High Ditch Company has 2250 shares at $10 par value. A farmer under this ditch is required to hold one share of Big Ditch stock for each share of High stock. Each High Ditch Company share represents 1 inch of water. His combined annual assessments for the two is about $225 on 160 acres of $1.40 per acre. There is no indebtedness against

this project, and, in fact, the company has some surplus. The Snow Ditch has 600 shares with a par value of $10. A farmer on this project must have 32 shares of each Big Ditch and Snow stock, each of which represents 2 inches of water per share, for 160 acres. His combined assessments per year average $160 or $1.00 per acre. The company has no indebtedness. Taxes vary somewhat in different parts of all three projects, but the average assessment is 50 mills and the annual tax per acre about $2.00.

These are amongs the oldest irrigation projects in Montana. Agriculture is highly developed and the system of farming pretty well established. Sugar beets and beans are the leading cash crops, with alfalfa being grown extensively. Small grains are incorporated in the cropping system, but are used primarily for feed. Although yields vary, the following are an approximately average: beets 16 tons, beans 15 cwt., alfalfa 4 tons from three cuttings, wheat 35 bushels, barley 45 bushels, and oats 60 bushels. Consederable dairying is done and beef cattle and sheep are kept in rather small units on most farms. Considerable winter feeding of beef and sheep is being done to utilize farm grown feed crops, tops and by-products readily obtainable from the factory at Billings. There are 350 stock holders under the Big Ditch, 125 under the High Ditch and 25 under the Snow Ditch. Farms vary considerably in size, from 5 acres to 480 acres, with an average of about 70 acres per farm.

The main line of the Northern Pacific Railroad traverses the entire project. The Chicago, Burlington and Quincey comes in from the north at about the middle of the project and extends east to Billings. The Yellowstone Trail, a Federal Highway, is not more than two miles from any farm. Billings, the third largest city in Montana, with a population of 16,000 is the principal market and trading center. At this place is located the factory of the Great Western Sugar Company, a number of excellent creameries, a vegetable cannery and a market for other farm produce.

Big Horn Low Line Canal Company—The project of the Big Horn Low Line Canal Company begins about 5 miles north of Hardin, in Big Horn County and extends north along the Big Horn River for about 10 miles. A branch line of the Chicago, Burlington and Quincy railroad between Hardin and Foster, serves the project. U. S. Highway No. 87 connects Hardin with Billings at a distance of 50 miles. Hardin, with a population of about 2000 is a local market for many farm products. There is a bean growers association located at this place. Sugar beets are shopped to the plant of the Holly Corporation at Sheridan, Wyoming, about 95 miles south.

A weather recording station is located at Foster which is at the lower end of the project. The elevation here is 2800 feet and the annual precipitation just under 11 inches. The last killing frost in the spring occurs about May 20 and the first killing frost in the fall about September 15, giving a frost-free period of approximately 120 days. Soils toward the upper end of the project are mostly a moderately heavy clay loam. Toward the lower end they are lighter, varying from a silty loam to a loam. There has been

considerable seepage but some drainage has been effected. Water is taken by gravity from the Big Horn River. The supply is ordinarily plentiful, although in the dry summer of 1931 a temporary dam had to be built to divert the necessary water.

A gross area of 10,000 acres is included in this project. About 7500 acres of this is being irrigated. There are 55 farms on the project having an average irrigated area of something like 120 acres. Sugar beets and beans are the principal cash crops, with alfalfa and small grains being grown rather extensively for feed. Beets yield 11 to 15 tons, beans 12 to 15 cwt., alfalfa 3 tons in 3 cuttings, wheat 30 bushels, barley 45 bushels, and oats 60 bushels. Some dairying is carried on and considerable other livestock is kept on farms. Winter feeding of livestock from adjacent ranges is carried on rather extensively.

Orginally 10,000 shares, with a par value of $12.50 were issued. About 25 per cent of these shares, representing water rights on the seeped and generally poor lands, have been recalled. The project has only a negligible indebtedness. Opration and maintenance charges average 60 cents an acre and taxes about $1.15 an acre. There is very little tax delinquency on the project.

Big Timber Carey Act Project—The Big Timber Carey Act Project lies on the bench above the Yellowstone River, beginning about 6 miles north of Big Timber in Sweet Grass County, and extending north and east some 15 miles. Big Timber, with a population of 1300 is the post office and shipping point. The main line of the Northern Pacific railroad passes through Big Timber. The Yellowstone Trail follows the Yellowstone Valley approximately paralleling the railroad.

The elevation of this project is approximately 4500 feet and the annual precipitation averages nearly 15 inches. The frost-free period is about 120 days. Topography is rolling, with some rather level benches. Soils are a moderately dark loam to clay loam with gravel and rock outcrops occurring frequently. Water is taken from Big Timber and Sweet Grass Creeks, the natural flow being supplemented by two large storage reservoirs. About 50 miles of canal is constructed.

This project was developed by the Glass-Lindsay Land Company in 1912. Originally there were 6500 acres of Carey lands included, the remainder being private land most of which was controlled by the company. Of the 17,000 acres of land included, about 10,000 acres are susceptible of irrigation. Approximately half this acreage has been developed and is now being irrigated. There are 35 farmers actually using water. Undeveloped land is being rented for grazing purposes either to farmers on the project or to neighboring ranchers. Farming being carried on is of the extensive type, with grain crops, alfalfa, and native hay utilizing most of the acreage. Alfalfa yields about 2½ tons in two cuttings, wild hay 1 ton, wheat 30 bushels, barley 40 bushels, and oats 50 bushels. Some livestock is being kept by the farmers but the project is not being utilized to the best advan-

tage. The water charge is approximately $1.00 an acre and taxes average about 90 cents.

Billings Bench Water Association—The Billings Bench Water Association is successor to the Billings Land and Irrigation Company, a Carey Land Act Project, undertaken in 1903. This project, originally embodying an area of 33,000 acres, of which 15,000 acres was Carey Act land, was claimed to have an irrigable area of 17,000 acres. At the present time the project includes 23,500 acres, of which 19,000 is classed as irrigable and is actually being irrigated. The lands under this system begin on the bench immediately north of Billings and extends north and east a distance of aproximately 25 miles.

Topography of the area is even, with sufficient slope to facilitate irrigation. Soils vary from loam to gumbo, with silt loam of good productivity predominating. The heavier soils underlaid with shale have developed considerable alkali in recent years. High water table and seepage have caused a good deal of trouble, and although considerable draining has been done, more remains to be done, particularly toward the lower end of the project. Water is taken by gravity from the Yellowstone River near Laurel. The supply was adequate even during the extremely dry summer of 1931.

To date approximately $815,000, or just under $40 an acre, has been expended in this project. The present indebtedness is $172,000 or about $9.00 an acre. Originally 23,500 shares of stock with a par value of $20 were issued. There are now outstanding 19,000 shares, or one share per acre actually irrigated. The assessment in 1931 was $2.50 although it is ordinarily only $2.00. Of this $1.50 is for actual operation and maintenance, while the balance is for enlargements, sinking fund and interest. Taxes are approximately $1.00 an acre in addition. There is very little delinquency in payment of either taxes or water charges.

There are 319 farms on the project, of which 256 are operated by the owner. Great variation in size is found, but the average is 64 acres of irrigable land per farm. Agriculture is highly developed and well diversified. A census taken by Trustees of the association in 1931 showed the greatest acreage being devoted to alfalfa, with pasture, beans, sugar beets and wheat following in the order named. Truck crops are also grown to quite an extent. Yields obtained are about as follows: Alfalfa 3 to 4 tons in three cuttings, beans 15 cwt., beets 14 tons, wheat 30 bushels, barley 45 bushels, oats 55 bushels. Irrigated pastures have a carrying capacity of as high as two mature animal units per acre over a 140-day period. Dairy cattle outnumber all other livestock although many beef cattle and sheep are brought to the farms and fed during the winter months. The accessibility of beet by-products to supplement farm-grown feeds encourages this practice.

For data on climate, markets and transportation refer to the Big Ditch group on page 87.

Canyon Creek Ditch Company—The Canyon Creek Ditch Company project is located on the north side of the Yellowstone River running two miles west of Laurel to the city limits of Billings. Topography is even. The soils are brown in color, and grade in texture from a loam to a clay loam. Water is taken by gravity from the Yellowstone River at a point about two miles west of Laurel. The supply is always plentiful. Some seepage has occurred, but drainage systems which have been installed, have corrected this difficulty.

Eight thousand acres of irrigated land is embodied in this system. This land is in 90 farms, which means that the average irrigated acreage per farm is just about 90 acres. Agriculture is very well developed on the project. Sugar beets and Great Northern beans are the leading cash crops grown. Beets yield an average of 15 tons and beans about 17 cwt. per acre. Alfalfa hay is grown on a substantial acreage, giving an average yield of 4 tons per acre. Small grain crops are grown largely for feed and their yields are above the average of the state for irrigated land. A considerable amount of diversified livestock is kept on the farms and some winter feeding of outside cattle and sheep is done.

The Canyon Project was developed in the year 1884. The stock has a par value of $10, and 2000 shares are outstanding. The indebtedness at present is about $3 an acre, a negligible amount on land of this productivity. Water assessments average $1 an acre. Delivery is made only out of the main canal, the farmers being required to construct and maintain their own lateral system. Taxes are about $2.10 an acre on an average.

Data relative to markets, transportation and climate are the same as given for the Big Ditch Group on page 87.

Grey Eagle Ditch Company—The Grey Eagle Ditch Company project is located just south of Billings in Yellowstone County. It was developed in the late nineties and includes 1300 acres, all but 150 acres of which is being irrigated at the present time. Water is taken from the Yellowstone River by gravity, the canal being only seven miles long. The supply is adequate at all times. Soils are a loam to silt loam and are highly productive. Only 200 acres have ever been troubled by seepage and that has all been reclaimed by drainage.

Shares representing water for ten acres each, and numbering 132, have been issued at a par value of $10. The company has no indebtedness whatever and almost no delinquency in payments. Operation and maintenance charges per acre vary from 35 cents to $1.00 a year with 45 cents as an average. Taxes are about $3.00 an acre.

There are 70 farms on this project varying in size from 3 to 70 acres. An intensive type of farming is practised. Sugar beets, giving an average

yield of 17 tons, are the principal crop. Beans are not grown to any extent because local conditions seem to result in the excess growth of vines at the expense of yield. Alfalfa, which is grown to some extent, yields about 5 tons in 4 cuttings. Truck gardening is done on nearly all of the farms. Dairy cows and poultry are the principal livestock kept on the project.

For data on climate, markets and transportation, refer to the Big Ditch Group on page 87.

Park Branch Canal Company—Land included in this project lies up the Yellowstone River about 20 miles south and west of Livingston, in Park County. Although Livingston with a population of 5300 is the principal trade center, and offers a local market for some farm products, there are several shipping points near at hand. The Livingston-Gardiner branch of the Northern Pacific railway traverses the project. Federal Highway No. 87, an excellent surfaced road, makes easy travel by car either to Livingston or to Yellowstone Park, 30 miles to the south.

An average elevation of 4000 feet obtains in this area. Annual precipitation is just under 15 inches, while the frost-free period averages about 100 days. The soils are dark in color and the better areas vary from a loam to clay loam. A considerable acreage of both stony and gravelly land is also found. Water is taken by gravity from the Yellowstone river. The main ditch, 11 miles in length, is too small to carry the necessary water, and since it passes under the railroad grade eleven times, the cost of enlarging would be extremely great.

Although 3400 acres could be irrigated in this system, only 1000 acres are actually irrigated because of the water shortage just mentioned. There are only seven farmers in this company, three of which have more than 80% of the stock. The irrigated land averages well over 100 acres per farm, and varying amounts of non-irrigated land are owned in addition. This is encouraged by the feed crops which can be produced here to supplement the excellent grazing on the nearby moothills and in the National Forest. Alfalfa yields about 2½ tons in two cuttings, and timothy and clover about 1¼ tons. Small grain crops for feed yield moderately well.

Development of this project took place in 1893. Two hundred and fifty shares with a par value of $100 each were sold. No specified amount of water is represented by stock, but available water is distributed portionally between the stockholders. Work of maintaining the ditches is largely done by the members of the company. The average yearly assessment is less than 50 cents an acre. Taxes are about 60 cents additional.

Rancher Ditch Company—This project is located immediately west of Hysham in Treasure County. It is traversed by the Federal highway, Trail No. 10, and also by the main line of the Northern Pacific Railway. It is approximately 80 miles east of Billings, where there is located the factory of the Great Western Sugar Company. Billings also provides a convenient market for beans and other products.

The altitude of this project is about 2700 feet. At this elevation the

last killing frost in the spring occurs about May 1 and the first killing frost in the fall about September 25, giving a growing season of approximately 136 days. The annual precipitation is about 14 inches. The surface of the land is quite level, making irrigation easy for the most part. The soil is a good quality silt loam. Water is taken by gravity from the Yellowstone River and the supply is adequate since the installation of a dam in 1931. Seepage is not a factor.

At present there are 40 farms on the project varying in size from 40 to 500 acres, although the most common size is about 80 acres. Alfalfa and beets are the principal crops, with small grains being grown to some extent for feed. Beets yield about 15 tons, alfalfa 3 tons, wheat 40 bushels, barley 60 bushels and oats 75 bushels. Considerable livestock is kept on the project.

This project, embodying 4,250 acres classed as irrigable land, was organized in 1904. Shares with a par value of $10.00 were sold for each two acres of irrigated land. The per acre cost of construction was very low and the company is virtually out of debt. Annual assessments for operation and maintenance average about 50 cents a year and taxes are about 75 cents an acre.

Shields River Ditch Company—The holdings of the Shields River Ranch Company lie just north of Wilsall in Park County. A branch line of the Northern Pacific Railroad connects Wilsall with Livingston to the south. Federal Highway No. 87 facilitates travel by car.

The average elevation of the irrigated land is about 5300 feet. Annual precipitation is around 16 inches and the frost-free period averages about 90 days. The topography is rather uneven. Approximately half the irrigable acreage is in the valley of the Shields River, while the remainder is bench land west of the river. Soils on the bench are a gravelly clay loam and those in the bottom are silt loam. The color of the soils is dark and they are productive for crops which are adapted to the short growing season found at this altitude. Water is taken from the Shields River and carried by an eight mile canal over the project. The company has been decreed about 10,000 miners inches although the full amount is seldom available. The water supply is ample for the amount being irrigated at present.

There are 14 farms purchasing water from the company. All of these are larger than 640 acres. Of this amount there is from 100 to 300 acres irrigated. Hay is the principal crop produced. Alfalfa yields about 2 tons in that many cuttings and timothy and clover in the bottoms yields about the same amount. Some small grains are grown for feed, but the acreage produced under irrigation is small. Some cattle, sheep and dairy cows are kept by farmers at present, but more of the hay is sold and shipped out than is actually fed on the farms. Enhanced by the nearness to cheap grazing, it would seem that all of the feeds grown on the project could be utilized to better advantage by feeding more cattle and sheep in the area where it is produced. Assessments for water are only about 25 cents an acre annually. Taxes average about 85 cents a year.

Development of this irrigation project took place about 1910. Of the 10,000 acres owned by this company, 2,500 acres are classed as irrigable and about 2000 acres are actually being irrigated. The company is anxious to subdivide its holdings into units of an economic size and sell to individual farmers.

Suburban Ditch Company—The Suburban Ditch Company project is located just southwest of Billings in Yellowstone County. This project, including 1200 acres, practically all of which is irrigated, was developed prior to 1900. Water is taken by gravity from the Yellowstone River and conveyed through a canal only a few miles in length. The supply is adequate at all times. The soil is a loam to silty loam and is very productive. Less than 100 acres have been troubled by seepage and this has been completely reclaimed by drainage.

Shares with a par value of $10 have been issued for each two acres, making a total of 600 shares. The company has no indebtedness. Operation and maintenance charges have averaged 75 cents an acre over a period of years. Taxes are about $1.15 an acre.

There are 75 water users on the project. Their acreage varies from a few city lots to one ownership of 240 acres. An intensive system of farming is practised with sugar beets and truck crops utilizing most of the acreage. Beets yield about 15 tons per acre. Very little livestock except dairy cows and poultry is kept.

For data on climate, markets and transportation see the general discussion of these points for the Big Ditch Group, page 87.

Two Leggin Water Users Association—This project is located in Big Horn County, most of the land irrigated being north of Hardin. The main canal is a high- line ditch, lying above and nearly paralleling that of the Big Horn Low Line Canal Company. The canal, however, extends about 6 miles farther north and east than does that of the latter project. Marketing and transportation facilities are the same as for the Big Horn Low Line Canal Project previously discussed, on page 89. Climatic conditions are also the same.

Soils of the project are largely a dark brown loam to silt loam, with some areas of heavier clay loam. The entire project is underlaid with gravel at a depth from 6 to 10 feet. Water is taken by gravity from the Big Horn River. The right is a very old one and an adequate supply is assured by a low dam across the river just below the headgate. Considerable seepage has occurred but this has virtually all been reclaimed by drainage.

A gross area of 20,000 acres is included in the project, practically all of which is being irrigated. There are 158 water users in the association. A good deal of variation occurs in the size of farms, but there are very few small holdings and the average size is around 120 acres of irrigated land. Many of the farms have dry land in connection. There is no established system of farming followed, although sugar beets and beans constitute the principal cash crops. A large acreage is devoted to alfalfa hay and small

grains for feed production. Yields being secured average as follows: Beans 12 to 15 cwt., beets 11 to 15 tons, alfalfa 3 tons, wheat 30 bushels, barley 45 bushels, and oats 60 bushels. A great deal of livestock is kept on the farms. Dairying has a prominent place, while beef cattle and sheep are either kept on the farms or brought to the project for winter feeding.

No shares of stock are issued, but each owner under the system has a deed representing his right to water which appertains to the land. The average assessment of the association is 80 cents an acre for water. The taxes on this land average about $1.00 an acre.

Waco-Custer Ditch Company—The project of the Waco-Custer Ditch Company is situated on the south side of the Yellowstone River about midway between Billings and Forsyth. The town of Custer is the principal shipping point. The main line of the Northern Pacific Railway extends the full length of the project as does also the Yellowstone Trail. Billings is the principal market for farm products in this area.

The altitude at Custer is 2749 feet. Frost-free period is usually about 135 days, while the annual precipitation is about 14 inches. The soils are largely a heavy silt loam of good productivity. Water is taken by gravity from the Yellowstone River. Since the construction of a dam nine years ago the supply has been adequate throughout the season. Some seepage has occurred but no drainage system has been installed.

This project was completed in 1908. Of the gross area of 4200 acres, 3000 are classed as irrigable and are being irrigated at present. Water is delivered to 35 farms. These vary somewhat in size but average from 80 to 100 acres. Alfalfa and sugar beets are the principal crops, with beans and small grains being grown to some extent. Beets yield 13 to 15 tons and alfalfa hay 3 tons in three cuttings. The few beans which are grown yield from 12 to 15 cwt. per acre. Livestock are not kept extensively, although nearly every farm has a few milk cows. Some feeding of outside livestock is done during the winter months.

Stock in this company was originally issued on the basis of one share for each two acres of land. The present outstanding indebtedness is $51,000 or $17.00 per irrigable acre. The company recently refunded its debt by issuing bonds which will mature serially from 1935 to 1950. Per acre assessments are now $2.50 of which 80 cents is for operation and maintenance. The company does not maintain a lateral system but delivers only out of the main canal. Taxes are about $1.25 an acre additional.

Yellowstone Valley Irrigation Company—Land lying adjacent to the city of Livingston in Park County is irrigated by this company. A good local market is available for milk, poultry products and vegetables. Livingston is a division point on the main line of the Northern Pacific Railway. Excellent highways extends in all four directions from this point.

The elevation at Livingston is 4500 feet, the annual precipitation is just under 15 inches and the frost-free period is about 115 days. The land lies fairly level so that irrigation is not difficult. Considerable gravelly soils

are found on the project although the predominating type is probably clay loam underlaid with gravel. An ample supply of water is diverted by gravity from the Yellowstone River.

This project was developed in 1901 by private individuals who purchased the land, made water available for it and offered it for sale. Two thousand acres is owned by the company but only 1100 acres is considered irrigable. Of this, about 800 is actually irrigated. With a few exceptions the farms are small diversified tracts operated by people who depend upon other sources for the greater part of their income. Dairying, poultry raising and gardening predominate, with alfalfa and some small grains being grown for feed.

The company has an indebtedness of about $30,000 and the property was recently taken over by the mortgagee, a banking firm in St. Paul. Their plan for disposal has not yet been announced. The annual charge for water is $1.50 an acre and taxes are about $1.20 an acre.

Part VI---Statistical Information

TABLE—1

Acreage Irrigated In Montana As to Type of Project
(Data From 1930 Census of Irrigation in Montana)

	Acreage Irrig. in '30		Acreage Irrig. in '20		
Type of Propect	Amount	Approximate Distribution	Amount	Per Cent Distribution	% Increase 1930 over 1920
Individual and partnership	885,274	56%	976,615	58%	—9.4%
Cooperative	418,862	26	393,257	23	6.5
Irrigation District	83,870*	5	35,153	2	138.6
Carey Act	10,000	1	54,771	3	—81.7
Commercial	22,375	2	34,115	2	—34.4
U. S. Indian Service	75,844	5	98,887	—6	—23.3
U. S. Reclamation Service	98,327	6	88,291	5	11.4
State	360		20	—	—
TOTAL	1,594,912		1,681,729		—5.2%

*This is exclusive of districts organized on Federal Reclamation projects.

TABLE—2

Acreage, Per Acre Indebtedness and Overhead Costs Per Acre for Montana Irrigation Districts Which Have Been Developed

District	Location	Gross Area	Irrigable Area	Irrigated Area	Indebtedness Total	Indebtedness Per Irrigable Acre	Annual Assessment Per Acre O & M	Annual Assessment Per Acre Other	Taxes Per Acre	Remarks
Ashley Lake	Kalispell	25,000	1,640	1,300	$ 32,000	$19.50	$1.40	$2.10	$ .50	Much delinquency.
Big Hole	Wisdom	9,522	8,500	None	287,000	34.00	None made			Never operated. Too little water. Nearly all tax delinquent.
Big Horn-Tullock	Big Horn	1,597	1,050	300	97,487	93.00			.60	Co. took tax title 1928
Bitter Root	Hamilton	25,000	18,460	15,000	750,000	40.50	1.50	2.50	.80	Fed. Govt. loan in 1931.
Blodgett Creek	Hamilton	1,911	1,900	1,900	0	0	.10	0	1.10	
Box Elder	Hysham	1,200	1,000	1,000	73,652	73.65	3.00	0	.75	Tax title—resold by Co.
Buffalo Rapids	Miles City	4,000	3,200	1,000	123,000	46,80	1.00	No data	.95	Tax title mostly.
Bynum	Bynum	32,462	21,201	16,000	1,180,000	55.70	.40	3.60	.35	Payments delinquent since January 1931.
Canyon Creek	Hamilton	1,500	1,200	1,000	5,200	4.35	.25	.50	.95	Protesting $3500 bonds
Cartersville	Forsyth	12,000	8,000	6,000	320,000	40.00	1.00	2.40	.75	Once readjusted.
Charlos	Como	1,000	750	750	300	.40	1.00	.50	.75	
Chestnut Valley	Cascade	4,500	4,000	No data	140,000	35.00	.75	No data	.90	Co. took tax title 1930

Clinton	Clinton	1,000	800	600	15,000	18.75	.50	2.70	1.00	
Columbus	Columbus	1,500	1,300	0	101,000	78.00			1.00	Co. has taken tax title
Cove	Billings	5,750	5,750	4,000	262,500	45.60	2.25	5.75	1.00	Rather heavy delinq.
Danford	Laurel	1,200	1,200	1,200	0	.0	.50	2.50	1.00	Excellent condition
			(2,650)		(10,000)	(4.00)		(2.00)		Figures in paranthasis
Glen Lake	Eureka	4,300	4,000	1,000	139,881	35.00		4.50	.50	show present status since reorganizing
Hammond	Forsyth	4,000	3,500	3,000	106,500	30.40	1.75	2.50	1.30	Refinanced in 1927
Judith Basin	Danvers	4,300	3,600	1,500	174,442	48.50			.65	Co. has taken tax title
Lockwood	Billings	2,600	2,600	2,600	73,500	28.25	3.50	4.50	1.00	Some bonds in default
Lomo	Hamilton	940	800	750	0	0	.05	0	.80	Only for collection.
Mill Creek	Hamilton	2,224	2,000	2,000	5,000	2.50	.10	.95	.95	Excellent condition
Missoula	Missoula	3,100	3,100	3,100	6,000	1.95	.70	1.95	2.85	Suburban settlement
North Sanders	Hysham	5,000	3,500	500	155,000	44.25			.55	Co. has taken tax title to nearly all
Red Lodge-Rosebud	Luther	20,000	9,758	1,000	440,000	45.00	(4.50)		1.25	Refinancing at present
Sunset	Stevensville	3,025	2,800	2,800	24,000	8.60	1.60	40	.95	In good condition
Tongue and Yellowstone	Miles City	11,155	9,700	9,000	144,302	14.90	(3.00)		.85	In good condition
Upper Glendive-fallon	Fallon	6,120	4,210		150,000	35.60	None since 1924		.80	Hasn't operated for several years
Victory Dist.	Custer	3,000	2,800	Few hundred	52,000	18.50	None since 1928			Land nearly all tax delinquent
Whitetail	Whitehall	5,000	3,000	900	120,000	40.00	None			Never completed.
Yellowstone	Forsyth	10,000	7,500	7,500	365,000	48.70	1.50	4.10	1.20	Refinanced in 1928

TABLE—3

Summary of Financial History of Montana Irrigation Districts Which Have Been Developed

District	Disposition of Bonds: Bonds Sold Face Value	Paid	Refunded	Cancelled	Outstanding	In Default	Warrants Outstanding	Remarks
Ashley Lake	70,000	39,000	None	None	$ 31,000	No data	$ 1,000	Water supply only recently made adequate.
Big Hole	130,000	1,500	None	None	128,500	Nearly all	No data	Co. now taking tax title
Big Horn-Tullock	75,000	None	None	None	75,000	No data	22,487	Co. took tax title 1928
Bitter Root	$ 659,500	$23,000	$477,375	159,125	See remarks	None	None	Fed. loan of $750,000 in 1931 includes refunding $477,375.
Blodgett Creek	20,000	20,000	None	None	None	None	None	
Box Elder	65,000	2,000	None	None	63,000	No data	10,652	Co. took tax title and has resold most of land
Buffalo Rapids	123,500	None	None	None	123,500	21,000	26,354	Co. has taken tax title to nearly all land in dist
Bynum	1,000,000	None	None	None	1,000,000	45,000	None	Interest for 3 years in default.
Canyon Creek	20,000	16,500	None	None	3,500	3,500	1,700	Protest bond payment.
Cartersville	335,000	None	No data	15,000	320,000	No data	None	Refunding issue in 1927
Charlos	None	None	None	None	None	None	320	
Chestnut Valley	140,000	None	None	None	140,000	140,000	None valid	Co. took tax title 1930. Bondholders purchased and are operating

Clinton	26,000	11,000	None	None	15,000	None	None	
Columbus	101,000	None	None	None	101,000	101,000	No data	Tax title to most of land.
Cove	300,000	37,500	None	None	262,500	25,000	None	Now refinancing
Danford	19,000	19,000	None	None	None	None	None	
Glen Lake	161,500	36,500	None	None	125,000	No data	14,881	Refinanced. Bonds cancelled. $10,000 in warrants outstanding. Bond holders operating
Hammond	124,000	4,500	40,000	23,000	96,500	No data	10,000	Refinanced in 1927
Judith Basin	169,000	2,000	None	None	158,000	No data	16,442	Co. has taken tax title
Lockwood	102,000	70,500	None	None	31,500	16,500	42,000	Plan to refinance
Lomo	None	None	None	None	None	None	None	Only for collections.
Mill Creek	25,000	20,000	None	None	5,000	None	None	
Missoula	None	None	None	None	None	None	6,000	
North Sanders	155,000	None	100,000	None	155,000	No data	No data	Co. has taken tax title
Red Lodge-Rosebud	418,000	None	None	None	418,000	Since 1927	22,000	Now refinancing
Sunset	20,000	3,000	None	None	17,000	None	7,000	
Tongue & Yellowstone	235,000	91,000	None	None	144,000	None	302	
Upper Glendive-Fallon	150,000	None	None	None	150,000	None	No data	Not operating.
Victory	52,000	None	None	None	52,000	No data	No data	Nearly all land tax delinquent. Not operating
Whitetail	113,000	None	None	None	113,000	No data	7,000	Not operating
Yellowstone	400,000	None	350,000	50,000	350,000	None	15,000	All warrants and $50,000 bonds cancelled in 1928.

TABLE—4

Acreage, Per Acre Indebtedness and Overhead Costs Per Acre for Montana Irrigation Districts Organized on United States Reclamation and United States Indian Service Projects

District	Location	Gross Area	Irrigable Area	Irrigated Area	Indebtedness		Annual Assessment Per Acre		Taxes Per Acre	Remarks
					District Total	Per Irrigable Acre	O & M	Other		
U. S. Reclamation										
Alfalfa Valley	Chinook	4,050	3,633	2,200	$ 30,000	$8.30	$(2.63)		$ .50	Additional $14.05 owed Federal Government
Fort Belknap	Chinook	9,000	3,824	3,000	77,000	20.00	(2.88)		.50	Additional $14.05 owed Federal Government
Fort Shaw	Fort Shaw	No data	13,902	7,500	—	34.68	.85	*	.50	No separate district indebtedness. Entire amt. owed Federal Gov't
Glasgow	Glasgow	19,995	10,506	6,031	—	57.00	(3.33)		.40	No separate district indebtedness. Entire amt. owed Federal Gov't.
Greenfield	Fairfield	128,840	90,206**	23,928	—	90.00†	.65	*	.30	No separate district indebtedness. Entire amt. owed Federal Gov't
Harlem	Harlem	12,770	8,918	7,641	109,955	12.30	(2.88)		.50	Additional $14.05 owed Federal Government
Huntley	Huntley	32,500	30,000	22,000	—	140 to 68	1.50	*	1.25	No separate district indebtedness. Entire amt. owed Federal Gov't

Lower Yellowstone	Sidney	58,321	47,450	31,000	—	66.00§	1.13	*	.90	No separate district indebtedness. Entire amt. owed Federal Gov't
Malta	Malta	58,671	25,031	14,358	—	57.00	(3.23)		.40	No separate district indebtedness. Entire amt. owed Federal Gov't
Paradise Valley	Zurich	11,548	7,017	4,785	103,000	14.65	(2.60)		.50	Additional $14.05 owed Federal Government
Zurich	Zurich	12,217	7,145	4,775	267,555	37.50	(4.88)		.50	Additional $14.05 owed Federal Government
U. S. Indian Service										
Flathead	Ronan	80,000	70,000	40,000	—	65.00	.75	2½% of construction cost	.50	No separate district indebtedness. Entire amt. owed Federal Gov't
Jocko Valley	Arlee	6,332	6,332	5,000	—	40.00	.50 to $1.††		.50	No separate district indebtedness. Entire amt. owed Federal Gov't
Mission	St. Ignatius	13,133	12,000	8,500	—	65.00	.75	2½% of construction cost	.50	No separate district indebtedness. Entire amt. owed Federal Gov't

* Construction charge is payable annually to the Federal Government at the rate of 5 per cent of the average gross crop value during the past ten years. No interest is charged on deferred payments.

** Only half of present irrigable acreage now equipped with canals and structures for irrigation.

† Tentative estimate. Cannot be determined until const ruction program completed.

§ Includes future drainage cost. Applicable to all but Class 5 land.

†† The construction charge is to be paid in 16 installments without interest. The first five payments are each to be 5 per cent of the cost, while the remaining eleven pay ments are each to be 7 per cent of the total cost.

TABLE—5

Comparison of Annual Water Assessments Per Acre Made By Irrigation Companies and Irrigation Districts

Irrigation Districts

Less than $1.00	$1.01 to $2.00	$2.01 to $3.00	$3.01 to $4.00	More than $4.00
18 per Cent	13 Per Cent	23 Per Cent	23 Per Cent	23 Per Cent

Irrigation Companies

10c or less	More than 10c but less than 26c	26c to 50c	51c to $1.00	More than $1.00
10 Per Cent	28 Per Cent	16 Per Cent	28 Per Cent	18 Per Cent