

LAND AVAILABLE FOR AGRICULTURE THROUGH RECLAMATION

PART IV OF THE REPORT ON LAND PLANNING



THIS PART WAS PREPARED BY THE BUREAU OF AGRICULTURAL ENGINEERING, DEPARTMENT OF AGRICULTURE
FOR THE
LAND PLANNING COMMITTEE OF THE NATIONAL RESOURCES BOARD

*The National Resources Board assumes no responsibility for the views
and opinions expressed herein*



UNITED STATES GOVERNMENT PRINTING OFFICE - - - - - WASHINGTON : 1937

P R E F A C E

On November 28, 1934, the National Resources Board submitted to the President, in accordance with an Executive order, its report on National Planning and Public Works in Relation to Natural Resources and Including Land Use and Water Resources. Part II of that report was the Report of the Land Planning Committee. In the course of preparing part II of the above report a large volume of basic data and information was collected which could not then be included. The publication of the present report is for the purpose of making such data and information available to interested persons and organizations.

The present land report has been organized into 11 parts according to subject matter and the contributing agencies. These 11 parts are made available as 11 separate publications. Organization and publication on this basis was done because many persons and agencies are interested only in certain parts of the present report, and the necessity of purchasing the whole report in order to obtain the desired part or parts is thereby eliminated.

The present land report, when conceived as a whole, does not purport to be a complete work on the subject of land utilization, or of its related problems and proposed lines of action; neither is it designed to be a thoroughly integrated piece of work. The primary aim here has been to set forth the facts, analyses, and the recommended lines of action as developed by each of the various contributing governmental bureaus, divisions, sections, or individuals, on the problems with which each of such agencies or persons is concerned. The points of view are, therefore, those of the contributing agencies or individuals themselves. The Land Planning Committee presents the report as

information, but assumes no responsibility for the opinions expressed in it.

This report was prepared under the direction of Dr. L. C. Gray, director of the Land Section of the National Resources Board, aided by John B. Bennett, who served as administrative assistant and as secretary to the Land Planning Committee. Editing and preparation of the report for publication were under the direction of Mr. H. H. Erdmann, agricultural economist of the Land Section, National Resources Board.

Authorship by agencies and individuals is acknowledged in their respective contributions. The following governmental agencies have contributed to the whole report: The Geological Survey, the Division of Grazing Control, the Office of Indian Affairs, the National Park Service, and the Bureau of Reclamation, in the United States Department of the Interior; and the Bureau of Agricultural Engineering, the Biological Survey, the Bureau of Chemistry and Soils, the Forest Service, the Soil Conservation Service, the Weather Bureau, the Divisions of Land Economics, of Farm Management and Costs, and of Farm Finance in the Bureau of Agricultural Economics, and the Land Policy Section, the Production Planning Section, the Import-Export Section, and the Agricultural-Industrial Relations Section of the Division of Program Planning of the Agricultural Adjustment Administration in the United States Department of Agriculture. Credit also is due to the State agricultural experiment stations and extension services, State planning boards, commissions, and other State organizations and individuals for aid in preparation of several sections of the report.

Land Planning Committee

M. L. WILSON, *Chairman.*

OSCAR CHAPMAN.

W. G. MENDENHALL

H. H. BENNETT.

MORDECAI EZEKIEL.

JACOB BAKER.

CHARLES W. ELIOT, 2D.

L. C. GRAY, *Director*

LAND AVAILABLE FOR AGRICULTURE THROUGH RECLAMATION

Contents

	PAGE
Preface	III
Section I. Extent of Land Use Under Irrigation	1
Introduction—Definitions of terms—Sources of data and acknowledgments—Summary for the 17 Western States—Explanation of map—Arizona—California—Colorado—Idaho—Kansas—Montana—Nebraska—Nevada—New Mexico—North Dakota—Oklahoma—Oregon—South Dakota—Texas—Utah—Washington—Wyoming.	
Section II. Relation of Drainage to Land Use Policies	35
Extent of drainage—Maintaining drainage improvements—Rehabilitating drainage districts—Draining additional land—Legislative problems—Summary and recommendations.	
Section III. Farm Land Available Through Clearing	42
Appendix	44

APPENDIX

SOURCES OF IRRIGATION DATA

Arizona

Literature cited and articles reviewed:

- (1) ARIZONA ENGINEERING COMMISSION:
Report Based on Reconnaissance Investigation of Arizona Land Irrigable from the Colorado River. 72 p., illus., 1922-23.
- (2) TROTT, FRANK P.:
Report of Altitude Surveys of Spencer, Bridge and Diamond Sites on the Colorado River. 3 p., illus., 1925.
- (3) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation of Agricultural Lands. Arizona, p. 68-75, 1930.
- (4) MEINZER, O. E., AND ELLIS, A. J.:
Ground Water in Paradise Valley, Arizona. U. S. Geol. Survey Water-Supply Paper 375-B: 51-75, 1915.
- (5) ROSS, C. P.:
The Lower Gila Region, Ariz., A Geographic, Geologic, and Hydrologic Reconnaissance, with a Guide to Desert Watering Places. U. S. Geol. Survey Water-Supply Paper 498; 237 p., 23 pls., 1923.
- (6) LARUE, E. C., with a foreword by Hubert Work, Secretary of the Interior:
Water Power and Flood Control of Colorado River Below Green River, Utah. U. S. Geol. Survey Water-Supply Paper 556: 176 p., 79 pls., 1925.
- (7) COLORADO RIVER COMMISSION OF CALIFORNIA, SACRAMENTO:
Colorado River and the Boulder Canyon Project, 1931.
- (8) UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION:
Colorado River Compact. Rec. Record 13 (12): p. 302-304, 1922.
- (9) FORTIER, S., AND YOUNG, A. A.:
Irrigation Requirements of the Arid and Semiarid Lands of the Southwest. U. S. Dept. Agr. Tech. Bul. 185. 68 p., illus., 1930.
- (10) UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS:
Plan and Estimated Cost of Revamping Canal System, Indian Lands, San Carlos Project, Arizona. (Unpublished report.) 56 p., illus., 1933.

Maps reviewed:

- U. S. Bureau of Indian Affairs, Reservations: Camp McDowell, Colorado River, Fort Mojave, Hopi, Leupp, Maricopa, Navajo, and Zuni; also San Carlos and Salt River Irrigation Projects.
- U. S. Bureau of Reclamation, Projects: Parker, Salt River, San Carlos, Verde, and Yuma; also, irrigation investigations for the Gila and Little Colorado Rivers.

California

Literature cited and articles reviewed:

- (17) STATE OF CALIFORNIA, DEPT. OF PUBLIC WORKS, DIV. OF WATER RESOURCES:
Report to Legislature of 1931 on State Water Plan. Bul. 25, 200 p., illus., 1930.
- (18) SACRAMENTO, SAN JOAQUIN, AND KERN RIVERS, CALIFORNIA:
A report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 2d Sess., H. Doc. No. 191, 1933.
- (19) THE UNITED STATES OF AMERICA AND IMPERIAL IRRIGATION DISTRICT:
Complete Text of the All-American Canal Contract, 1932.
- (20) DIVISION OF WATER RESOURCES, STATE DEPARTMENT OF PUBLIC WORKS, STATE OF CALIFORNIA:
Sacramento River Basin. Bul. 26, 583 p., illus., 1931.
- (21) STATE DEPARTMENT OF PUBLIC WORKS, STATE OF CALIFORNIA:
San Joaquin River Basin. Bul. 29, 656 p., illus., 1931.
- (22) STATE DEPARTMENT OF PUBLIC WORKS, STATE OF CALIFORNIA, DIVISION OF ENGINEERING AND IRRIGATION:
Irrigation Requirements of California Lands. Bul. 6, 196 p., illus., 1923.
- (23) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation of Agricultural Lands. California, p. 86-98, 1930.
- (24) AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS:
The Need for Additional Water Supplies in the Irrigated Areas of the Western States. Section II of the Report of the Committee on Irrigation of the American Society of Agricultural Engineers, for the 2 years ending June 1931.

Maps reviewed:

- U. S. Bureau of Reclamation: Klamath and Orland projects, Imperial Canal System, All-American Canal System and Imperial Irrigation District.
- U. S. Bureau of Indian Affairs: Pyramid Lake and Truckee Reservations. (California and Nevada).

Colorado

Literature cited and articles reviewed:

- (32) FELLOWS, A. L.:
Irrigation Needs and Possibilities of the Great Plains. Report by U. S. Dept. Agr., Bur. Agr. Engr., Div. of Irrig., 1930. (Unpublished.)

- (33) STATE OF COLORADO, DEPARTMENT OF STATE ENGINEER, IN COOPERATION WITH THE PLATTE VALLEY WATER CONSERVATION LEAGUE AND THE U. S. ARMY ENGINEERS:

Report of Water Resources of the South Platte River Basin in Colorado and Present Utilization of Same, together with Present and Future Transmountain Diversions, 407 p., illus., 1931.

- (34) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:

Fifteenth Census of the United States. Irrigation of Agricultural Lands. Colorado. p. 100-111, 1930.

- (35) FALCK, D., GREENSLET, E. R., AND MORGAN, R. E.:

Land Classification of the Central Great Plains, Parts 4 and 5, Eastern Colorado, U. S. Dept. of Interior, Geological Survey. 110 p., illus., 1931.

- (36) BROOKS, L. R., DEEDS, J. F. FALCK, D., GREENSLET, E. R., KERR, G. M., AND PETERSON, J. Q.:

Land Classification of the Central Great Plains, Western Colorado. U. S. Dept. of Interior, Geological Survey, 53 p., illus., 1933.

- (37) FOLLANSBEE, ROBT.:

Upper Colorado River and Its Utilization. U. S. Dept. of Interior, Geological Survey Water Supply Paper 617, 394 p., illus., 1929.

- (38) WOOLLEY, RALF R.:

The Green River and Its Utilization. U. S. Dept. of Interior, Geological Survey Water-Supply Paper 618, 456 p., illus., 1930.

- (39) ARKANSAS RIVER AND ITS TRIBUTARIES:

Extract from Report 308 to the Secretary of War from the Chief of Engineers, U. S. Army.

- (41) MISSOURI RIVER:

Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.

- (42) FORTIER, S.:

Irrigation Requirements of the Arid and Semiarid Lands of the Missouri and Arkansas River Basins. U. S. Dept. Agr. Tech. Bul. 36, 112 p., illus., 1928.

- (43) FORTIER, S., AND YOUNG, A. A.:

Irrigation Requirements of the Arid and Semiarid Lands of the Southwest. U. S. Dept. Agr. Tech. Bul. 185, 68 p., illus., 1930.

Maps reviewed:

U. S. Bureau of Reclamation—Projects: Grand Valley, Little Snake River, Lower White River, Upper White River, San Juan River, Uncompahgre; also Irrigated and Irrigable Areas, Reservoirs and Reservoir Sites.

U. S. Geological Survey—Irrigated and Irrigable areas, Reservoirs and Reservoir Sites, Topographical sheet La Platte County.

U. S. War Department—Republican River Irrigation projects, General Development, Existing and Potential Irrigation and Potential Reservoirs on the Platte River.

Idaho

Literature cited and articles reviewed:

- (51) AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS:

The Need for Additional Water Supplies in the Irrigated Areas of the Western States, Section II of the Report of the Committee on Irrigation of the American Society of Agricultural Engineers, for the 2 years ending June 1931.

- (52) AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS:

Areas Needing Supplementary Irrigation and the Benefits to be Expected Therefrom in the Various States, Section I of the Report of the Committee on Irrigation of the American Society of Agricultural Engineers, for the 2 years ending June 1931.

- (53) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:

Fifteenth Census of the United States. Irrigation of Agricultural Lands. Idaho, p. 114-123, 1930.

- (54) HOYT, W. G.:

Utilization of Water Resources of Snake River Basin. Advance Synopsis of Water-Supply Paper 657, 64 p., U. S. G. S., 1932.

- (55) FARIS, R. W.:

Supplementary Water for Irrigation in Idaho. With Particular Reference to Boise and Snake River Valleys, 16 p. (Not printed), 1934.

- (56) COLUMBIA RIVER AND MINOR TRIBUTARIES:

A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 103, Vols. I & II, 1845 p., illus., 1933-34.

- (57) SNAKE RIVER AND TRIBUTARIES:

A Report to the Chief of Engineers, U. S. Army, from the District Engineer, Portland, Oreg. (Unpublished report), 1933.

- (58) SNAKE RIVER AND TRIBUTARIES:

A Report to the Chief of Engineers, U. S. Army, from the Division Engineer, San Francisco, Calif. (Unpublished report), 1933.

- (59) FORTIER, S., AND YOUNG, A. A.:

Irrigation Requirements of the Arid and Semiarid Lands of the Columbia River Basin. U. S. Dept. Agr. Tech. Bul. 200, 55 p., illus., 1930.

- (60) FORTIER, S.:

Irrigation Requirements of the Arable Lands of the Great Basin. U. S. Dept. Agr. Bul. 1340, 56 p., illus., 1925.

Maps reviewed:

U. S. Bureau of Reclamation—Projects: Bear Lake, Boise, Hansen Butte Pumping, King Hill, Minidoka, Owyhee, Rathdrum Prairie, Snake River.

U. S. Bureau of Indian Affairs—Projects: Fort Hall, Shoshone and Western Shoshone.

U. S. Geological Survey—Snake River Basin.

Kansas

Literature cited and articles reviewed:

- (69) **SOUTHWESTERN BELL TELEPHONE COMPANY:**
Economic Survey of Kansas, 215 p., illus., 1930.
- (70) **STATE IRRIGATION COMMISSIONER:**
Biennium Report to the Kansas State Board of Agriculture, 43 p., illus., 1920-22.
- (71) **UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:**
Fifteenth Census of the United States. Irrigation of Agricultural Lands. Kansas, p. 126-130, 1930.
- (72) **PETERSON, J. Q., MORGAN, R. E., AND GREENSLET, E. R.:**
Land Classification of the Central Great Plains, Part 2, 36 p. U. S. Dept. of Interior, Geological Survey.
- (73) **MISSOURI RIVER:**
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (74) **OSAGE RIVER, MISSOURI AND KANSAS:**
A report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong. 1st Sess., H. Doc. No. 91, 157 p., illus., 1933.
- (75) **REPUBLICAN RIVER:**
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (76) **ARKANSAS RIVER AND ITS TRIBUTARIES:**
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (77) **FORTIER, S.:**
Irrigation Requirements of the Arid and Semiarid Lands of the Missouri and Arkansas River Basins. U. S. Dept. Agr. Tech. Bul. 36, 112 p., illus., 1928.

Montana

Literature cited and articles reviewed:

- (87) **AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS:**
The Need for Additional Water Supplies in the Irrigated Areas of the Western States, Section II of the Report of the Committee on Irrigation of the American Society of Agricultural Engineers, for the 2 years ending June 1931.
- (88) **FELLOWS, A. L.:**
Irrigation Needs and Possibilities of the Great Plains. Report by U. S. Dept. Agr., Bur. Agr. Engr., Div. of Irrig., 1930. (Unpublished.)
- (89) **MONTANA IRRIGATION COMMISSION:**
Irrigation Possibilities in Montana. Montana Irrig. Com. An. Rpt., 96 p., illus., 1920.
- (90) **UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:**
Fifteenth Census of the United States. Irrigation of Agricultural Lands. Montana, p. 142-151, 1930.
- (91) **ALDOUS, A. E., AND DEEDS, J. F.:**
Land Classification of the Northern Great Plains. U. S. Dept. of Interior, Geological Survey. Mimeo. Report, 136 p., 1929.

(92) **COLUMBIA RIVER AND MINOR TRIBUTARIES:**

A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 103, Vol. I & II, 1845 p., illus., 1933-34.

- (93) **JEFFERSON, MADISON, AND GALLATIN RIVERS, MONTANA (Three Forks Basin):**
A report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 143, 161 p., illus., 1932.
- (94) **LITTLE MISSOURI, WYOMING, MONTANA, SOUTH DAKOTA, AND NORTH DAKOTA:**
A report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 64, 90 p., illus., 1933.
- (95) **MARIAS RIVER, MONTANA:**
A report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 191, 91 p., illus., 1932.
- (96) **MILK RIVER, MONTANA:**
A report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 88, 257 p., illus., 1933.
- (97) **MISSOURI RIVER:**
Extract from Unpublished Report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (98) **MUSSELSHELL RIVER, MONTANA:**
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 146, 74 p., illus., 1932.
- (99) **STATE ENGINEER'S OFFICE, MONTANA:**
Excerpts from Report on Irrigation in the Columbia Drainage Area, 1934.
- (100) **FORTIER, S.:**
Irrigation Requirements of the Arid and Semiarid Lands of the Missouri and Arkansas River Basins. U. S. Dept. Agr. Tech. Bul. 36, 112 p., illus., 1928.
- (101) **FORTIER, S., AND YOUNG, A. A.:**
Irrigation Requirements of the Arid and Semiarid Lands of the Columbia River Basin. U. S. Dept. Agr. Tech. Bul. 200, 55 p., illus., 1930.
- (102) **HARDING, S. T.:**
Irrigation Development in Montana. Mont. Agr. Col. Expt. Sta. Bul. 103, 336 p., illus., 1915.

Maps reviewed:

- U. S. Bureau of Reclamation—Projects: Bitter Root Valley, Flat Head, and Huntley.
U. S. Bureau of Indian Affairs—Reservations: Black Feet, Crow Indian, Flat Head, Fort Belknap, and Fort Peck.

Nebraska

Literature cited and articles reviewed:

- (111) **FELLOWS, A. L.:**
Irrigation Needs and Possibilities of the Great Plains. Report by U. S. Dept. Agr., Bur. Agr. Engr., Div. of Irrig., 1930. (Unpublished.)
- (112) **STATE OF NEBRASKA:**
Water Power and Drainage of the State of Nebraska. Special Survey Report of the Dept. of Public Works, Bureau of Irrigation, 390 p., illus., 1931.

- (113) EWING, PAUL A., AND HUTCHINS, WELLS A.:
Farmers' Irrigation District. Rehabilitation and
Agricultural Report by Div. of Irrig., Bur. Agr.
Engr., U. S. Dept. Agr., 1933. (Unpublished.)
- (114) UNITED STATES DEPARTMENT OF COM-
MERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irriga-
tion of Agricultural Lands. Nebraska, p.
154-161, 1930.
- (115) PETERSON, J. Q., MORGAN, R. E., AND
GREENSLET, E. R.:
Land Classification of the Central Great Plains,
Part 2, Western Kansas and Southwestern
Nebraska. U. S. Dept. of Interior, Geological
Survey. 36 p., 1930.
- (116) MISSOURI RIVER:
Extract from unpublished report to the Secretary
of War from the Chief of Engineers, U. S.
Army, 1934.
- (117) NIOBRARA RIVER, NEBRASKA AND WYO-
MING:
A Report to the Secretary of War from the Chief
of Engineers, U. S. Army. 73d Cong., 1st
Sess., H. Doc. No. 90, 105 p., illus., 1934.
- (118) WHITE AND BAD RIVERS, SOUTH DAKOTA
AND NEBRASKA:
A Report to the Secretary of War from the Chief
of Engineers, U. S. Army. 73d Cong., 2d Sess.,
H. Doc. No. 189, 53 p., illus., 1934.
- (119) LOUP RIVER:
Extract from unpublished report to the Secretary
of War from the Chief of Engineers, U. S.
Army, 1934.
- (120) FORTIER, S.:
Irrigation Requirements of the Arid and Semiarid
Lands of the Missouri and Arkansas River
Basins. U. S. Dept. Agr. Tech. Bul. 36, 112 p.,
illus., 1928.

Maps reviewed:

- U. S. Bureau of Reclamation—North Platte Project.
U. S. War Department—Platte and Republican
Rivers and Reservoirs.

Nevada

Literature cited and articles reviewed:

- (129) STATE OF NEVADA, OFFICE OF THE STATE
ENGINEER:
Abstract of Claims to the Waters of Salmon River
and Tributaries, 16 pp., 1916.
- (130) ———:
Humboldt River Distribution and Different Fea-
tures: Affecting These Deliveries for the Years
1927 to 1931, incl., 1932.
- (131) ———:
Irrigable Areas. (Unpublished report.)
- (132) ———:
Order of Determination of the Relative Rights of
Claimants and Appropriators of the Waters of
the Carson River and Its Forks, 43 pp., 1928.
- (133) UNITED STATES DEPARTMENT OF COM-
MERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation
of Agricultural Lands. Nevada, pp. 164-171,
1930.
- (134) FORTIER, S.:
Irrigation Requirements of the Arable Lands of

the Great Basin. U. S. Dept. Agr. Bul. 1340, 56
pp., illus., 1925.

Maps reviewed:

- U. S. Bureau of Indian Affairs—Reservations: Pyra-
mid Lake, Shoshone, Truckee, Walker River.
U. S. Bureau Reclamation—Carson Valley and New-
lands projects, Humboldt River Investigations,
Truckee-Carson Drainage Area.
U. S. Geological Survey—Snake River Basin.

New Mexico

Literature cited and articles reviewed:

- (144) AMERICAN SOCIETY OF AGRICULTURAL
ENGINEERS:
The Need for Additional Water Supplies in the
Irrigated Areas of the Western States, Section
II of the Report of the Committee on Irrigation
of the American Society of Agricultural Engi-
neers, for the 2 years ending June 1931.
- (146) FELLOWS, A. L.:
Irrigation Needs and Possibilities of the Great
Plains. Report by U. S. Dept. Agr., Bur. Agr.
Engr., Div. of Irrig., 1930. (Unpublished.)
- (147) LINNEY, CHARLES E., GARCIA, FABIAN, and
HOLLINGER, E. C.:
Climate as it Affects Crops and Ranges in New
Mexico. New Mexico College of Agriculture,
Agr. Expt. Sta., Bul. 182, 84 p., illus., 1930.
- (148) UNITED STATES DEPARTMENT OF COM-
MERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irriga-
tion of Agricultural Lands. New Mexico, pp.,
174-182, 1930.
- (149) FORTIER, S., and YOUNG, A. A.:
Irrigation Requirements of the Arid and Semiarid
Lands of the Southwest. U. S. Dept. Agr.
Tech. Bul. 185, 68 pp., illus., 1930.
- (150) SOUTH CANADIAN RIVER:
Extract from Unpublished Report to the Secre-
tary of War from the Chief of Engineers, U. S.
Army, 1934.

Maps reviewed:

- U. S. Bureau of Indian Affairs—Navajo County.
U. S. Bureau of Reclamation—Carlsbad and Rio
Grande Projects, San Juan River Basin, Gila
River Investigations, Pecos Valley.

North Dakota

Literature cited and articles reviewed:

- (159) FELLOWS, A. L.:
Irrigation Needs and Possibilities of the Great
Plains. Report by U. S. Dept. Agr., Bur. Agr.
Engr., Div. of Irrig., 1930. (Unpublished.)
- (160) ALDOUS, A. E., AND DEEDS, J. F.:
Land Classification of the Northern Great Plains.
U. S. Dept. of Interior, Geological Survey.
Mimeo. Report, 136 p., 1929
- (161) UNITED STATES DEPARTMENT OF COM-
MERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation
of Agricultural Lands. North Dakota, p. 184-
188, 1930.
- (162) CANNONBALL, GRAND AND MOREAU RIV-
ERS, NORTH DAKOTA AND SOUTH
DAKOTA:

- A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 76, 79 p., illus., 1934.
- (163) JAMES RIVER, NORTH DAKOTA AND SOUTH DAKOTA:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 83, 130 p., illus., 1934.
- (164) MISSOURI RIVER (MAIN STEM):
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (165) YELLOWSTONE RIVER:
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (166) FORTIER, S.:
Irrigation Requirements of the Arid and Semiarid Lands of the Missouri and Arkansas River Basins. U. S. Dept. Agr. Tech. Bul. 36, 112 p., illus., 1928.

Oklahoma

Literature cited and articles reviewed:

- (176) CIMARRON RIVER:
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (177) NORTH CANADIAN RIVER:
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (178) FELLOWS, A. L.:
Irrigation Needs and Possibilities of the Great Plains. Report by U. S. Dept. Agr., Bur. Agr. Engr., Div. of Irrig., 1930. (Unpublished.)
- (179) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation of Agricultural Lands. Oklahoma, p. 189-193, 1930.
- (180) SCHWENNESEN, A. T.:
Ground Water for Irrigation in the Vicinity of Enid, Oklahoma. U. S. Dept. of Interior, U. S. G. S. Water-Supply Paper 345-B, 23 p., illus., 1914.
- (181) _____
Ground Water for Irrigation in the Valley of North Fork of Canadian River near Oklahoma City. Oklahoma. U. S. Dept. of Interior, U. S. G. S. Water-Supply Paper 345-D, 51 p., illus., 1914.
- (183) MISSOURI RIVER AND TRIBUTARIES:
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (184) FORTIER, S., AND YOUNG, A. A.:
Irrigation Requirements of the Arid and Semiarid Lands of the Southwest. U. S. Dept. Agr. Tech. Bul. 185, 68 p., illus., 1930.

Maps reviewed:

U. S. Bureau of Reclamation—Red River Project.

Oregon

Literature cited and articles reviewed:

- (195) AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS:

- The Need for Additional Water Supplies in the Irrigated Areas of the Western States, Section II of the Report of the Committee on Irrigation of the American Society of Agricultural Engineers, for the 2 years ending June 1931.
- (196) DUBUIS, JOHN:
Report to Desert Land Board on Central Oregon Project, 58 pp., illus., 1915.
- (197) SNAKE RIVER AND ITS TRIBUTARIES:
A Report to the Chief of Engineers, U. S. Army from the District Engineer, Portland, Oreg., 1933. (Unpublished report.)
- (198) POWERS, W. L.:
Twenty-five Years of Supplemental Irrigation Investigations in Willamette Valley. Oreg. State Agr. Col., Agr. Expt. Sta. Bul. 302, 30 pp., illus., 1932.
- (199) WHISTLER, JOHN T., AND LEWIS, JOHN H.:
Ochoco Project and Crooked River Investigations. Bul. publ. by U. S. Bureau of Reclamation in cooperation with State of Oregon, 98 pp., illus., 1915.
- (200) _____
Harney and Silver Creek Projects. Irrigation and Drainage. Bulletin published by U. S. Bureau of Reclamation in cooperation with State of Oregon, 91 pp., illus., 1916.
- (201) _____
John Day Project. Irrigation and Drainage. Bul. publ. by U. S. Bureau of Reclamation in cooperation with State of Oregon, 185 pp., illus., 1916.
- (202) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation of Agricultural Lands. Oregon, pp. 196-204, 1930.
- (203) UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY:
Inventory of the Water Supply of the Snake River Plains in Southeastern Idaho. Mimeo. Rpt., 8 pp., 1932.
- (204) CHEHALIS RIVER, WASHINGTON:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 148, 36 pp., illus., 1931.
- (205) COLUMBIA RIVER AND MINOR TRIBUTARIES:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 103, Vols. I and II, 1845 pp., illus., 1933-34.
- (206) COQUILLE RIVER:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 78, 33 pp., illus., 1931.
- (207) JOHN DAY RIVER, OREGON:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 84, 82 pp., illus., 1933.
- (208) SNAKE RIVER AND TRIBUTARIES:
A Report to the Chief of Engineers, U. S. Army, from the Division Engineer, San Francisco, Calif., 1933. (Unpublished report.)

- (209) **WILLAMETTE RIVER, OREGON:**
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 263, 136 pp., illus., 1932.
- (210) **FORTIER, S., AND YOUNG, A. A.:**
Irrigation Requirements of the Arid and Semiarid Lands of the Columbia River Basin. U. S. Dept. Agr. Tech. Bul. 200, 55 pp., illus., 1930.
- (211) **FORTIER, S., AND YOUNG, A. A.:**
Irrigation Requirements of the Arid and Semiarid Lands of the Pacific Slope Basins. U. S. Dept. Agr. Tech. Bul. 379, 69 pp., illus., 1933.
- (212) **FORTIER, S.:**
Irrigation Requirements of the Arable Lands of the Great Basin. U. S. Dept. Agr. Bul. 1340, 56 pp., illus., 1925.

Maps reviewed:

- U. S. Bureau of Indian Affairs—Klamath Indian Reservation.
- U. S. Bureau of Reclamation—Projects: Baker, Columbia Basin, Horse Heaven, John Day, Klamath, Owyhee, Silver Lake, Umatilla, Vale, White River, also Rogue River, Silver Creek, Upper Deschutes, Warner and Willamette Valley Investigations.
- U. S. Geological Survey—Snake River Basin, Silver Creek Project.
- Warner Valley (Henshaw and Stewart).

South Dakota

Literature cited and articles reviewed:

- (226) **FELLOWS, A. L.:**
Irrigation Needs and Possibilities of the Great Plains, Rpt. U. S. Dept. of Agr., Bur. Agr. Engr., Div. of Irrig., 1930. (Unpublished.)
- (227) **UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:**
Fifteenth Census of the United States. Irrigation of Agricultural Lands. South Dakota, pp. 206-211, 1930.
- (228) **ALDOUS, A. E. and DEEDS, J. F.:**
Land Classification of the Northern Great Plains, U. S. Dept. of Interior, Geological Survey. Mimeo. Report, 136 pp., 1929.
- (229) **BIG AND LITTLE SIOUX RIVERS, IOWA AND SOUTH DAKOTA:**
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 189, 114 pp., illus., 1932.
- (230) **CANNONBALL, GRAND AND MOREAU RIVERS, NORTH DAKOTA AND SOUTH DAKOTA:**
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 76, 79 pp., illus., 1934.
- (231) **CHEYENNE RIVER, SOUTH DAKOTA AND WYOMING:**
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 190, 277 pp., illus., 1932.
- (232) **JAMES RIVER, NORTH DAKOTA AND SOUTH DAKOTA:**

A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 83, 130 pp., illus., 1934.

- (233) **LITTLE MISSOURI RIVER, WYOMING, MONTANA, SOUTH DAKOTA, AND NORTH DAKOTA:**
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 64, 90 pp., illus., 1933.
- (234) **MISSOURI RIVER AND TRIBUTARIES:**
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (235) **WHITE AND BAD RIVERS, SOUTH DAKOTA AND NEBRASKA:**
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 2d Sess., H. Doc. No. 189, 53 pp., illus., 1934.
- (236) **FORTIER, S.:**
Irrigation Requirements of the Arid and Semiarid Lands of the Missouri and Arkansas River Basins. U. S. Dept. Agr. Tech. Bul. 36, 112 pp., illus., 1928.

Maps reviewed:

U. S. Bureau of Reclamation—Belle Fourche Project.

TEXAS

Literature cited and articles reviewed:

- (246) **AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS:**
The Need for Additional Water Supplies in the Irrigated Areas of the Western States, Section II of the Report of the Committee on Irrigation of the American Society of Agricultural Engineers, for the 2 years ending June 1931.
- (247) **INTERNATIONAL BOUNDARY COMMISSION, UNITED STATES AND MEXICO:**
Tabular Data on Irrigable and Irrigated Lands along the Rio Grande River, with detailed statement, 1932.
- (248) **FELLOWS, A. L.:**
Irrigation Needs and Possibilities of the Great Plains. Report by U. S. Dept. Agr., Bur. Agr. Engr., Div. of Irrig., 1930. (Unpublished.)
- (249) **LAWSON, L. M.:**
Data on Irrigated Lands along the Rio Grande; with detail statement, from an article (1929) "Engineering Problems of the International Boundary Commission, United States and Mexico", 11 pp., 1929.
- (250) **INTERNATIONAL WATER COMMISSION OF THE UNITED STATES AND MEXICO:**
Report of the American Section of the International Water Commission of the United States and Mexico. 71st Cong., 2d sess., H. Doc. No. 359, 492 pp., illus., 1930.
- (251) **UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:**
Fifteenth Census of the United States. Irrigation of Agricultural Land. Texas, pp. 214-223, 1930.

- (252) FORTIER, S., and YOUNG, A. A.:
Irrigation Requirements of the Arid and Semiarid
Lands of the Southwest. U. S. Dept. Agr.
Tech. Bul. 185, 68 pp., illus., 1930.

Maps reviewed:

- American Section, International Boundary Commission of the United States and Mexico-Rio Grande.
Texas Board of Water Engineers—Lower Rio Grande Valley, Lakes and Dams.
U. S. Bureau of Reclamation—Projects: Rio Grande and Cotulla.

UTAH

Literature cited and articles reviewed:

- (261) GREEN, W. M.:
Report on the Cache Valley Project of the Salt Lake Basin Investigation, Utah. U. S. Dept. Interior, Bureau of Reclamation. 114 pp., illus., 1924.
- (262) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation of Agricultural Lands, Utah, pp. 226-235; 1930.
- (263) WOOLLEY, RALF R.:
Water Powers of the Great Salt Lake Basin. U. S. Dept. of Interior, U. S. G. S. Water Supply Paper 517, 270 pp., illus., 1924.
- (265) FORTIER, S.:
Water Supply of Cache Valley. Utah Agricultural College, 1897.
- (266) FORTIER, S.:
Irrigation Requirements of the Arable Lands of the Great Basin. U. S. Dept. Agr. Bul. 1340, 56 pp., illus., 1925.
- (267) FOLLANSBEE, ROBT.:
Upper Colorado River and Its Utilization. U. S. Dept. of Interior, U. S. G. S. Water Supply Paper 617, 394 pp., illus., 1929.
- (268) WOOLLEY, RALF R.:
The Green River and Its Utilization. U. S. Dept. of Interior, U. S. G. S. Water Supply Paper 618, 456 pp., illus., 1930.

Maps reviewed:

- U. S. Bureau of Indian Affairs—Uintah Project.
U. S. Bureau of Reclamation—Projects: Castle Peak, Bear Lake, Dixie, Hyrum, Price River, Salt Lake Basin, Strawberry Valley, White River, Wonsit, also Colorado River Basin, Moon Lake Investigations, and Provo River Development.
U. S. Department of Agriculture—Cache Valley.

WASHINGTON

Literature cited and articles reviewed:

- (271) UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION:
Summary of Project Data from the Denver, Colo., Office, 1934.
- (272) UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF CHEMISTRY AND SOILS:
Soil Survey (Reconnaissance) of Columbia Basin Area, Washington. Bul. 28, 55 pp., illus., 1929.

- (273) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation of Agricultural Lands. Washington, pp., 238-246, 1930.
- (274) HOYT, W. G.:
Utilization of Water Resources of Snake River Basin. Advance Synopsis of Water Supply Paper 657, 64 p., U. S. G. S., 1932.
- (275) JESSUP, L. T.:
Preliminary Report on Hydrology for the State of Washington, 1934. (Unpublished.)
- (276) CHEHALIS RIVER, WASHINGTON:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st sess., H. Doc. No. 148, 36 p., illus., 1931.
- (277) COLUMBIA RIVER AND MINOR TRIBUTARIES:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st sess., H. Doc. No. 103, Vols. I & II, 1845 p., illus., 1933-34.
- (278) ————
A Report to the Secretary of War from the Chief of Engineers, U. S. Army, 1932. (Mimeographed.)
- (279) GREEN RIVER, WASHINGTON:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 2d sess., H. Doc. No. 286, 36 p., illus., 1934.
- (280) PUYALLUP RIVER, WASHINGTON:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st sess. H. Doc. No. 153, 45 p., illus., 1931.
- (281) SNAKE RIVER AND TRIBUTARIES:
A Report to the Chief of Engineers, U. S. Army from the District Engineer, Portland, Oreg., 1933. (Unpublished report.)
- (282) ————
A Report to the Chief of Engineers, U. S. Army from the Division Engineer, San Francisco, Calif., 1933. (Unpublished report.)
- (283) COLUMBIA BASIN SURVEY COMMISSION, STATE OF WASHINGTON:
The Columbia Basin Irrigation Project, 185 pp., illus., 1920.
- (284) GOETHALS, GEO. W., & CO., INC.:
Columbia Basin Irrigation Project. A Report to the Department of Conservation and Development, State of Washington, 56 pp., illus., 1921.
- (285) LANGLOE, LARS:
Report on the Horse Heaven Irrigation Project to the Directors of the District, 1920.
- (286) FORTIER, S., AND YOUNG, A. A.:
Irrigation Requirements of the Arid and Semiarid Lands of the Columbia River Basin. U. S. Dept. Agr. Tech. Bul. 200, 55 pp., illus., 1930.
- (287) SNOHOMISH RIVER, WASHINGTON:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 2d Sess., H. Doc. No. 258, 83 pp., illus., 1934.

Maps reviewed:

- U. S. Bureau of Indian Affairs—Projects: Ahtanum, Colville, Lummi, Simcoe, Klickitat, Toppenish, Wapato, Yakima.
- U. S. Bureau of Reclamation—Projects: Columbia Basin, Horse Heaven, Kittitas-Yakima, Okanogan, Priest Rapids, Rathdrum Prairie, Sunnyside Unit, Yakima.
- U. S. Geological Survey—Snake River Basin.

Wyoming

Literature cited and articles reviewed:

- (297) AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS:
The Need for Additional Water Supplies in the Irrigated Areas of the Western States, Section II of the Report of the Committee on Irrigation of the American Society of Agricultural Engineers, for the 2 years ending June 1931.
- (298) FORTIER, S.:
Irrigation Requirements of the Arid and Semiarid Lands of the Missouri and Arkansas River Basins. U. S. Dept. Agr. Tech. Bul. 36, 112 pp., illus., 1928.
- (299) FORTIER, S., AND YOUNG, A. A.:
Irrigation Requirements of the Arid and Semiarid Lands of the Southwest. U. S. Dept. Agr. Tech. Bul. 185, 68 pp., illus., 1930.
- (300) ———:
Irrigation Requirements of the Arid and Semiarid Lands of the Columbia River Basin. U. S. Dept. Agr. Tech. Bul. 200, 55 pp., illus., 1930.
- (301) WHITING, JOHN A.:
Nineteenth Biennial Report of the State Engineer, 83 pp., illus., 1927-28.
- (302) JOHNSTON, CLARENCE T.:
Irrigation in Wyoming. U. S. Dept. Agr. Office of Expt. Sta. Bul. 205, 60 pp., illus., 1909.
- (303) DEEDS, J. F., FALCK, DEPUE, GREENSLET, E. R., MORGAN, R. E., AND HOPPER, W. L.:
Land Classification of the Central Great Plains, Part 3, Southeastern Wyoming. U. S. Dept. Interior, U. S. G. S., 39 pp. 1929.
- (304) ALDOUS, A. E., AND DEEDS, J. F.:
Land Classification of the Northern Great Plains, U. S. Dept. Interior, Geological Survey. Mimeo. Rpt., 136 pp., 1929.
- (305) CHEYENNE RIVER, SOUTH DAKOTA AND WYOMING:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 72d Cong., 1st Sess., H. Doc. No. 190, 277 pp., illus., 1932.
- (306) WOOLLEY, RALF R.:
The Green River and Its Utilization. U. S. Dept. of Interior, U. S. G. S. Water-Supply Paper 618, 456 pp., illus., 1930.
- (307) LITTLE MISSOURI RIVER, WYOMING, MONTANA, SOUTH DAKOTA, AND NORTH DAKOTA:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 64, 90 pp., illus., 1933.
- (308) MISSOURI RIVER AND TRIBUTARIES:
Extract from unpublished report to the Secretary of War from the Chief of Engineers, U. S. Army, 1934.
- (309) NIOBRARA RIVER, NEBRASKA AND WYOMING:
A Report to the Secretary of War from the Chief of Engineers, U. S. Army. 73d Cong., 1st Sess., H. Doc. No. 90, 105 pp., illus., 1934.
- (310) WOOLLEY, RALF R.:
The Green River and Its Utilization. U. S. Dept. of Interior, U. S. G. S. Water-Supply Paper 618, 456 pp., illus., 1930.
- (311) FOLLANSBEE, ROBT.:
Surface Waters of Wyoming and Their Utilization, 331 pp., illus., 1923.
- (312) UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS:
Fifteenth Census of the United States. Irrigation of Agricultural Lands, Wyoming, pp. 248-256, 1930.

Maps reviewed:

- U. S. Bureau of Indian Affairs—Wind River Reservation.
- U. S. Bureau of Reclamation—Projects: Alcove-Casper, North Platte, Shoshone, also Irrigation on Colorado River Basin, Snake River Basin.
- U. S. War Department—General Development of Platte River, Little Snake River Project, Reservoirs, Yellowstone River.