

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

WATER-SUPPLY PAPER 376

PROFILE SURVEYS  
IN  
CHELAN AND METHOW RIVER BASINS  
WASHINGTON

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

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Prepared in cooperation with  
THE STATE OF WASHINGTON



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1915



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## ILLUSTRATIONS.

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- PLATES I-III. Plan and profile of Stehekin River below Bridge Creek, Railroad Creek near Lucerne, and Chelan River from lake to mouth, Wash. (3 sheets, A-C) ..... At end of volume.
- IV-V. Plan and profile of Methow River from Pateros to mouth of Gold Creek and Chewack Creek, Wash. (2 sheets, A and B)..... At end of volume.



# PROFILE SURVEYS IN CHELAN AND METHOW RIVER BASINS, WASHINGTON.

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 position 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.

## CHELAN RIVER BASIN.

### GENERAL FEATURES.

Chelan River forms the outlet of Lake Chelan, in Chelan County, Wash. The river, which joins Columbia River at Chelan Falls, Wash., is only 4 miles long and in this distance has a fall of 380 feet. The lake and valley have been described by Willis<sup>1</sup> as follows:

Lake Chelan is a slender body of water 65 miles long,<sup>2</sup> whose southeastern end lies open to the sky between the grass-grown hills of the outer Columbia Valley, while its northwestern lies in shadow between precipitous mountains in the heart of the Cascade Range. There are sandy hollows near its outlet, but beneath the cliffs of its upper course the water is profoundly deep.

In brief technical phrase the lake basin is a canyon modified, deepened, and dammed by glaciation. The canyon is that of the Stehekin-Chelan River, which rises in latitude 48° 30' in glaciers of the Cascade Range at altitudes of 5,000 to 8,000 feet. The headwaters descend very abruptly, 1,000 to 1,800 feet in the first mile below the

<sup>1</sup> Willis, Bailey, Contributions to the geology of Washington: Physiography and deformation of the Wenatchee-Chelan district, Cascade Range: U. S. Geol. Survey Prof. Paper 19, pp. 58, 81, 1903.

<sup>2</sup> The length is 48 miles as measured on the Stehekin, Methow, and Chelan topographic sheets, U. S. Geol. Survey.

glaciers, and combine in a U-shaped valley of gentler grade, the fall being 2,500 feet in 23 miles. This section is cut in rock bottom. For 12 miles farther downstream the valley is floored with boulders, coarse gravel, and sand, and the slope is but 20 feet to the mile, ending in the delta which the stream is building in Lake Chelan.

The gravel-filled section of the valley is no doubt deeply cut in the solid rock, since but a short distance beyond the front of the delta the lake is more than 500 feet deep. For a distance of 35 miles the depth varies from 1,000 to 1,400 feet, 1,419 feet being the maximum as yet sounded. As the water surface is but 1,079 feet above sea, the bottom of the lake is for a short stretch 300 feet below sea level. \* \* \* Fifteen miles from its outlet the lake begins to shallow, and in its lower reach does not exceed 200 feet in depth.

The water is retained at its present level by a dam of sand and gravel, which in the section exposed by Chelan River is seen to consist of several successive members, i. e., soil, coarse stream gravel, till, very coarse gravel in pockets or channels, and cross-stratified sands. The base of the drift is not exposed. This drift dam fills the pre-glacial valley by which the Stehekin-Chelan River once reached the Columbia, and the present outlet turns from the drift into the gneiss and granite south of it, and has there cut a deep rock gorge.

According to the altitudes above sea of rock in place in the Columbia several miles below the junction, that of the lowest rock sill over which the waters of Lake Chelan can have escaped is about 700 feet.

Development of the fall on Chelan River between the lake and the mouth is contemplated by the Great Northern Railway Co.

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

#### GAGING STATIONS.

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

Stehekin River (head of Chelan River) near Stehekin, Wash., 1910-  
Chelan Lake at Lakeside, Wash., 1897-1899; 1905.  
Chelan Lake at Chelan, Wash., 1910-  
Chelan River at Chelan, Wash., 1903-  
Railroad Creek at Lucerne, Wash., 1910-1912.

#### METHOW RIVER BASIN.

##### GENERAL FEATURES.

Methow River rises on the eastern slope of the Cascade Mountains, in the northern part of Okanogan County, flows southeastward and unites with Columbia River near Pateros. It is about 60 miles long, and its drainage basin, which lies west of the Okanogan basin and east of the basin of Chelan Lake, comprises about 1,700 square miles. The most important tributaries of the Methow are Chewack Creek,



which joins it near Winthrop, and Twisp River, which enters from the west at Twisp.

The country is rough and mountainous and lightly forested. The mean annual rainfall ranges from 70 or 80 inches on the summit of the Cascades to about 15 inches at the mouth of the river. Irrigation is not practiced except on the lands lying contiguous to the streams. The climatic conditions are favorable for intensive agriculture.

A hydroelectric plant on Methow River just above Pateros supplies power and light for Pateros, Bridgeport, and Brewster and power to ranchers for pumping water from Columbia River for irrigation. The pumping plants along the Columbia in this locality require a lift of 30 to 125 feet. The flume of the power plant carries about 600 second-feet of water.

The results of profile surveys in the Methow River basin are given in Plates IV-V (at end of volume).

#### GAGING STATIONS.

The Geological Survey has maintained in the basin of Methow River three gaging stations as follows:

Methow River at Winthrop, Wash., 1912.

Methow River at Pateros, Wash., 1903-

Twisp River near Twisp, Wash., 1912-1913.

The dash after the date indicates that the station was being maintained June 30, 1915. A period after the date indicates discontinuance.

#### PUBLICATIONS.

The following publications of the Geological Survey contain the results of investigations of stream flow at stations in Chelan and Methow River basins:

Chelan River basin:

Annual Reports: Nineteenth, Part IV; Twentieth, Part IV; Twenty-first, Part IV.

Water-Supply Papers: 16, 28, 38, 100, 135, 178, 292, 312, 332 A, 362 A,<sup>1</sup> 392.<sup>1</sup>

Methow River basin:

Water-Supply Papers: 100, 135, 178, 214, 252, 272, 292, 312, 332 A, 362 A,<sup>1</sup> 392.<sup>1</sup>

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.

<sup>1</sup> In preparation.

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

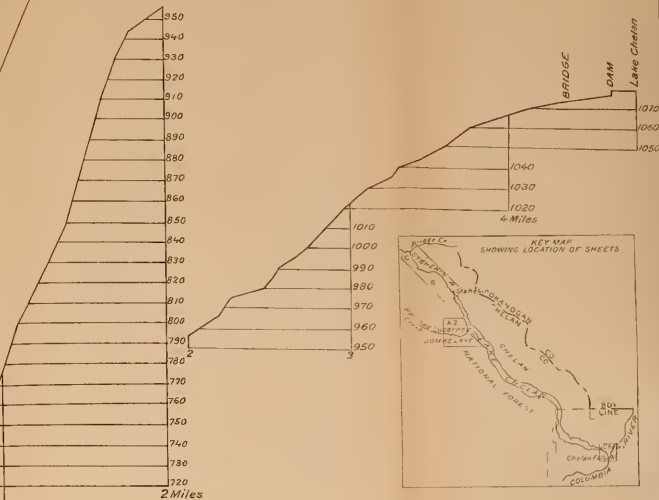
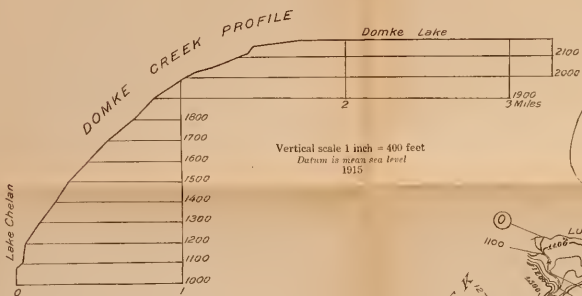
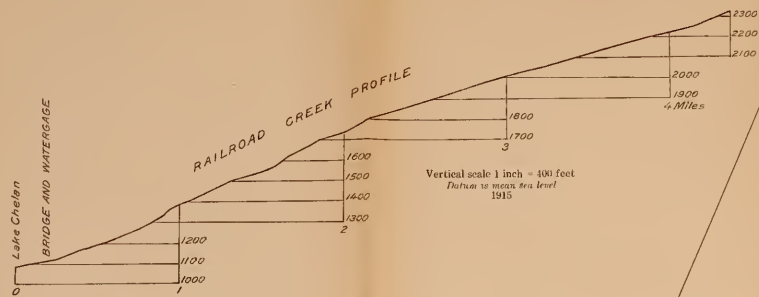
4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

- 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., 328 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 of the United States Geological Survey Washington, D. C.



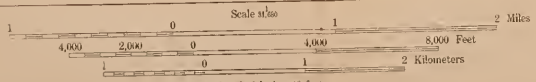
PLAN AND PROFILE OF  
 STEHEKIN RIVER BELOW BRIDGE CREEK,  
 RAILROAD CREEK NEAR LUCERNE,  
 AND CHELAN RIVER, LAKE TO MOUTH, WASHINGTON



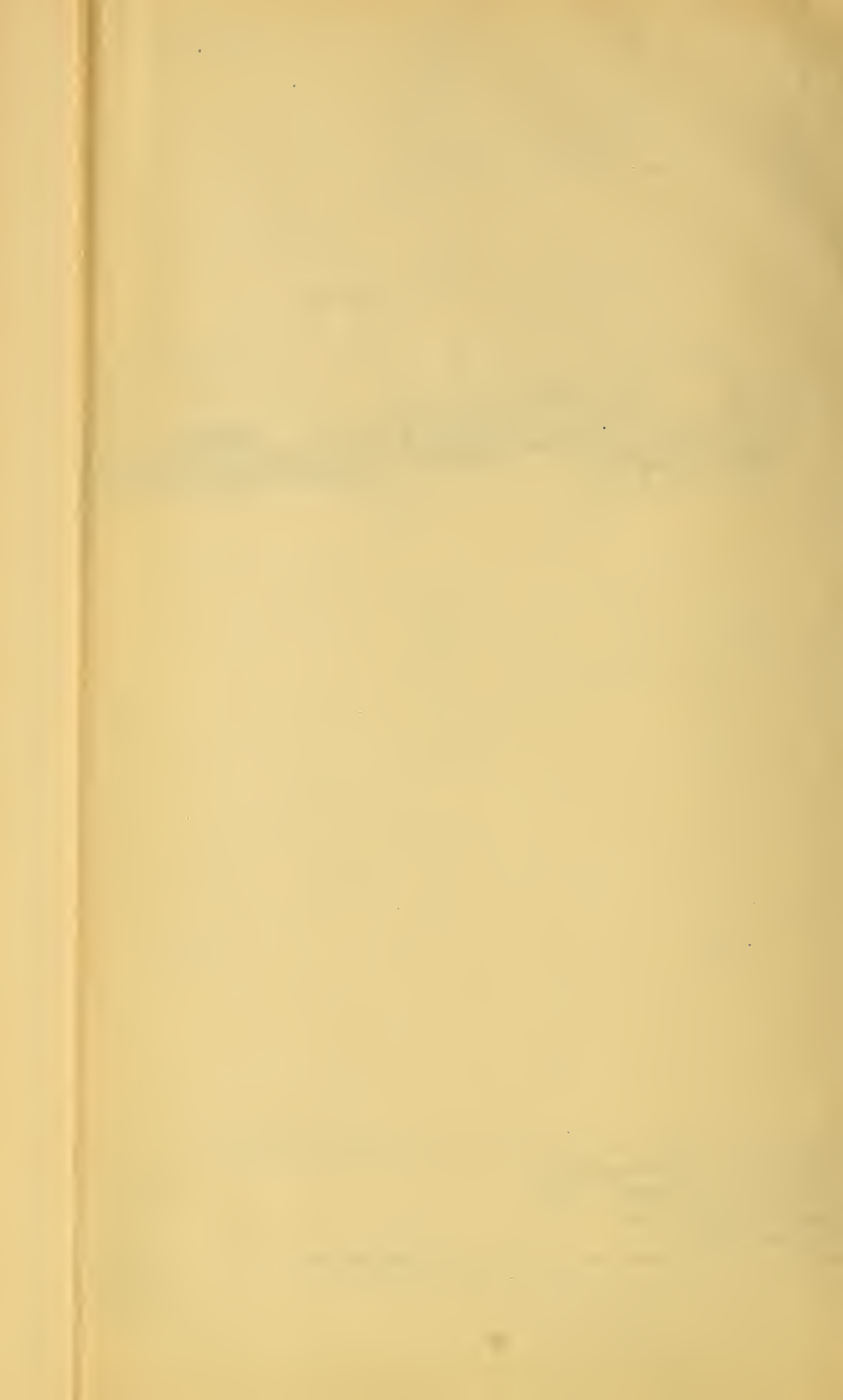
R. B. Marshall, Chief Geographer  
 T. G. Garding, Geographer in charge  
 Topography by A. J. Ozie  
 Surveyed in 1912  
 SURVEYED IN COOPERATION WITH THE STATE OF WASHINGTON

DIAGRAM OF TOWNSHIP

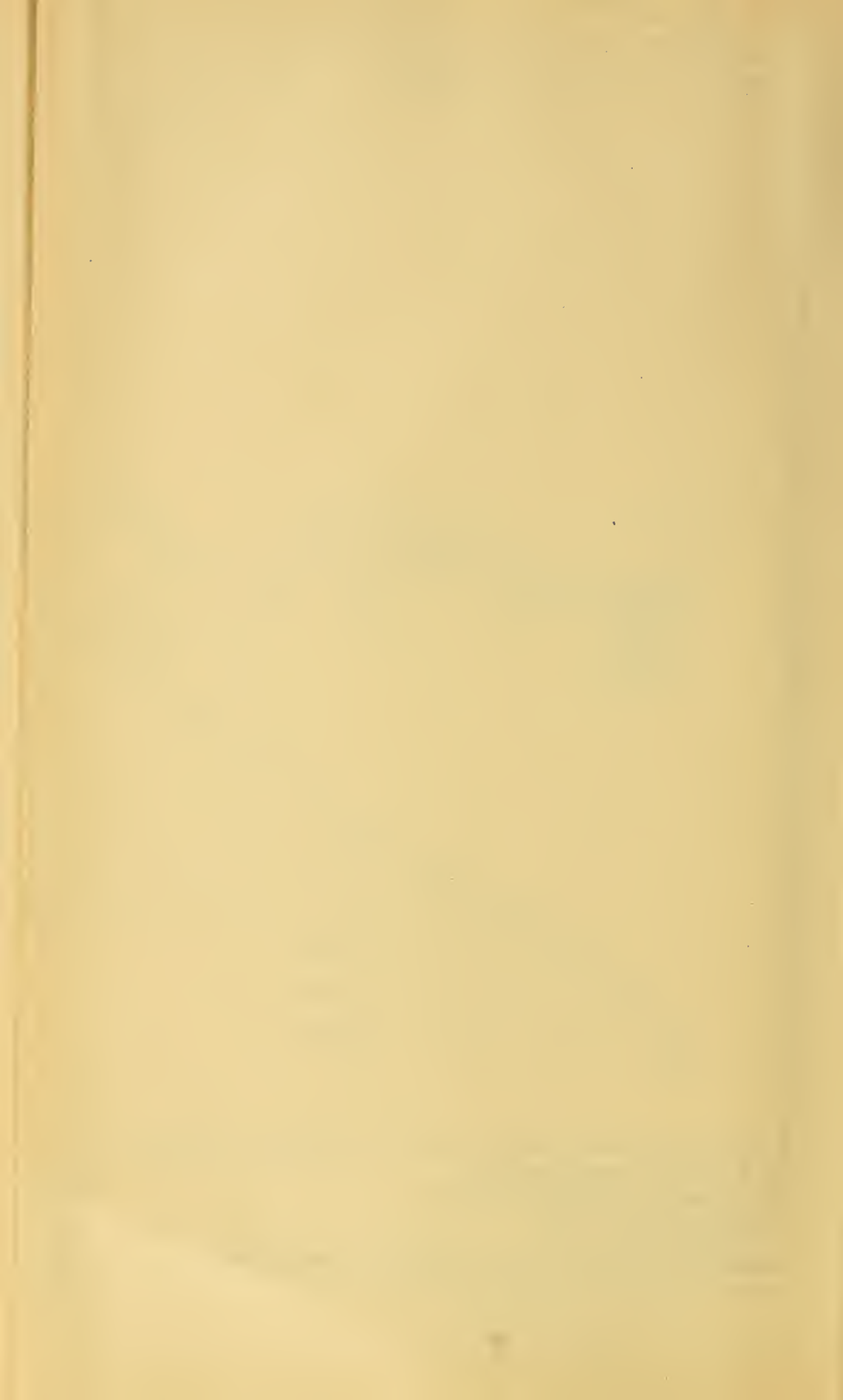
4 5	5 6	6 7
7 8	8 9	9 10
10 11	11 12	12 13
13 14	14 15	15 16
16 17	17 18	18 19
19 20	20 21	21 22
22 23	23 24	24 25
25 26	26 27	27 28
28 29	29 30	30 31
31 32	32 33	33 34
34 35	35 36	36 37



Vertical scale 1 inch = 40 feet  
 Contour interval on land 25 feet  
 Contour interval on river surface 5 feet  
 Contour interval in vicinity of Domke Lake 10 feet  
 Datum is mean sea level







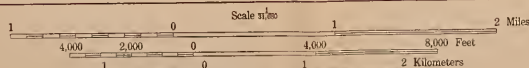
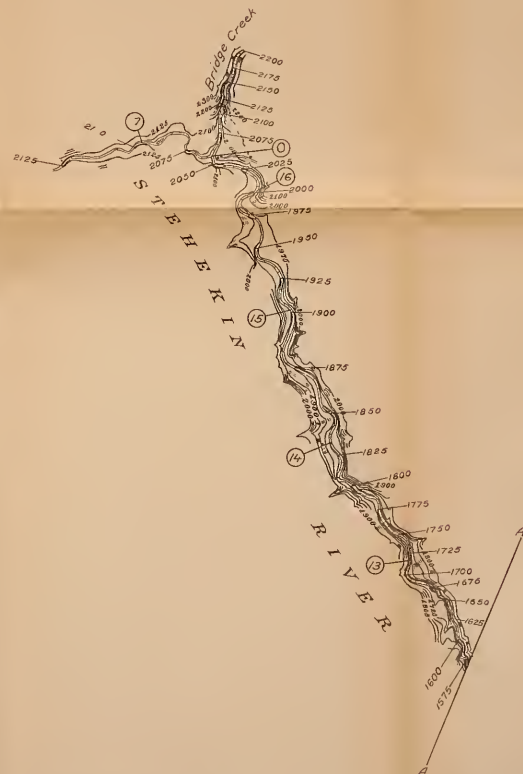
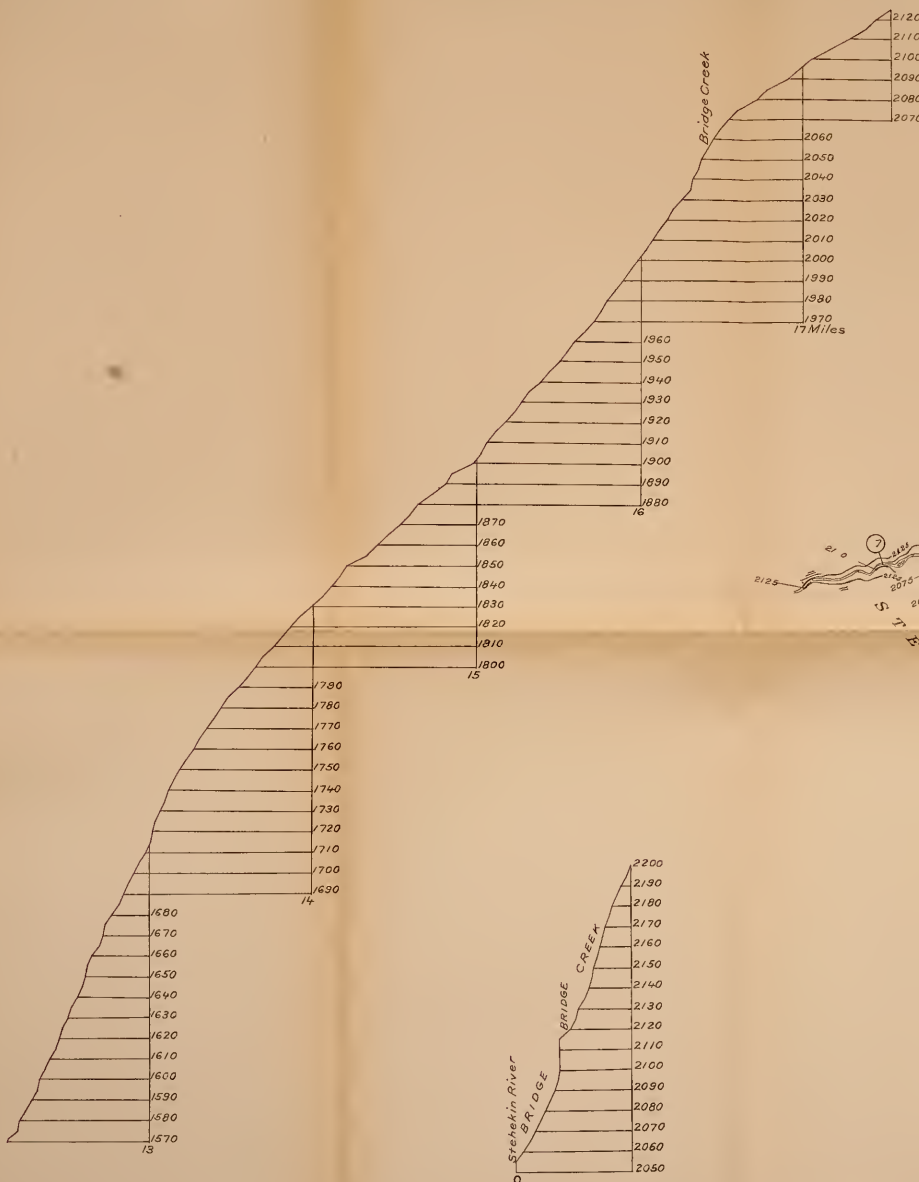


PLAN AND PROFILE OF  
 STEHEKIN RIVER BELOW BRIDGE CREEK,  
 RAILROAD CREEK NEAR LUCERNE,  
 AND CHELAN RIVER, LAKE TO MOUTH, WASHINGTON

SHEET C

WATER-SUPPLY PAPER 376 PLATE III

NOTE THIS SHEET IS WITHIN CHELAN COUNTY  
 AND CHELAN NATIONAL FOREST



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



Subject to adjustment

3 SHEETS

R. B. Marshall, Chief Geographer  
 T. G. Gerdine, Geographer in charge  
 Topography by A. J. Ogle  
 Surveyed in 1912  
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DIAGRAM OF TOWNSHIP

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35
36	37	38	39	40	41	42



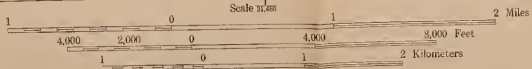




R. B. Marshall, Chief Geographer  
 T. G. Geidine, Geographer in charge  
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DIAPHRAM OF CORRECTION

14 7	2 7	1
7 8	9	11 12
10 11	10	11 12
13 20	21	22 24
30 29	28	27 26 25
24 23	22 21	20 20

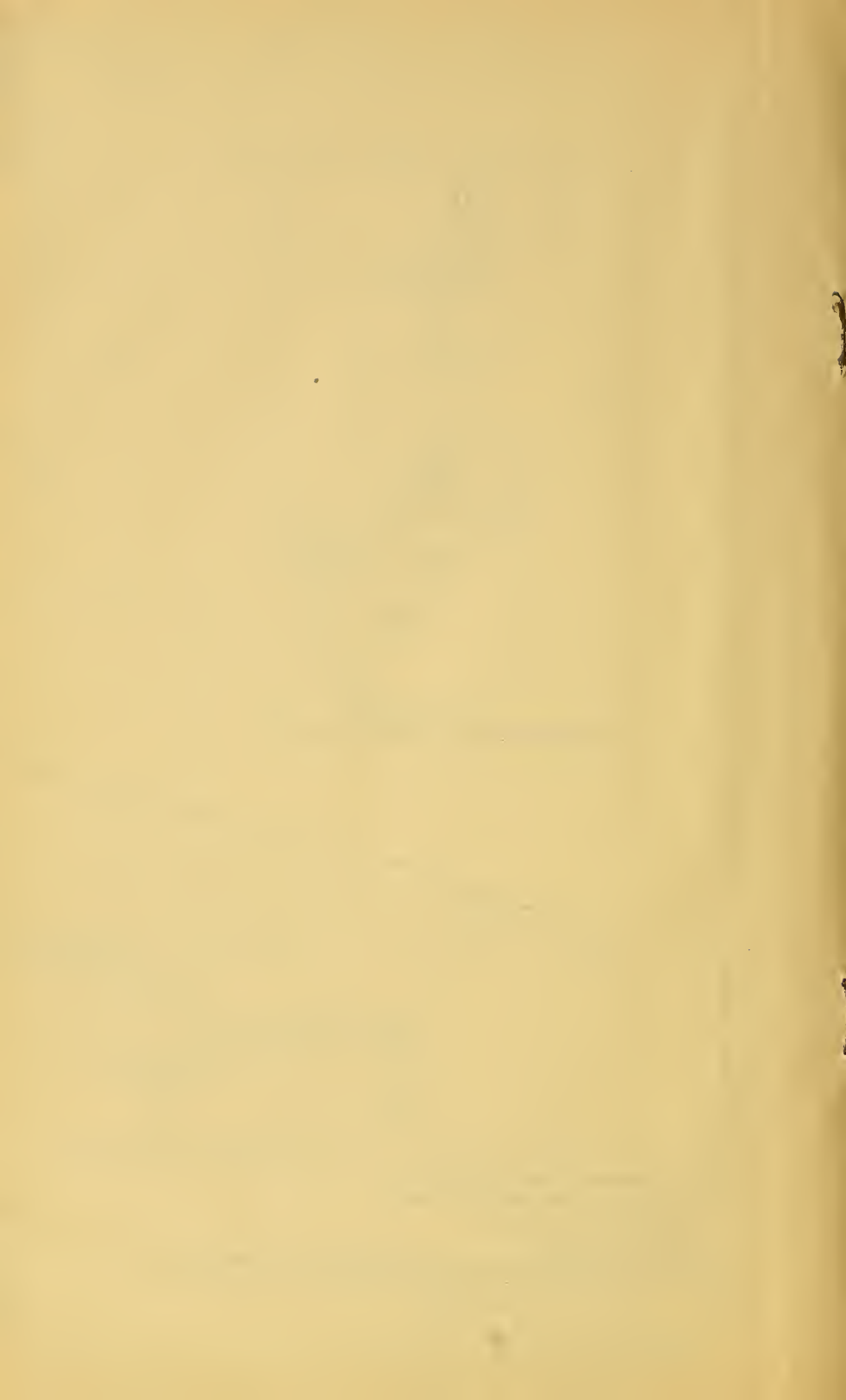


Vertical scale 1 inch = 40 feet  
 Contour interval on land 25 feet  
 Contour interval on river surface 5 feet  
 Datum to mean sea level

21.5°  
 TRUE NORTH  
 MAGNETIC NORTH

APPROXIMATE MEAN  
 OCCULTATION 1912

Subject to adjustment 7 SHEETS









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