DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 377

PROFILE SURVEYS
IN
SPOKANE RIVER BASIN, WASHINGTON
AND
JOHN DAY RIVER BASIN, OREGON

PREPARED UNDER THE DIRECTION OF
R. B. MARSHALL, CHIEF GEOGRAPHER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1915

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 377

PROFILE SURVEYS
IN
SPOKANE RIVER BASIN, WASHINGTON
AND
JOHN DAY RIVER BASIN, OREGON

PREPARED UNDER THE DIRECTION OF
R. B. MARSHALL, CHIEF GEOGRAPHER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1915

CONTENTS.

ILLUSTRATIONS.

98107°—15

PROFILE SURVEYS IN SPOKANE RIVER BASIN, WASHINGTON, AND JOHN DAY RIVER BASIN, OREGON.

Prepared under the direction of R. B. Marshall, Chief Geographer.

INTRODUCTION.

In order to determine the location of undeveloped water powers on the rivers of the United States, the United States Geological Survey has from time to time made surveys and profiles of some of the streams adapted to the development of power by low or medium heads of 20 to 100 feet.

The surveys are made by means of plane table and stadia. Elevations are based on heights derived from primary or precise levels of the United States Geological Survey. The maps are made in the field and show not only the outlines of the river banks, the islands, the positions of rapids, falls, shoals, and existing dams, and the crossings of all ferries and roads but the contours of banks to an elevation high enough to indicate the possibility of using the stream. The elevations of the bench marks left are noted on the field sheets in their proper positions. All gaging stations are shown on the maps, and the elevation of the zero of the gage is given.

SPOKANE RIVER BASIN, WASHINGTON.

GENERAL FEATURES.

Spokane River rises in Cœur d'Alene Lake in western Idaho, flows west and northwest, and discharges into Columbia River near Fort Spokane, Wash.

Cœur d'Alene Lake, which receives the drainage from the western slope of the Bitterroot Mountains, occupies a wide valley. Its upper end is within the area formerly reserved for the Cœur d'Alene Indians. The lands bordering it are for the most part low and swampy, and the lake itself is being gradually filled by sediment brought in by St. Joe and Cœur d'Alene rivers, its principal tributaries. Undoubtedly the lake once extended a considerable distance up the valleys of these streams, and for 15 or 20 miles above their mouths the bottom lands are subject annually to overflow, except

where the rivers are artificially confined in their channels. Along the immediate banks of the streams the land is relatively higher than that nearer the hills. The channels of the lower sections of the rivers are comparatively deep and are favorable for navigation. The valleys are used more or less for agriculture.

The principal tributaries received by Spokane River between the lake and the Columbia are Latah or Hangman Creek, which enters the stream from the south near Spokane, Wash.; Little Spokane River, which comes in from the north about 12 miles below Spokane; and Chamokane Creek, which is tributary from the north and forms the eastern boundary of the Spokane Indian Reservation. Its drainage area comprises about 5,880 square miles. Nearly all of the upper portion is heavily forested and a large area is included in the Cœur d'Alene National Forest.

The topography of the country is rugged and broken. The valley's sides are very steep and many of the peaks rise to regions of perpetual snow.

The mean annual rainfall at Spokane is 17 inches; at St. Maries, 20 inches; and on the summit of the Bitterroot Mountains it is probably 50 inches or more. A large portion of the precipitation, particularly at the higher altitudes, is in the form of snow whose gradual melting helps to feed the streams during the summer season. Occasionally the snow banks are melted suddenly by chinook winds, and when these winds are accompanied by heavy rainfall the flood damage is sometimes great, although its severity is mitigated to a large extent by the natural storage in Cœur d'Alene Lake.

The lands bordering Spokane River are for the most part agricultural. Above Spokane the valley is comparatively wide and level and is underlain throughout with coarse gravel that affords ample ground-water storage from which a liberal supply for irrigation can be drawn. A gravity ditch system diverts water from the right bank of Spokane River at Post Falls. Below Spokane, where the river enters a comparatively deep canyon, the agricultural lands consist of narrow strips along the river banks and are irrigated for the most part by pumping from the river. The lands flanking the canyon of Spokane River are high and are used extensively for wheat raising. The chief products of the region, however, are from its mines.

The Spokane affords a large amount of power. At Post Falls, 8 miles below the outlet of Coeur d'Alene Lake, the Washington Water Power Co. has constructed a dam and power plant. The crest of this dam is at elevation 2,116.5 feet above sea level and is provided with a bear-trap dam 100 feet long, by means of which the water can be raised 10 feet above the crest proper. There are also eight Tainter gates, which, when opened, afford an additional spillway length of 159 feet. The company's overflow privileges do not allow

them to raise the height of water in Coeur d'Alene Lake above an elevation of 2,126 feet. During floods, therefore, the Tainter gates are opened and the bear-trap dam is lowered in order to afford as large capacity of outflow as possible. When the water falls to an elevation of 2,126 feet in the lake the bear trap is raised and the Tainter gates are manipulated to maintain the water at this point as nearly as possible. The waters so stored are released through the power houses. The Post Falls plant of the Washington Water Power Co. has a nominal capacity of 15,000 horsepower; the Spokane plant, 12,000 horsepower. The Ninemile plant of the Spokane & Inland Empire Railroad Co. has a capacity of 10,000 horsepower. The Washington Water Power Co. has completed a plant at Little Falls for a development of 20,000 horsepower and has partly completed a plant at Long Lake between Ninemile and Little Falls.

> The Long Lake plant * * * constitutes the latest and one of the most interesting stations on the Pacific coast. It is situated about 24 miles northwest of the city of Spokane and 4.5 miles from the Little Falls station of the same company. At the site of the station Spokane River makes a complete horseshoe bend and passes through a box canyon of granite formation rising to a height of 350 feet above the water surface. There the power company has erected the highest spillway dam in existence, with the power station around the bend about 250 feet from the dam. The dam, which is thrown across the river, gives a fall of 170 feet at the power house and backs up the water for 23 miles.[1]

Another plant is projected at a favorable point 14 miles below Little Falls, and still another at the Narrows at the mouth of the river near Fort Spokane. At both places plants of 20,000 horsepower capacity could be constructed.

The results of profile surveys in the Spokane River basin are given in Plates I–III (at end of volume).

GAGING STATIONS.

The Geological Survey has maintained in the basin of Spokane River the gaging stations indicated by the following list. The stations are arranged in downstream order, the position of tributaries being indicated by indention. A dash after the date indicates that the station was being maintained June 30, 1915. A period after the date indicates discontinuance.

Cœur d'Alene River, North Fork (head of Cœur d'Alene River and through Cœur d'Alene Lake of Spokane River) at Prichard, Idaho, 1911–15.
Cœur d'Alene River near Enaville, Idaho, 1911–12.
Cœur d'Alene River at Cataldo, Idaho, 1911–12.
Cœur d'Alene Lake at Cœur d'Alene, Idaho, 1903–
Spokane River near Trent, Wash., 1912–
Spokane River at Washington Water Power Co. dam at Spokane, Wash., 1891–1896.

[1] Electrical World, vol. 65, No. 22, p. 1389, May 29, 1915.

Spokane River at Spokane, Wash., 1896–
Spokane Valley Land & Water Co. canal near Post Falls, Wash., 1911–
Spokane River near Long Lake, Wash., 1912—
Little North Fork of Cœur d'Alene River near Enaville, Idaho, 1911–12.
St. Joe River at Avery, Idaho, 1911–
St. Joe River near Calder, Idaho, 1911–12.
St. Maries River at Lotus, Idaho, 1911–12.
Latah [Hangman] Creek at Tekoa, Wash., 1904–05.
Latah Creek near Tekoa, Wash., 1904–05.
North Fork of Latah [Hangman] Creek at Tekoa, Wash., 1904–05.
Little Spokane River near Spokane, Wash., 1903–1905; 1911–

JOHN DAY RIVER BASIN, OREGON.

GENERAL FEATURES.

John Day River drains the country to the northwest of the Blue Mountains. The river rises on the divide between Grant and Baker counties, Oreg., flows westward and then northward, and joins Columbia River about 28 miles above The Dalles. Its principal tributaries are the North, Middle, and South forks. Its total drainage area is 7,800 square miles.

The general elevation of its headwaters is about 6,000 feet above sea level; at Fossil the elevation is 1,500 feet. The headwater region of the stream is forested. Except wheat, which is grown on the rolling uplands by "dry farming," no agricultural products of consequence can be raised without irrigation, and as the areas which admit of easy irrigation are confined to the immediate valleys of the streams comparatively little has been done in this direction. Several projects have been suggested under which, by means of storage reservoirs and high-line canals, large areas of very productive table-lands would be developed. The storage facilities are ample for this purpose.

The mean annual rainfall varies from 24 inches on the headwaters to 10 inches at the mouth. The winters are cold, and the streams are frequently icebound throughout the greater part of the winter.

The results of profile surveys in John Day River basin are given in Plates IV to X (at end of volume).

GAGING STATIONS.

The Geological Survey has maintained in the basin of John Day River the gaging stations indicated by the following list. The stations are arranged in downstream order, the position of tributaries being indicated by indention. A dash after the date indicates that the station was being maintained June 30, 1915. A period after the date indicates discontinuance.

John Day River near Dayville, Oreg., 1908–1914.
John Day River at Clarno, Oreg., 1914–

John Day River at McDonald, Oreg., 1904–
South Fork of John Day River at Dayville, Oreg., 1908–1914.
Dayville ditch at Dayville, Oreg., 1910–1914.
Rock Creek near Arlington, Oreg., 1905; 1911.

PUBLICATIONS.

The following publications of the Geological Survey contain the results of investigations of stream flow at the stations indicated in the preceding lists:

Spokane River basin:
Annual Reports: Eighteenth, Part IV; Nineteenth, Part IV; Twentieth, Part IV; Twenty-first, Part IV; Twenty-second, Part IV.
Water-Supply Papers: 11, 16, 28, 38, 39, 51, 66, 75, 85, 100, 135, 178, 214, 252, 272, 292, 312, 332-A, 362-A,[1] 392.[1]
John Day River basin:
Water-Supply Papers: 135, 178, 214, 252, 272, 292, 312, 332-C, 362-C, 394.[1]

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
St. Paul, Minn., Old Capitol Building.
Madison, Wis., Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 302 Chamber of Commerce Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., Federal Building.
San Francisco, Cal., 505 Customhouse.
Los Angeles, Cal., Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications will be sent on application to the Director, United States Geological Survey, Washington, D. C.

---

[1] In preparation.

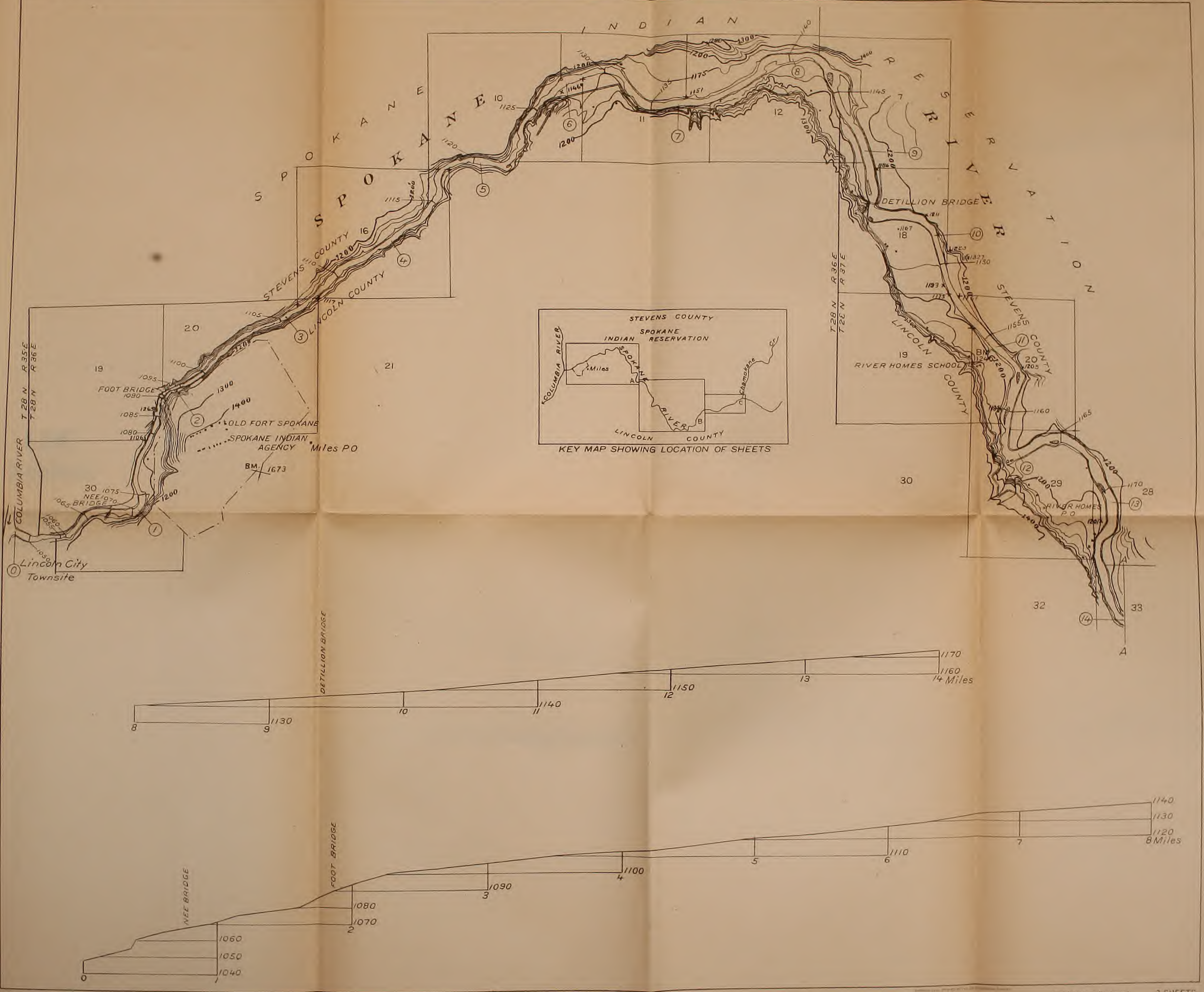
○

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

PLAN AND PROFILE OF SPOKANE RIVER
MOUTH TO CHAMOKANE CREEK, WASHINGTON

SHEET A

WATER-SUPPLY PAPER 377 PLATE I



R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by A. P. Meade
Surveyed in 1912

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1	
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

Scale $\frac{1}{31,680}$

2 Miles
8,000 Feet
2 Kilometers

Vertical scale 1 inch = 40 feet
Contour interval on land 25 feet
Contour interval on river surface 5 feet
Datum is mean sea level
1915

APPROXIMATE MEAN DECLINATION 1912

Subject to adjustment

3 SHEETS

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

PLAN AND PROFILE OF SPOKANE RIVER MOUTH TO CHAMOKANE CREEK, WASHINGTON

SHEET B

WATER-SUPPLY PAPER 377 PLATE II

KEY MAP SHOWING LOCATION OF SHEETS

R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by A. P. Meade
Surveyed in 1912

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 31,680

1 0 1 2 Miles

4,000 2,000 0 4,000 8,000 Feet

1 0 1 2 Kilometers

Vertical scale 1 inch = 40 feet
Contour interval on land 25 feet
Contour interval on river surface 5 feet
Datum is mean sea level
1915

APPROXIMATE MEAN DECLINATION 1912

Subject to adjustment

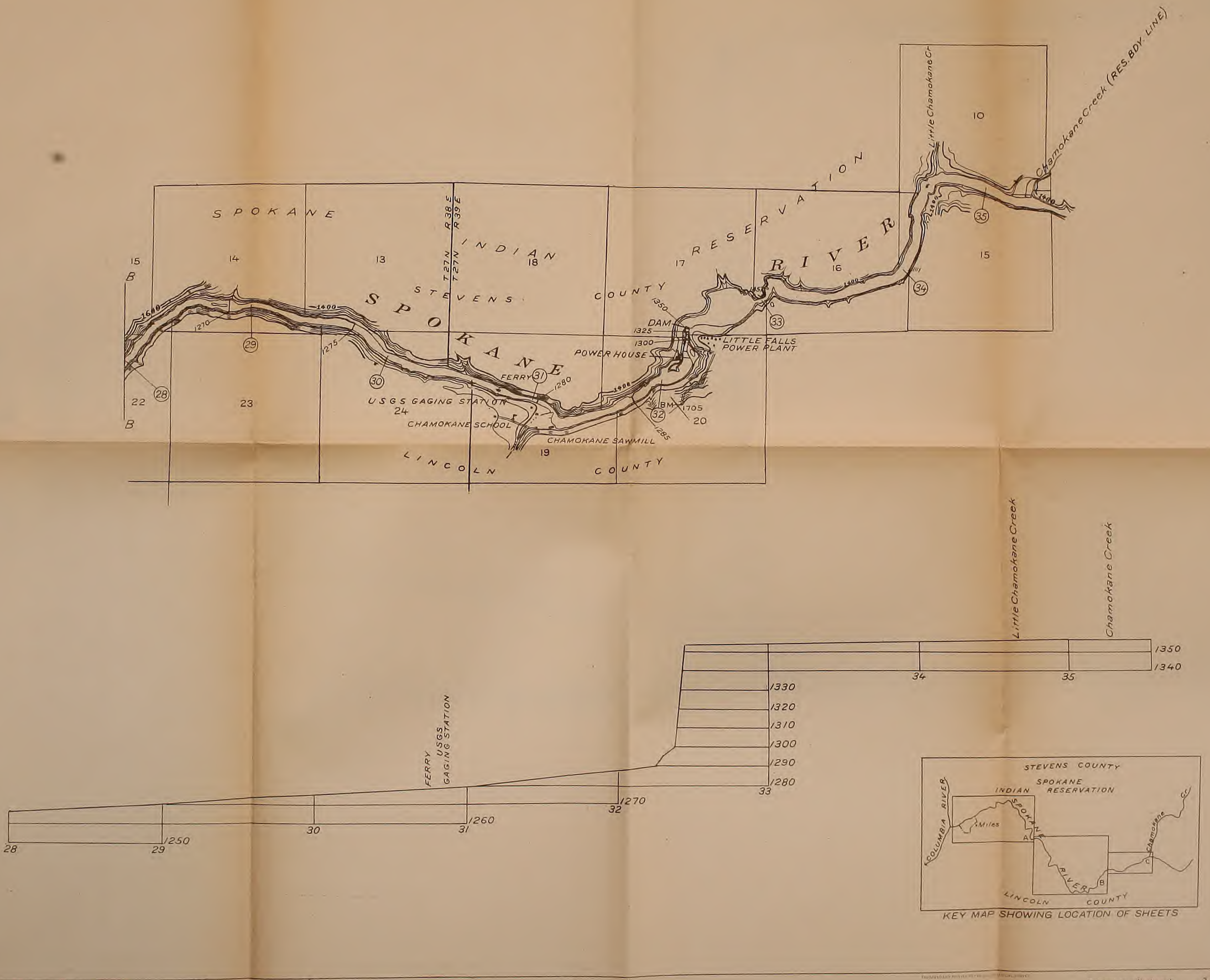
3 SHEETS

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

PLAN AND PROFILE OF SPOKANE RIVER MOUTH TO CHAMOKANE CREEK, WASHINGTON

SHEET C

WATER-SUPPLY PAPER 377 PLATE III



KEY MAP SHOWING LOCATION OF SHEETS

R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by A. P. Meade
Surveyed in 1912

DIAGRAM OF TOWNSHIP

	6	5	4	3	2	1
	7	8	9	10	11	12
	18	17	16	15	14	13
	19	20	21	22	23	24
	30	29	28	27	26	25
	31	32	33	34	35	36

Scale 1/31,680

1 0 1 2 Miles

4,000 2,000 0 4,000 8,000 Feet

1 0 1 2 Kilometers

Vertical scale 1 inch = 40 feet
Contour interval on land 25 feet
Contour interval on river surface 5 feet
Datum is mean sea level
1915

23° TRUE NORTH MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION 1912

Subject to adjustment

3 SHEETS

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

RECONNAISSANCE PLAN AND PROFILE OF JOHN DAY RIVER MOUTH TO MIDDLE FORK, OREGON

SHEET A

WATER-SUPPLY PAPER 377 PLATE IV

Subject to adjustment

7 SHEETS

R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by E. L. Sellon
Surveyed in 1909

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 31,680

2 Miles
8,000 Feet
2 Kilometers

Vertical scale 1 inch = 20 feet
Contour interval on land 25 feet

APPROXIMATE MEAN DECLINATION 1909

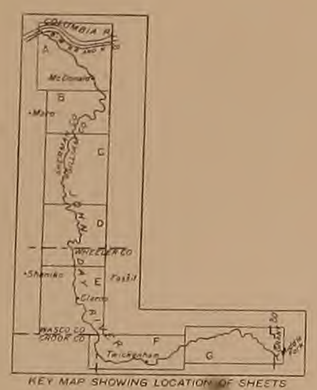
1915

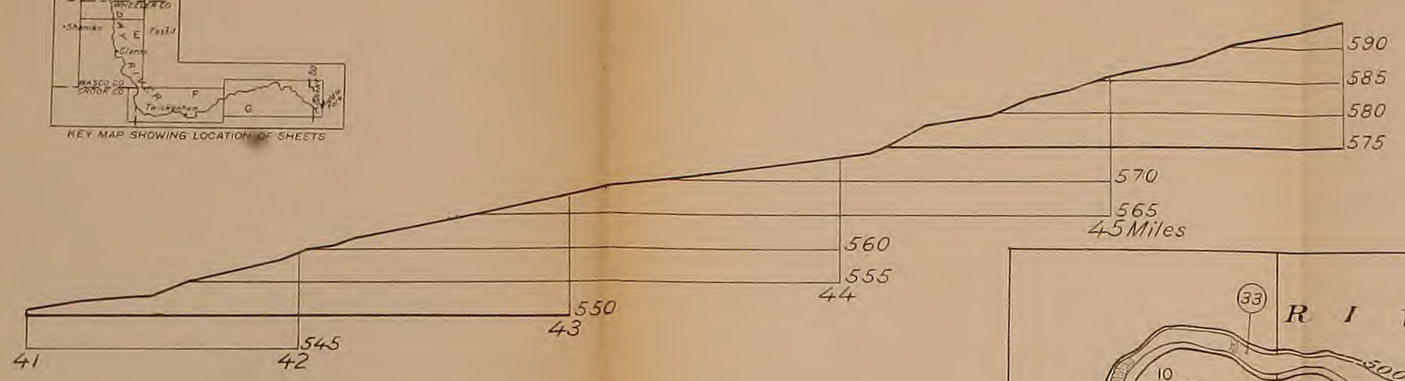
U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

RECONNAISSANCE PLAN AND PROFILE OF JOHN DAY RIVER MOUTH TO MIDDLE FORK, OREGON

SHEET B

WATER-SUPPLY PAPER 377 PLATE V





R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by E. L. Sellon
Surveyed in 1909

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 1/31,680

1 0 1 2 Miles

4,000 2,000 0 4,000 8,000 Feet

1 0 1 2 Kilometers

Vertical scale 1 inch = 20 feet
Contour interval on land 25 feet

1915

APPROXIMATE MEAN DECLINATION 1909

Subject to adjustment

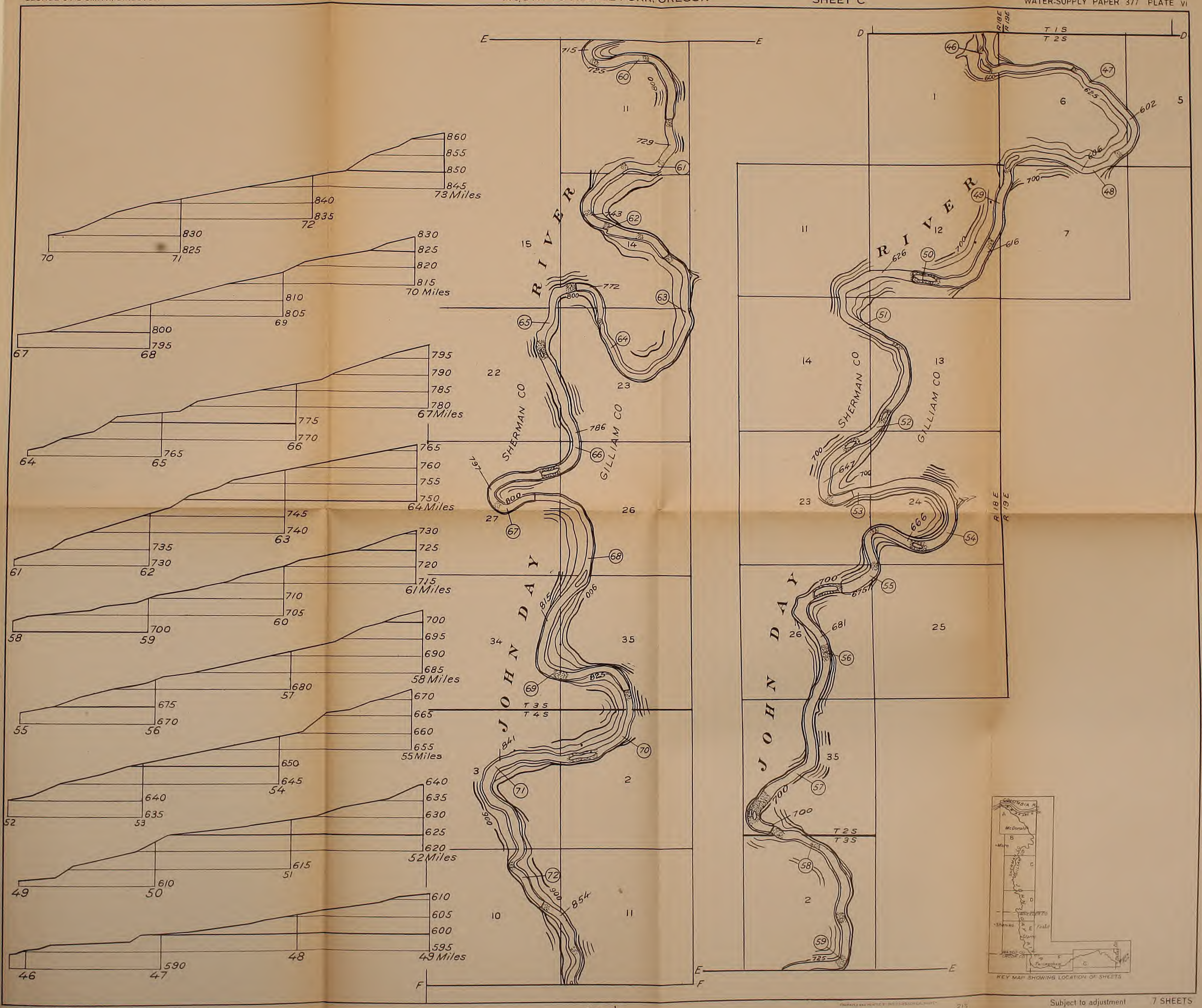
7 SHEETS

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

RECONNAISSANCE
PLAN AND PROFILE OF
JOHN DAY RIVER
MOUTH TO MIDDLE FORK, OREGON

SHEET C

WATER-SUPPLY PAPER 377 PLATE VI



Subject to adjustment

7 SHEETS

R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by E. L. Sellon
Surveyed in 1909

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1	
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

Scale 31,680

1 0 1 2 Miles

4,000 2,000 0 4,000 8,000 Feet

1 0 1 2 Kilometers

Vertical scale 1 inch = 20 feet
Contour interval on land 25 feet

APPROXIMATE MEAN DECLINATION 1909

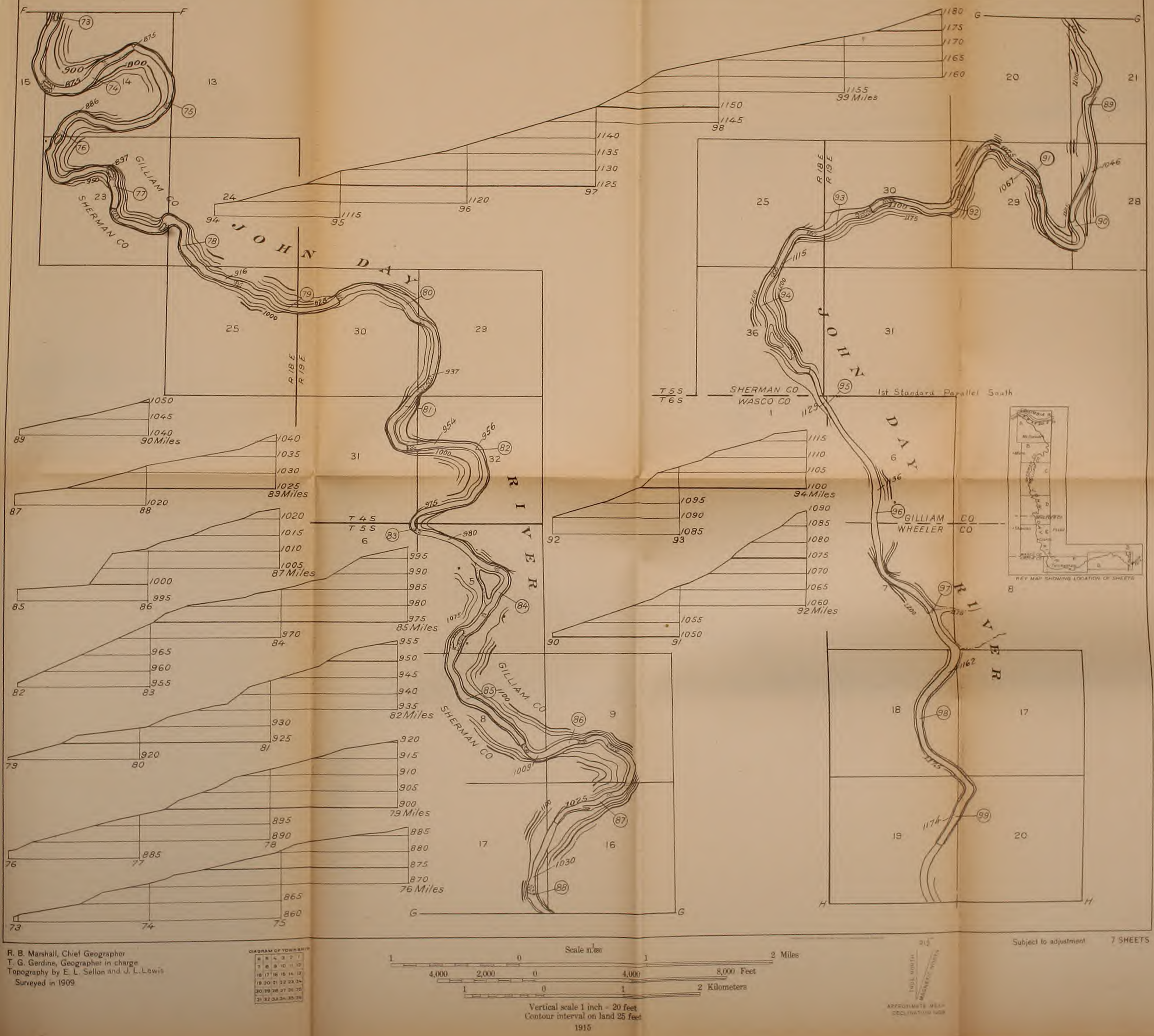
1915

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

RECONNAISSANCE PLAN AND PROFILE OF JOHN DAY RIVER MOUTH TO MIDDLE FORK, OREGON

SHEET D

WATER-SUPPLY PAPER 377 PLATE VII



R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by E. L. Sellon and J. L. Lewis
Surveyed in 1909

DIAGRAM OF TOWNSHIP

Scale 1:62500
1 0 1 2 Miles
4,000 2,000 0 4,000 8,000 Feet
1 0 1 2 Kilometers

Vertical scale 1 inch = 20 feet
Contour interval on land 25 feet
1915

Subject to adjustment

7 SHEETS

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

RECONNAISSANCE PLAN AND PROFILE OF JOHN DAY RIVER MOUTH TO MIDDLE FORK, OREGON

SHEET E

WATER-SUPPLY PAPER 377 PLATE VIII

R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by J. L. Lewis
Surveyed in 1909

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1	
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

Scale 1/31,680

1 0 1 2 Miles

4,000 2,000 0 4,000 8,000 Feet

1 0 1 2 Kilometers

Vertical scale 1 inch = 20 feet
Contour interval on land 25 feet

1915

APPROXIMATE MEAN DECLINATION 1909

Subject to adjustment

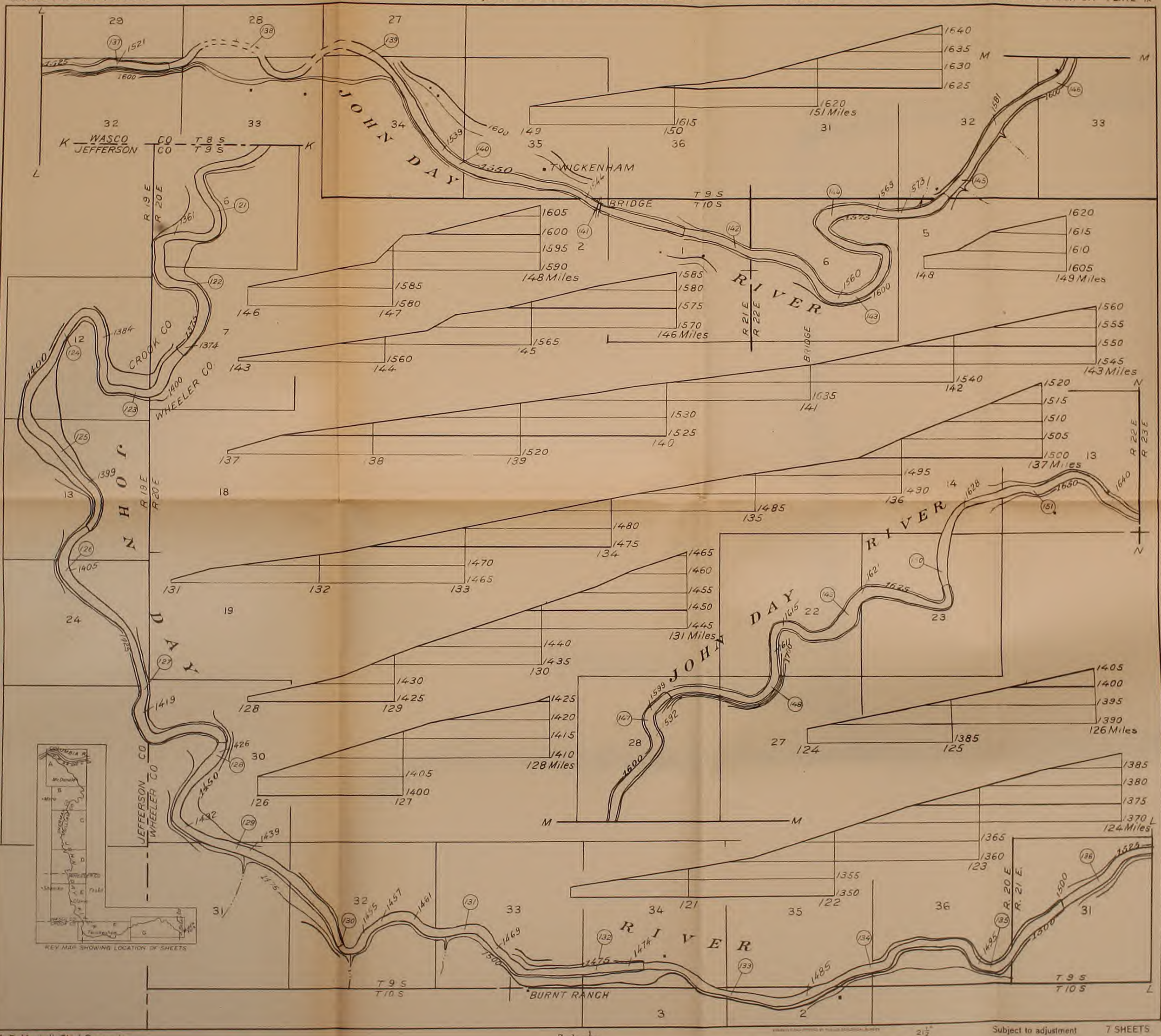
7 SHEETS

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

RECONNAISSANCE
PLAN AND PROFILE OF
JOHN DAY RIVER
MOUTH TO MIDDLE FORK, OREGON

SHEET F

WATER-SUPPLY PAPER 377 PLATE IX



R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by J. L. Lewis
Surveyed in 1909

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1	
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

Scale 31,680

1 0 1 2 Miles

4,000 2,000 0 4,000 8,000 Feet

1 0 1 2 Kilometers

Vertical scale 1 inch = 20 feet
Contour interval on land 25 feet

1915

APPROXIMATE MEAN DECLINATION 1909

Subject to adjustment

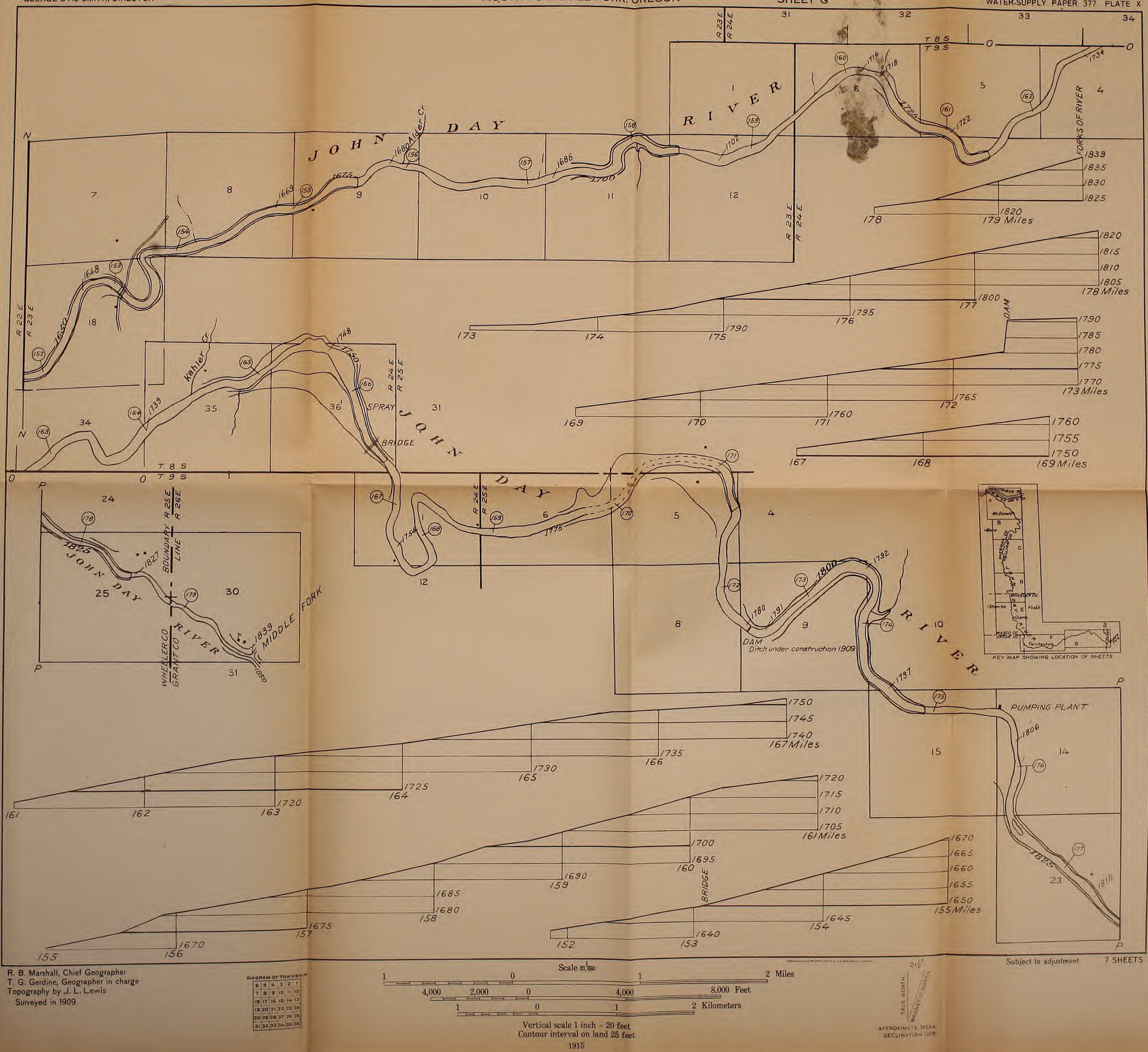
7 SHEETS

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

RECONNAISSANCE PLAN AND PROFILE OF JOHN DAY RIVER MOUTH TO MIDDLE FORK, OREGON

SHEET G

WATER-SUPPLY PAPER 377 PLATE X



R. B. Marshall, Chief Geographer
T. G. Gerdine, Geographer in charge
Topography by J. L. Lewis
Surveyed in 1909

DIAGRAM OF TOWNSHIP

6	5	4	3	2	1	
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

Scale 1/31,680

1 0 1 2 Miles
4,000 2,000 0 4,000 8,000 Feet
1 0 1 2 Kilometers

Vertical scale 1 inch = 20 feet
Contour interval on land 25 feet

1915

TRUE NORTH
MAGNETIC NORTH
21½°
APPROXIMATE MEAN DECLINATION 1909