DEPARTMENT OF THE INTERIOR
HUBERT WORK, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

**Water-Supply Paper 515**

# SURFACE WATER SUPPLY OF HAWAII

## JULY 1, 1918, TO JUNE 30, 1919

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**Prepared in cooperation with the**
**TERRITORY OF HAWAII**

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# CONTENTS.

# SURFACE WATER SUPPLY OF HAWAII, JULY 1, 1918, TO JUNE 30, 1919.

## AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams and ditches in the Territory of Hawaii made during the year ending June 30, 1919. The investigations leading to the report were made by the United States Geological Survey in cooperation with the Territory of Hawaii, under the general sanction of the organic law of the Survey (Stat. L., vol. 20, p. 394), which contains the following paragraph:

*Provided*, That this officer [the Director] shall have the direction of the geological survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

As water is the most abundant and most valuable of the minerals, the investigation of water resources is authorized under the provision for examining mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

The legislature of the Territory of Hawaii approved on March 22, 1909, "An act to promote the conservation and development of the natural resources of the Territory," which provided in substance as follows: A special tax of 2 per cent shall be levied, assessed, and collected annually on all incomes in excess of $4,000; and all amounts so collected shall constitute a special fund to be expended only for the encouragement of immigration and the conservation of natural resources in the proportion of three-fourths for immigration and one-fourth for conservation. The conservation fund shall be used for the development, conservation, improvement, and utilization of the natural resources, and shall be available for expenditure at such times and in such manner as a board of three persons appointed in accordance with section 80 of the organic act shall, with the approval of the governor, determine.

An act of April 26, 1911, amended the original act so as to extend it until December 31, 1913.

On April 4, 1913, the governor of the Territory of Hawaii approved the following acts providing (act 56) for the creation and maintenance

of a division of hydrography under the board of agriculture and forestry, and (act 57) appropriating the revenues from water licenses for the use of the board of commissioners of agriculture and forestry toward forest protection and hydrographic surveying.

Section 1 of act 56 reads:

The board of agriculture and forestry is hereby authorized to create and maintain a division of hydrography for the investigation and determination of the water resources of the Territory by the gaging of streams and rainfall and other means, in cooperation with the United States Geological Survey or otherwise, and in furtherance thereof to take over and exercise the functions of the Territory in the conduct of the present hydrographic survey of the Territory.

Section 2 provides that this act shall take effect July 1, 1913.

Section 1 of act 57 reads:

All revenues derived from water licenses issued by the Territory during the period beginning July 1, 1913, and ending June 30, 1915, whether by way of rentals or otherwise, shall constitute and be held as a special fund in the treasury of the Territory to be disbursed on warrants of the auditor issued on approved vouchers of the president of the board of commissioners of agriculture and forestry. Such moneys shall be apportioned and applied from time to time by the board of commissioners of agriculture and forestry, acting with the approval of the governor, equally between the division of forestry and the division of hydrography to the following general purposes, and not otherwise:

1. For the protection of forest reservations, established or set apart according to law, against damage by fire, animals, and otherwise by means of fences and any other means whatsoever, and for the expenditures of the division of forestry.

2. For the development and maintenance of the hydrographic survey throughout the Territory.

Each voucher against said fund shall designate the general purpose for which it is drawn.

Section 2 provides that this act also shall take effect July 1, 1913.

Since June 30, 1915, the funds for the use of the division of hydrography have been supplied by successive appropriations from the general revenues of the Territory.

On March 23, 1917, the following act by the legislature of the Territory of Hawaii was approved:

ACT 27.

SECTION 1. The division of hydrography, authorized by and created pursuant to section 483 of the Revised Laws of Hawaii, 1915, is hereby transferred, together with all the materials, equipment, and supplies now under the control of the division or of the board of commissioners of agriculture and forestry for the division, to the commissioner of public lands.

SEC. 2. The commissioner of public lands shall have and exercise the same powers, duties, and jurisdiction with respect to said division as are now exercised by the board of commissioners of agriculture and forestry.

SEC. 3. All unexpended balances of appropriations heretofore made for said division, the expenditure of which is now by law vested in the board of commissioners of agriculture and forestry, are hereby transferred to the commissioner of public lands and the expenditure thereof vested in said commissioner.

SEC. 4. This act shall take effect upon its approval.

## COOPERATION.

### COOPERATION WITH THE TERRITORY OF HAWAII.

Under the authority conferred by the Federal and Territorial legislation, the Director of the United States Geological Survey and the governor of the Territory of Hawaii entered into a cooperative agreement, dating from July 1, 1910, for "the gaging of streams and the determination of the water supply of the Territory of Hawaii." [1]

The principal features of this agreement are:

1. The United States Geological Survey assumes the responsibility of gathering, analyzing, and publishing the data.

2. During the progress of the work all notes, maps, and data gathered as a result of field studies are at all times open to inspection by the representative of the Territory, and if they are not satisfactory the agreement can be terminated.

3. Accounts for payment of salaries, travel, and subsistence, supplies, or other expenses necessary to the completion of the work shall be rendered in the manner required by the laws and regulations of the contracting parties, and vouchers shall be preferred to either party for payment according as it may be convenient or according to the balance remaining in the respective allotments.

4. The cost of publication is borne entirely by the Geological Survey.

Unless otherwise stated, all data have been collected and are published under this cooperative agreement with the Territory of Hawaii, which has borne from 60 to 80 per cent of the cost thereof.

Until June 30, 1913, the Territory of Hawaii was represented in the cooperation by the Board of Conservation; from July 1, 1913, to March 23, 1917, by the Board of Commissioners of Agriculture and Forestry; and since this date by the Commissioner of Public Lands.

### OTHER COOPERATION.

Special investigations have been made in cooperation with the city and county of Honolulu, and private persons and corporations, under one of the plans indicated in the following paragraphs:

1. Expense of work, equipment, or installation paid entirely or in part by the cooperating party or by direct reimbursement to the field men.

2. Records collected by employees of a cooperating party but under supervision of and by methods of the Survey.

3. Assistance given in the collection of records, such as furnishing transportation, subsistence, or equipment.

[1] The United States Geological Survey also cooperated with the Territory of Hawaii in mapping several islands. The whole of the islands of Kauai and Oahu and a part of the island of Hawaii have been mapped.

4. Records furnished by a cooperating party, collected by his methods and under his supervision.

Cooperation in the collection of records for whose accuracy responsibility has not rested with the Survey has been acknowledged in the descriptions of the stations. Special acknowledgment is due to the following individuals and companies cooperating under plans 1, 2, and 3: Island of Kauai—Waimea Sugar Co.; Island of Oahu—Wahiawa Water Co., Island of Maui—Pioneer Mill Co., and East Maui Irrigation Co.

## SCOPE OF WORK.

The investigations of the surface waters of the Territory are not complete nor do they include all the streams and ditches that might advantageously be studied. They include, however, as many of the streams and ditches on the four larger islands as the available appropriations would allow. It is essential that records of stream flow should be kept during a period of years long enough to determine within reasonable limits the range of flow from the maximum to the minimum. The length of such a period manifestly varies for different streams. Experience has shown that the records should be kept from 20 to 30 years.

In the performance of this work an effort is made to reach the highest degree of precision possible with a rational expenditure of time and money. In all engineering work there is a point beyond which refinement is needless and wasteful, and this statement applies with especial force to stream-measurement work in Hawaii. It has been found, however, that it is possible to obtain data which are sufficiently accurate, although many of those presented in this report are for periods too short to yield definite conclusions.

Special intensive investigations of the discharge of many streams which are of major importance for domestic water supply, power, and irrigation have been made.

Investigations of ditch seepage and other losses, in many localities, were made in cooperation with the United States Army and private corporations.

## DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated more or less definitely with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as "second-feet," "gallons per minute," "gallons per day," "miner's inches," and "run-off in second-feet per square mile," and (2) those which represent the actual quantity of water, as "run-off in depth in inches," "million gallons," and "acre-feet." They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the unit for the rate of discharge of water flowing in a stream 1 square foot in cross section at a rate of 1 foot per second. It is generally adopted as the fundamental unit in the measurement of flowing water and is the "natural" unit, as the foot and the second are the units used in making the physical determinations. Other units may be computed from this by the use of factors given in the table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply, the United States gallon of 231 cubic inches being the unit of quantity and 1 minute the unit of time.

The "miner's inch" is the unit for the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly, both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

In the Territory of Hawaii the unit most commonly used in measuring water is the "million gallons." This is used with two meanings—(1) to indicate a rate of flow and (2) to express an actual quantity of water. In the former sense "million gallons per day" is inferred, 1,000,000 gallons being taken as the unit of quantity and 24 hours as the unit of time. With this meaning the term is generally used in connection with pumping and irrigation. In the latter sense "million gallons" as an absolute quantity is used in the measurement of storage capacities of reservoirs.

The following convenient approximate relations exist between second-feet, million gallons per day, and acre-feet: 1 second-foot flowing 24 hours equals about 2 acre-feet; 1,000,000 gallons equals about 3 acre-feet; and 1 second-foot equals approximately two-thirds million gallons per day.

"Man's water" is an irrigator's term also in common use in Hawaii. It signifies the amount of water that one irrigator can properly handle in the field. It varies greatly, being dependent upon the condition of

the furrows, the age of the crop, and the skill and individuality of the irrigator.

## EXPLANATION OF TABLES.

For each current-meter gaging station are given, in general, the following data: Description of station, list of discharge measurements, table of daily discharge, table of monthly and yearly discharge and run-off in acre-feet and million gallons.

All rates of flow are expressed as million gallons per day.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as shifting channels and backwater; also information regarding diversions which decrease the total flow at the measuring station. Statements are also made regarding the utilization of the water, the maximum and minimum stage and discharge, and the accuracy of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, gage height, and discharge in second-feet and million gallons per day.

The table of daily discharge gives the discharge in million gallons per day corresponding to the observed gage height as determined from the rating table, the number of significant figures used varying with the size of the discharge.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The columns headed "Mean" give the average flow in million gallons per day and in cubic feet per second during the month. The "Total in million gallons" and "Total in acre-feet" given in the columns under these heads are computed from the mean discharge in million gallons per day.

Owing to the volcanic formation of the Hawaiian Islands there is so wide a diversity in the character and porosity of the rocks of the drainage basins that the determination of a general relation between rainfall and run-off is of no value. For this reason information concerning drainage areas has been omitted in the various station descriptions.

## ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends (1) on permanence of the relation between discharge and stage, (2) number, accuracy, and distribution of discharge measurements, and (3) on the accuracy of observations of stage and interpretation of data.

The accuracy recorded in the station description is based on the accuracy of the rating curve, the reliability of the gage-height record, the range of the fluctuation in stage, and knowledge of local conditions. The use of "excellent," "good," "fair," or "poor," indicates that the probable errors are within 5, 10, 15, and 25 per cent, respectively.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published.

## DIVISION OF WORK.

The data were collected and prepared for publication under the direction of C. T. Bailey and James E. Stewart, acting district engineers, Honolulu, Hawaii, by Max. H. Carson, office engineer, W. V. Hardy, R. D. Klise, H. A. R. Austin, A. H. Wong, B. F. Rush, M. H. Merry, R. H. Remington, W. C. Renshaw, E. M. Pickop, E. E. Goo, John Kaheaku, and Earl Smith. The manuscript has been prepared by James E. Stewart and Max. H. Carson.

## GAGING-STATION RECORDS.

### ISLAND OF KAUAI.

#### WAIALAE RIVER AT ELEVATION 800 FEET, NEAR WAIMEA, KAUAI.

LOCATION.—Half a mile above confluence with Waimea River and 10 miles north of Waimea.

RECORDS AVAILABLE.—December 31, 1915, to June 30, 1919. Data from December 19, 1916, to June 30, 1918, has been revised on the basis of later studies.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 120 feet above and 200 feet below gage; right bank sloping and brushy; left bank vertical and clean. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.02 feet at 11.30 p. m. November 24 (discharge, approximately 1,000 million gallons per day, or 1,500 second-feet); minimum stage recorded, 0.72 foot January 23 and 24 (discharge, 6.8 million gallons per day, or 10.5 second-feet).

1915–1919: Maximum stage recorded, 6.55 feet at 10.30 p. m. December 18, 1916 (discharge, approximately 1,700 million gallons per day, or 2,630 second-feet); minimum stage recorded, 1.1 feet June 27–30, 1918 (discharge, 4 million gallons per day, or 6.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—For irrigation of sugar cane, rice, and taro and for domestic supply.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, applicable as follows: First curve, December 19, 1916, to October 17, 1917, and March 3 to April 18, 1918; second curve, October 18, 1917, to January 26, 1918, and August 22, 1918, to June 30, 1919; third curve, January 27 to March 2, 1918, and April 19 to July 10, 1918; fourth curve, July 11 to August 21, 1918. Operation of water-stage recorder satisfactory. Records fair.

*Discharge measurements of Waialae River at elevation 800 feet, near Waimea, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 29 | W. V. Hardy | 0.94 | 16.8 | 10.9 |
| Oct. 23 | ....do | .92 | 9.4 | 6.0 |
| Feb. 25 | ....do | 1.02 | 12.5 | 8.1 |
| Mar. 15 | Y. Masato | 1.12 | 19.2 | 12.4 |
| May 14 | S. Takabayashi | .83 | 6.6 | 4.3 |

*Daily discharge, in million gallons, of Waialae River at elevation 800 feet, near Waimea, Kauai, for the years ending June 30, 1917–1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1916–17. | | | | | | | | | | | | |
| 1 | ..... | ..... | ..... | ..... | ..... | ..... | 117 | 46 | ..... | 105 | ..... | 42 |
| 2 | ..... | ..... | ..... | ..... | ..... | ..... | 124 | 325 | ..... | 26 | ..... | 21 |
| 3 | ..... | ..... | ..... | ..... | ..... | ..... | 88 | 93 | ..... | 16.6 | ..... | 16.6 |
| 4 | ..... | ..... | ..... | ..... | ..... | ..... | 99 | 82 | ..... | 29 | ..... | 21 |
| 5 | ..... | ..... | ..... | ..... | ..... | ..... | 62 | 77 | ..... | 32 | ..... | 29 |
| 6 | ..... | ..... | ..... | ..... | ..... | ..... | 53 | 82 | ..... | 26 | ..... | 29 |
| 7 | ..... | ..... | ..... | ..... | ..... | ..... | 35 | 82 | ..... | 21 | ..... | 50 |
| 8 | ..... | ..... | ..... | ..... | ..... | ..... | 26 | 77 | ..... | 21 | ..... | 38 |
| 9 | ..... | ..... | ..... | ..... | ..... | ..... | 35 | 82 | ..... | 18.8 | ..... | 18.8 |
| 10 | ..... | ..... | ..... | ..... | ..... | ..... | 46 | 88 | ..... | 16.6 | ..... | 16.6 |
| 11 | ..... | ..... | ..... | ..... | ..... | ..... | 88 | 72 | ..... | 11.5 | ..... | 14.8 |
| 12 | ..... | ..... | ..... | ..... | ..... | ..... | 62 | 77 | ..... | 29 | ..... | 13.0 |
| 13 | ..... | ..... | ..... | ..... | ..... | ..... | 29 | 111 | ..... | 26 | ..... | 13.0 |
| 14 | ..... | ..... | ..... | ..... | ..... | ..... | 16.6 | 62 | ..... | 29 | ..... | 13.0 |
| 15 | ..... | ..... | ..... | ..... | ..... | ..... | 14.8 | 35 | ..... | 24 | ..... | 13.0 |
| 16 | ..... | ..... | ..... | ..... | ..... | ..... | 38 | 50 | ..... | 16.6 | ..... | 21 |
| 17 | ..... | ..... | ..... | ..... | ..... | ..... | 99 | 62 | ..... | 13.0 | ..... | 29 |
| 18 | ..... | ..... | ..... | ..... | ..... | ..... | 77 | 159 | ..... | 11.5 | ..... | 21 |
| 19 | ..... | ..... | ..... | ..... | ..... | 355 | 205 | 93 | ..... | 11.5 | ..... | 18.8 |
| 20 | ..... | ..... | ..... | ..... | ..... | 111 | 530 | 88 | ..... | 50 | ..... | 13.0 |
| 21 | ..... | ..... | ..... | ..... | ..... | 93 | 205 | ..... | ..... | 32 | 26 | 11.5 |
| 22 | ..... | ..... | ..... | ..... | ..... | 99 | 124 | ..... | ..... | 14.8 | 21 | 10.0 |
| 23 | ..... | ..... | ..... | ..... | ..... | 159 | 82 | ..... | ..... | 13.0 | 21 | 8.7 |
| 24 | ..... | ..... | ..... | ..... | ..... | 242 | 168 | ..... | ..... | 11.5 | 21 | 8.7 |
| 25 | ..... | ..... | ..... | ..... | ..... | 132 | 105 | ..... | ..... | 10.0 | 16.6 | 8.7 |
| 26 | ..... | ..... | ..... | ..... | ..... | 105 | 93 | ..... | ..... | 10.0 | 14.8 | 8.7 |
| 27 | ..... | ..... | ..... | ..... | ..... | 99 | 88 | ..... | 11.5 | ..... | 14.8 | 7.4 |
| 28 | ..... | ..... | ..... | ..... | ..... | 99 | 88 | ..... | 11.5 | ..... | 29 | 7.4 |
| 29 | ..... | ..... | ..... | ..... | ..... | 111 | 82 | ..... | 11.5 | ..... | 21 | 7.4 |
| 30 | ..... | ..... | ..... | ..... | ..... | 99 | 72 | ..... | 13.0 | ..... | 35 | 7.4 |
| 31 | ..... | ..... | ..... | ..... | ..... | 99 | 46 | ..... | ..... | ..... | ..... | ..... |

*Daily discharge, in million gallons, of Waialae River at elevation 800 feet, near Waimea, Kauai, for the years ending June 30, 1917–1919*—Continued.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1917–18. | | | | | | | | | | | | |
| 1 | 7.4 | 7.4 | 4.6 | 5.4 | 7.8 | 14.8 | 10.4 | 33 | 50 | 10.0 | 18.8 | 10.8 |
| 2 | 7.4 | 6.4 | 4.6 | 8.7 | 11.8 | 10.4 | 9.1 | 30 | 103 | 14.8 | 18.8 | 9.3 |
| 3 | 18.8 | 7.4 | 4.6 | 8.7 | 53 | 7.8 | 7.8 | 27 | 58 | 50 | 16.6 | 9.3 |
| 4 | 38 | 7.4 | 3.8 | 10.0 | 20.0 | 7.8 | 7.8 | 24 | 93 | 82 | 21 | 7.8 |
| 5 | 14.8 | 8.7 | 3.8 | 8.7 | 18.2 | 16.4 | 7.8 | 24 | 62 | 50 | 21 | 7.8 |
| 6 | 10.0 | 7.4 | 3.8 | 6.4 | 14.8 | 20 | 7.8 | 58 | 62 | 18.8 | 16.6 | 7.8 |
| 7 | 11.5 | 10.0 | 3.8 | 6.4 | 10.4 | 18.2 | 11.8 | 27 | 35 | 13.0 | 21 | 7.8 |
| 8 | 11.5 | 10.0 | 3.8 | 5.4 | 11.8 | 13.2 | 20 | 21 | 26 | 13.0 | 27 | 6.8 |
| 9 | 72 | 6.4 | 3.8 | 4.6 | 10.4 | 30 | 13.2 | 36 | 24 | 32 | 16.6 | 6.8 |
| 10 | 24 | 5.4 | 3.8 | 4.6 | 11.8 | 24 | 9.1 | 27 | 26 | 196 | 14.4 | 6.8 |
| 11 | 16.6 | 5.4 | 3.8 | 4.6 | 11.8 | 22 | 9.1 | 36 | 205 | 280 | 12.6 | 6.8 |
| 12 | 13.0 | 21 | 3.8 | 5.4 | 7.8 | 24 | 24 | 43 | 88 | 88 | 21 | 6.8 |
| 13 | 10.0 | 26 | 6.4 | 13.0 | 6.8 | 28 | 11.8 | 46 | 62 | 99 | 21 | 14.4 |
| 14 | 10.0 | 38 | 10.0 | 16.6 | 6.8 | 18.2 | 36 | 30 | 88 | 42 | 14.4 | 14.4 |
| 15 | 8.7 | 11.5 | 10.0 | 10.0 | 6.8 | 14.8 | 20 | 18.8 | 50 | 24 | 12.6 | 16.6 |
| 16 | 7.4 | 18.8 | 10.0 | 230 | 6.8 | 11.8 | 13.2 | 66 | 82 | 21 | 10.8 | 18.8 |
| 17 | 21 | 13.0 | 10.0 | 46 | 5.8 | 11.8 | 10.4 | 73 | 62 | 29 | 18.8 | 12.6 |
| 18 | 14.8 | 8.7 | 18.8 | 22 | 5.8 | 9.1 | 13.2 | 196 | 32 | 550 | 18.8 | 9.3 |
| 19 | 11.5 | 7.4 | 14.8 | 16.4 | 5.8 | 9.1 | 168 | 73 | 24 | 242 | 12.6 | 9.3 |
| 20 | 8.7 | 6.4 | 7.4 | 13.2 | 6.8 | 9.1 | 53 | 62 | 18.8 | 186 | 10.8 | 16.6 |
| 21 | 7.4 | 5.4 | 5.4 | 13.2 | 7.8 | 11.8 | 28 | 168 | 26 | 98 | 10.8 | 24 |
| 22 | 7.4 | 5.4 | 5.4 | 13.2 | 9.1 | 10.4 | 36 | 66 | 18.8 | 66 | 10.8 | 12.6 |
| 23 | 7.4 | 7.4 | 4.6 | 18.2 | 6.8 | 7.8 | 46 | 73 | 16.6 | 50 | 10.8 | 10.8 |
| 24 | 6.4 | 11.5 | 4.6 | 13.2 | 5.8 | 7.8 | 24 | 36 | 18.8 | 43 | 9.3 | 16.6 |
| 25 | 8.7 | 7.4 | 4.6 | 10.4 | 7.8 | 10.4 | 26 | 33 | 18.8 | 36 | 9.3 | 10.8 |
| 26 | 11.5 | 6.4 | 6.4 | 9.1 | 18.2 | 14.8 | 117 | 30 | 16.6 | 33 | 12.6 | 7.8 |
| 27 | 8.7 | 5.4 | 24 | 9.1 | 50 | 58 | 132 | 27 | 14.8 | 30 | 46 | 24 |
| 28 | 8.7 | 5.4 | 14.8 | 7.8 | 24 | 36 | 70 | 58 | 14.8 | 27 | 21 | 12.6 |
| 29 | 7.4 | 4.6 | 11.5 | 7.8 | 18.2 | 16.4 | 66 | ..... | 14.8 | 24 | 50 | 7.8 |
| 30 | 7.4 | 4.6 | 7.4 | 7.8 | 24 | 13.2 | 62 | ..... | 14.8 | 21 | 30 | 6.8 |
| 31 | 7.4 | 4.6 | ..... | 9.1 | ..... | 11.8 | 40 | ..... | 11.5 | ..... | 14.4 | ..... |
| 1918–19. | | | | | | | | | | | | |
| 1 | 6.4 | 12.3 | 9.4 | 4.5 | 17.8 | 11.8 | 11.2 | 7.2 | 5.6 | 5.0 | 7.8 | 6.2 |
| 2 | 5.8 | 11.8 | 17.1 | 4.4 | 36 | 11.0 | 9.9 | 9.6 | 5.5 | 5.0 | 5.8 | 5.6 |
| 3 | 6.8 | 11.2 | 20 | 4.2 | 21 | 105 | 9.4 | 8.3 | 5.6 | 4.7 | 5.3 | 11.2 |
| 4 | 7.4 | 11.0 | 9.9 | 4.0 | 13.8 | 27 | 9.6 | 7.4 | 5.3 | 4.7 | 6.4 | 13.8 |
| 5 | 38 | 18.8 | 7.4 | 3.8 | 28 | 67 | 13.2 | 6.6 | 5.2 | 4.5 | 8.1 | 7.2 |
| 6 | 17.0 | 18.8 | 6.4 | 4.1 | 15.4 | 168 | 23 | 6.2 | 15.8 | 4.5 | 8.6 | 5.6 |
| 7 | 49 | 13.1 | 6.0 | 4.1 | 10.4 | 105 | 12.6 | 5.8 | 24 | 4.5 | 8.3 | 4.8 |
| 8 | 14.0 | 14.7 | 9.6 | 4.1 | 8.3 | 72 | 9.6 | 5.6 | 11.2 | 4.4 | 10.1 | 6.2 |
| 9 | 10.5 | 14.1 | 10.1 | 4.5 | 17.5 | 33 | 8.6 | 9.9 | 7.4 | 4.4 | 14.2 | 6.2 |
| 10 | 150 | 12.5 | 7.0 | 4.5 | 14.2 | 111 | 8.1 | 9.6 | 16.8 | 4.4 | 12.4 | 4.8 |
| 11 | ..... | 11.2 | 6.2 | 4.4 | 62 | 42 | 8.1 | 7.4 | 19.3 | 4.2 | 17.8 | 4.5 |
| 12 | ..... | 13.1 | 6.2 | 15.4 | 42 | 26 | 7.6 | 16.8 | 28 | 4.1 | 8.3 | 4.4 |
| 13 | ..... | 25 | 7.4 | 15.1 | 17.8 | 21 | 17.8 | 10.1 | 15.4 | 4.1 | 5.8 | 4.2 |
| 14 | ..... | 52 | 6.2 | 77 | 14.8 | 18.2 | 12.9 | 7.4 | 19.3 | 4.1 | 5.3 | 4.0 |
| 15 | ..... | 19.6 | 5.5 | 33 | 14.8 | 16.1 | 9.4 | 6.4 | 11.8 | 4.5 | 4.8 | 3.8 |
| 16 | ..... | 15.0 | 5.3 | 19.3 | 11.0 | 14.5 | 8.1 | 6.0 | 8.3 | 8.8 | 4.8 | 3.8 |
| 17 | ..... | 36 | 5.2 | 12.4 | 9.1 | 14.5 | 7.2 | 5.8 | 7.4 | 7.8 | 16.1 | 3.8 |
| 18 | ..... | 32 | 5.5 | 7.8 | 8.3 | 17.5 | 6.8 | 5.5 | 7.0 | 9.9 | 10.4 | 3.7 |
| 19 | 16.4 | 26 | 14.2 | 6.4 | 7.8 | 17.5 | 6.6 | 5.5 | 7.2 | 33 | 6.4 | 3.6 |
| 20 | 15.7 | 26 | 10.7 | 7.2 | 7.4 | 16.8 | 6.8 | 5.5 | 9.6 | 22 | 5.6 | 3.5 |
| 21 | 23 | 39 | 7.4 | 7.6 | 6.8 | 13.2 | 7.8 | 17.5 | 11.5 | 15.8 | 5.3 | 3.5 |
| 22 | 23 | 19.6 | 6.0 | 7.0 | 6.4 | 11.5 | 16.1 | 16.1 | 30 | 17.1 | 4.8 | 3.4 |
| 23 | 20 | 19.6 | 5.5 | 6.2 | 6.4 | 11.0 | 30 | 11.5 | 12.6 | 21 | 4.7 | 3.4 |
| 24 | 66 | 12.4 | 5.3 | 5.8 | 30 | 10.7 | 14.2 | 7.6 | 9.9 | 12.9 | 4.7 | 3.4 |
| 25 | 28 | 19.6 | 5.2 | 5.3 | 295 | 11.0 | 9.6 | 9.4 | 7.6 | 8.3 | 4.7 | 3.5 |
| 26 | 42 | 12.4 | 5.0 | 5.0 | 50 | 10.1 | 8.1 | 9.4 | 6.6 | 6.4 | 4.8 | 3.6 |
| 27 | 25 | 8.6 | 4.8 | 7.6 | 23 | 9.1 | 7.4 | 6.8 | 6.0 | 5.6 | 4.5 | 4.8 |
| 28 | 17.6 | 7.2 | 4.8 | 7.0 | 16.8 | 28 | 8.1 | 5.8 | 5.8 | 5.3 | 4.4 | 9.6 |
| 29 | 15.4 | 6.6 | 5.3 | 5.5 | 14.2 | 26 | 8.8 | ..... | 5.6 | 5.0 | 7.8 | 8.3 |
| 30 | 13.8 | 6.6 | 4.8 | 19.3 | 12.6 | 14.8 | 8.8 | ..... | 5.3 | 5.2 | 11.0 | 11.2 |
| 31 | 12.8 | 12.1 | ..... | 99 | ..... | 15.4 | 7.6 | ..... | 5.2 | ..... | 6.8 | ..... |

*Monthly discharge of Waialae River at elevation 800 feet, near Waimea, Kauai, for the years ending June 30, 1917–1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| 1917. | | | | | | |
| January | 530 | 14.8 | 96.7 | 150 | 3,000 | 9,200 |
| June | 50 | 7.4 | 17.9 | 27.7 | 538 | 1,650 |
| 1917–18. | | | | | | |
| July | 72 | 6.4 | 13.7 | 21.2 | 426 | 1,300 |
| August | 38 | 4.6 | 9.70 | 15.0 | 301 | 923 |
| September | 24 | 3.8 | 7.47 | 11.6 | 224 | 688 |
| October | 230 | 4.6 | 18.2 | 28.2 | 565 | 1,730 |
| November | 53 | 5.8 | 13.8 | 21.4 | 413 | 1,270 |
| December | 58 | 7.8 | 16.7 | 25.8 | 519 | 1,590 |
| January | 168 | 7.8 | 35.8 | 55.4 | 1,110 | 3,410 |
| February | 196 | 18.8 | 51.5 | 79.7 | 1,440 | 4,430 |
| March | 205 | 11.5 | 46.4 | 71.8 | 1,440 | 4,410 |
| April | 550 | 10.0 | 82.3 | 127 | 2,470 | 7,580 |
| May | 50 | 9.3 | 18.4 | 28.5 | 570 | 1,750 |
| June | 24 | 6.8 | 11.3 | 17.5 | 340 | 1,040 |
| The year | 550 | 3.8 | 26.9 | 41.6 | 9,820 | 30,100 |
| 1918–19. | | | | | | |
| July | 150 | 5.8 | 27.9 | 43.2 | 864 | 2,650 |
| August | 52 | 6.6 | 18.0 | 27.9 | 558 | 1,710 |
| September | 20 | 4.8 | 7.65 | 11.8 | 229 | 704 |
| October | 99 | 3.8 | 13.4 | 20.7 | 416 | 1,270 |
| November | 295 | 6.4 | 28.0 | 43.3 | 839 | 2,580 |
| December | 168 | 9.1 | 34.7 | 53.7 | 1,080 | 3,300 |
| January | 30 | 6.6 | 10.7 | 16.6 | 333 | 1,020 |
| February | 17.5 | 5.5 | 8.45 | 13.1 | 237 | 726 |
| March | 30 | 5.2 | 11.0 | 17.0 | 342 | 1,050 |
| April | 33 | 4.1 | 8.37 | 13.0 | 251 | 771 |
| May | 17.8 | 4.4 | 7.61 | 11.8 | 236 | 724 |
| June | 13.8 | 3.4 | 5.52 | 8.54 | 166 | 508 |
| The year | 295 | 3.4 | 15.2 | 23.5 | 5,540 | 17,000 |

NOTE.—Record no good Feb. 21 to Mar. 26, 1917; intake stopped up. Clock stopped, Apr. 27 to May 20, 1917. Supply of paper exhausted July 11–18, 1918; no record and discharge estimated by comparison with Koaie Stream near Waimea, at 30 million gallons per day.

### KEKAHA DITCH AT CAMP NO. 1, NEAR WAIMEA, KAUAI.

LOCATION.—800 feet below intake and 85 feet below Kekaha Sugar Co.'s weir, 8 miles by trail north of Waimea.

RECORDS AVAILABLE.—October 26, 1917, to June 30, 1919. Staff at flume No. 4, 1 mile below intake, February 25, 1916, to August 2, 1917; weir 85 feet above present site, November 8, 1907, to June 30, 1915.

GAGE.—Vertical staff; read by Manuel Arruda.

DISCHARGE MEASUREMENTS.—Made from upper end of covered section of ditch.

CHANNEL AND CONTROL.—Ditch about 9 feet wide cut in soft lava rock; straight for 100 feet above and below gage. Control is concrete-lined section of ditch and probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.35 feet several times during year (discharge, 62 million gallons per day, or 96 second-feet); water occasionally shut off.

1907–1919: Maximum stage recorded, 29½ inches on weir, April ,1910 (discharge, 66 million gallons per day, or 102 second-feet); water occasionally shut off.

DIVERSIONS.—Ditch diverts part of flow of Waimea River.

REGULATION.—By headgates.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation permanent. Rating curves well defined above 10 million gallons per day. Gage read to hundredths twice daily. Records good for all stages.

*Discharge measurements of Kekaha ditch at camp No. 1, near Waimea, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 16 | W. V. Hardy | 3.23 | 92 | 59 |
| Aug. 29 | .....do | 2.95 | 81 | 52 |
| Oct. 23 | .....do | 2.52 | 62 | 40 |
| Feb. 25 | .....do | 2.77 | 69 | 44.5 |
| Mar. 14 | Y. Masato | 3.35 | 98 | 64 |
| May 14 | S. Takabayashi | 2.38 | 47.5 | 30.5 |

*Daily discharge, in million gallons, of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 47 | 48 | 0 | 36 | 62 | 60 | 27 | 62 | 38 | 36 | 61 | 55 |
| 2 | 46 | 48 | 47 | 34 | 62 | 60 | 46 | 61 | 38 | 35 | 48 | 44 |
| 3 | 19 | 48 | 53 | 34 | 62 | 60 | 60 | 58 | 36 | 35 | 43 | 62 |
| 4 | 6 | 48 | 61 | 32 | 62 | 60 | 60 | 50 | 36 | 35 | 62 | 58 |
| 5 | 52 | 58 | 54 | 32 | 60 | 60 | 60 | 46 | 36 | 35 | 62 | 43 |
| 6 | 53 | 61 | 50 | 34 | 62 | 60 | 60 | 44 | 50 | 35 | 62 | 39 |
| 7 | 53 | 60 | 47 | 32 | 58 | 60 | 60 | 42 | 62 | 35 | 62 | 38 |
| 8 | 54 | 55 | 55 | 32 | 52 | 60 | 60 | 40 | 61 | 34 | 62 | 44 |
| 9 | 56 | 58 | 61 | 34 | 45 | 60 | 60 | 62 | 47 | 34 | 62 | 42 |
| 10 | 58 | 60 | 50 | 34 | 9 | 60 | 60 | 62 | 55 | 34 | 62 | 38 |
| 11 | 60 | 55 | 47 | 34 | 62 | 60 | 58 | 61 | 62 | 32 | 61 | 38 |
| 12 | 60 | 61 | 47 | 62 | 58 | 60 | 58 | 62 | 62 | 8 | 58 | 36 |
| 13 | 60 | 62 | 46 | 58 | 62 | 60 | 60 | 62 | 62 | 0 | 46 | 35 |
| 14 | 60 | 62 | 44 | 62 | 62 | 60 | 60 | 55 | 62 | 34 | 39 | 35 |
| 15 | 60 | 62 | 42 | 62 | 62 | 60 | 60 | 47 | 62 | 36 | 38 | 35 |
| 16 | 60 | 62 | 42 | 62 | 61 | 60 | 58 | 44 | 48 | 35 | 50 | 35 |
| 17 | 60 | 62 | 40 | 60 | 56 | 60 | 53 | 43 | 61 | 56 | 62 | 34 |
| 18 | 60 | 62 | 42 | 50 | 53 | 60 | 48 | 42 | 53 | 61 | 61 | 34 |
| 19 | 60 | 62 | 62 | 43 | 50 | 60 | 47 | 40 | 46 | 62 | 48 | 34 |
| 20 | 60 | 62 | 62 | 44 | 47 | 60 | 46 | 40 | 53 | 62 | 42 | 34 |
| 21 | 60 | 62 | 55 | 44 | 44 | 60 | 48 | 52 | 61 | 62 | 62 | 32 |
| 22 | 60 | 62 | 42 | 42 | 40 | 60 | 60 | 62 | 62 | 62 | 47 | 32 |
| 23 | 60 | 62 | 42 | 39 | 40 | 60 | 60 | 62 | 62 | 62 | 40 | 29 |
| 24 | 60 | 62 | 44 | 38 | 50 | 60 | 61 | 47 | 62 | 62 | 44 | 29 |
| 25 | 60 | 62 | 42 | 35 | 24 | 47 | 62 | 48 | 53 | 58 | 42 | 29 |
| 26 | 61 | 62 | 39 | 34 | 21 | 60 | 62 | 55 | 46 | 48 | 53 | 29 |
| 27 | 61 | 61 | 39 | 50 | 21 | 58 | 62 | 40 | 43 | 43 | 42 | 35 |
| 28 | 61 | 55 | 39 | 46 | 38 | 47 | 62 | 36 | 44 | 39 | 39 | 42 |
| 29 | 61 | 52 | 39 | 36 | 60 | 40 | 62 | ..... | 42 | 39 | 50 | 39 |
| 30 | 60 | 53 | 39 | 62 | 60 | 44 | 62 | ..... | 40 | 60 | 58 | 60 |
| 31 | 53 | 55 | ..... | 62 | ..... | 31 | 61 | ..... | 39 | ..... | 42 | ..... |

NOTE.—Flow for only part of day July 3, 4, Aug. 31, Nov. 9, 10, and Apr. 12.

*Monthly discharge of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July (29⅓ days) | 61 | 6 | 57.6 | 89.1 | 1,700 | 5,220 |
| August (30⅔ days) | 62 | 48 | 58.4 | 90.4 | 1,800 | 5,540 |
| September (29 days) | 62 | 39 | 47.3 | 73.2 | 1,370 | 4,210 |
| October | 62 | 32 | 43.8 | 67.8 | 1,360 | 4,170 |
| November (29⅘ days) | 62 | 9 | 51.7 | 80.0 | 1,500 | 4,620 |
| December | 60 | 31 | 57.0 | 88.2 | 1,770 | 5,420 |
| January | 62 | 27 | 56.9 | 88.0 | 1,760 | 5,410 |
| February | 62 | 36 | 50.9 | 78.8 | 1,420 | 4,370 |
| March | 62 | 36 | 51.1 | 79.1 | 1,580 | 4,860 |
| April (28½ days) | 62 | 8 | 44.9 | 69.5 | 1,270 | 3,890 |
| May | 62 | 38 | 51.9 | 80.3 | 1,610 | 4,940 |
| June | 62 | 29 | 39.0 | 60.3 | 1,170 | 3,590 |
| The year (360⅛ days) | 62 | 6 | 50.9 | 78.8 | 18,300 | 56,200 |

### KEKAHA DITCH BELOW TUNNEL No. 12, NEAR WAIMEA, KAUAI.[1]

LOCATION.—7½ miles below intake, 2 miles by trail from Waimea, and half a mile below diversion for Waimea domestic supply.

RECORDS AVAILABLE.—April 7, 1908, to June 30, 1914, and July 20, 1916, to June 30, 1919.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Channel cut in lava rock; fairly straight in vicinity of gage. Control is old wooden weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.00 feet March 1–2 (discharge, 53 million gallons per day, or 82 second-feet); minimum, water shut off occasionally.

1916–1918: Maximum stage recorded, 3.6 feet December 1, 1916 (discharge, 50 million gallons per day, or 77 second-feet[2]); minimum, water shut off occasionally.

DIVERSIONS.—Small amount is diverted above station for domestic supply and occasionally for irrigation of rice and taro.

REGULATION.—By headgates.

UTILIZATION.—For irrigation of sugar cane, rice, and taro and for domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Observer not reliable, did not read gage twice daily to hundredths as he was supposed to do and as his books show. Errors due to observer's incorrect record in book probably caused no large errors in results, except when ditch was shut down. Records good.

*Discharge measurements of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Jan. 20 | W. V. Hardy | 2.90 | 56 | 36 |
| Feb. 21 | do | 3.20 | 63 | 40.5 |
| Mar. 26 | Y. Masato | 3.05 | 54 | 35 |
| Apr. 11 | W. V. Hardy | 3.02 | 57 | 37 |
| May 5 | S. Takabayashi | 3.33 | 69 | 44.5 |

[1] Published as "Kekaha ditch at weir below tunnel No. 12, near Waimea, Kauai," in Water-Supply Paper 318 and as "Kekaha ditch at tunnel No. 12, near Waimea, Kauai," in Water-Supply Papers 336 and 430.

[2] Incorrectly published as 76 second-feet in Water-Supply Paper 485.

*Daily discharge, in million gallons, of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30 | 36 | 0 | 25 | 37 | 44 | 36 | 42 | 53 | 28 | 37 | 37 |
| 2 | 28 | 36 | 30 | 25 | 37 | 44 | 34 | 42 | 53 | 28 | 37 | 36 |
| 3 | ..... | 34 | 22 | 25 | 37 | 44 | 45 | 39 | 45 | 28 | 37 | 44 |
| 4 | ..... | 34 | 34 | 22 | 37 | 45 | 45 | 37 | 45 | 31 | 45 | 44 |
| 5 | 30 | 34 | 34 | 22 | 37 | 45 | 45 | 37 | 37 | 31 | 45 | 37 |
| 6 | 37 | 42 | 33 | 22 | 37 | 47 | 45 | 36 | 44 | 31 | 45 | 33 |
| 7 | 39 | 40 | 31 | 27 | 37 | 47 | 44 | 36 | 44 | 31 | 45 | 31 |
| 8 | 37 | 37 | 30 | 27 | 37 | 47 | 44 | 36 | 42 | 31 | 44 | 31 |
| 9 | 37 | 39 | 37 | 27 | ..... | 45 | 44 | 37 | 40 | 31 | 44 | 31 |
| 10 | 40 | 39 | 34 | 27 | ..... | 45 | 44 | 37 | 40 | 31 | 37 | 31 |
| 11 | 40 | 34 | 33 | 28 | 40 | 44 | 44 | 45 | 40 | 31 | 37 | 30 |
| 12 | 42 | 39 | 31 | 28 | 40 | 44 | 42 | 45 | 39 | 10 | 44 | 30 |
| 13 | 40 | 39 | 31 | 28 | 40 | 45 | 42 | 45 | 39 | 0 | 44 | 30 |
| 14 | 39 | 42 | 31 | 28 | 40 | 45 | 42 | 44 | 39 | 31 | 44 | 30 |
| 15 | 39 | 40 | 31 | 28 | 40 | 45 | 42 | 42 | 39 | 31 | 44 | 30 |
| 16 | 39 | 42 | 31 | 30 | 40 | 44 | 40 | 37 | 37 | 37 | 44 | 27 |
| 17 | 39 | 40 | 30 | 30 | 40 | 44 | 39 | 36 | 37 | 37 | 44 | 27 |
| 18 | 39 | 44 | 30 | 30 | 40 | 44 | 39 | 34 | 36 | 45 | 42 | 25 |
| 19 | 39 | 40 | 42 | 37 | 36 | 42 | 39 | 33 | 34 | 45 | 42 | 25 |
| 20 | 40 | 39 | 42 | 37 | 34 | 42 | 39 | 31 | 39 | 45 | 37 | 25 |
| 21 | 40 | 39 | 39 | 37 | 33 | 42 | 39 | 45 | 39 | 45 | 36 | 25 |
| 22 | 39 | 39 | 33 | 39 | 31 | 42 | 45 | 45 | 39 | 45 | 36 | 25 |
| 23 | 42 | 37 | 31 | 39 | 31 | 42 | 45 | 44 | 44 | 42 | 37 | 25 |
| 24 | 42 | 37 | 31 | 39 | 31 | 42 | 47 | 44 | 44 | 42 | 42 | 25 |
| 25 | 42 | 37 | 31 | 40 | 31 | 40 | 47 | 44 | 39 | 42 | 42 | 25 |
| 26 | 42 | 34 | 31 | 40 | 31 | 40 | 47 | 42 | 37 | 45 | 45 | 25 |
| 27 | 39 | 37 | 30 | 40 | 31 | 40 | 45 | 44 | 37 | 45 | 37 | 25 |
| 28 | 40 | 34 | 30 | 40 | 31 | 40 | 45 | 44 | 34 | 30 | 36 | 36 |
| 29 | 39 | 34 | 28 | 40 | 44 | 40 | 45 | ..... | 34 | 30 | 33 | 36 |
| 30 | 39 | 31 | 28 | 40 | 44 | 40 | 44 | ..... | 33 | 37 | 44 | 36 |
| 31 | 37 | 31 | ..... | 40 | ..... | 40 | 44 | ..... | 33 | ..... | 44 | ..... |

NOTE.—Discharge for July 3 and 4, Aug. 31, Sept. 1, Nov. 9 and 10, Apr. 12 and 13, estimated by comparison with station on Kekaha ditch below camp No. 1. Estimated discharge for July 3 and 4, 10 million gallons per day, and Nov. 9 and 10, 20 million gallons per day.

*Monthly discharge of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 42 | ..... | 36.6 | 56.6 | 1,140 | 3,480 |
| August | 44 | 31 | 37.4 | 57.9 | 1,160 | 3,560 |
| September (29 days) | 42 | ..... | 32.0 | 49.5 | 929 | 2,850 |
| October | 40 | 22 | 31.9 | 49.4 | 987 | 3,030 |
| November | 44 | ..... | 35.5 | 54.9 | 1,060 | 3,270 |
| December | 47 | 40 | 43.2 | 66.8 | 1,340 | 4,110 |
| January | 47 | 34 | 42.8 | 66.2 | 1,330 | 4,070 |
| February | 45 | 31 | 40.1 | 62.0 | 1,120 | 3,450 |
| March | 53 | 33 | 39.8 | 61.6 | 1,240 | 3,790 |
| April (29 days) | 45 | ..... | 35.0 | 54.2 | 1,020 | 3,110 |
| May | 45 | 33 | 41.0 | 63.4 | 1,270 | 3,900 |
| June | 44 | 25 | 30.6 | 47.3 | 917 | 2,820 |
| The year (363 days) | 53 | ..... | 37.2 | 57.6 | 13,500 | 41,400 |

### WAIMEA DITCH NEAR WAIMEA, KAUAI.

LOCATION.—1½ miles below intake, at lower portal of tunnel No. 22, 2½ miles north of Waimea, and 1 mile below old station.

RECORDS AVAILABLE.—November 4, 1911, to September 30, 1913, at old location at ditch intake, 1 mile above present location; February 28, 1916, to June 30, 1919, at present site.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from foot plank 10 feet below gage.

CHANNEL AND CONTROL.—Clean channel about 4 feet wide in solid rock.

EXTREMES OF DISCHARGE.—1916–1919: Maximum stage recorded, 1.40 feet at 5.15 a. m. June 3, 1919 (discharge, 7.5 million gallons per day, or 11.6 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch diverts from Waimea River.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined above 1 million gallons per day.

*Discharge measurements of Waimea ditch near Waimea, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Jan. 20 | W. V. Hardy | 0.76 | 3.8 | 2.5 |
| Feb. 28 | do | .95 | 5.5 | 3.6 |
| Mar. 26 | Y. Masato | .76 | 3.5 | 2.2 |
| May 15 | S. Takabayashi | .98 | 6.0 | 3.8 |

*Daily discharge, in million gallons, of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.3 | 3.6 | ..... | 3.0 | 4.8 | ..... | ..... | 1.9 | 4.0 | 3.0 | 6.4 | 5.0 |
| 2 | 3.3 | 3.4 | ..... | 2.7 | 3.6 | ..... | 1.0 | 2.6 | 4.0 | 3.4 | 5.0 | 4.4 |
| 3 | 3.6 | 3.6 | 4.6 | 2.3 | 3.6 | ..... | 1.1 | 2.7 | 4.2 | 3.6 | ..... | 6.8 |
| 4 | 4.0 | 3.6 | 4.4 | 2.0 | 2.7 | ..... | 3.0 | 2.3 | 4.0 | 4.4 | ..... | 6.8 |
| 5 | 2.6 | 4.0 | 4.0 | 2.0 | 3.0 | ..... | 1.3 | 2.6 | 4.0 | 4.6 | ..... | 5.2 |
| 6 | 4.4 | 4.4 | 3.9 | ..... | 3.2 | 2.6 | 1.8 | 2.6 | 4.4 | 4.8 | 4.8 | 3.6 |
| 7 | 5.2 | 4.6 | 3.6 | 2.3 | ..... | 1.8 | 1.2 | 2.3 | 4.2 | 4.2 | 5.5 | 3.2 |
| 8 | 4.8 | 4.8 | 3.6 | ..... | ..... | ..... | 1.3 | 2.5 | 3.4 | 4.4 | 6.6 | 3.3 |
| 9 | 3.6 | 4.8 | 4.4 | ..... | 3.0 | 1.0 | 1.1 | 3.2 | 2.6 | 4.2 | 5.5 | 3.9 |
| 10 | 5.2 | 4.8 | 4.0 | ..... | 4.0 | 1.1 | 1.1 | 3.0 | 2.5 | 4.4 | 6.4 | 3.2 |
| 11 | 5.0 | 4.8 | 3.3 | ..... | 3.0 | 1.8 | 1.1 | 3.0 | 2.5 | 4.6 | 5.7 | 3.0 |
| 12 | 4.2 | 5.0 | 3.4 | ..... | 4.2 | 1.8 | 1.5 | 3.2 | 2.0 | 5.0 | 5.5 | 3.0 |
| 13 | 3.3 | 5.5 | 3.3 | 4.4 | 3.4 | 2.0 | 4.0 | 2.7 | 2.3 | 6.2 | 4.0 | 3.0 |
| 14 | 4.2 | 5.7 | 2.3 | 4.8 | 3.6 | 2.1 | 3.2 | 2.6 | 2.1 | 3.4 | 3.2 | 3.0 |
| 15 | ..... | 5.0 | 3.3 | ..... | 3.4 | 2.0 | 3.4 | 3.3 | 2.5 | 3.0 | 3.3 | 2.7 |
| 16 | ..... | 4.6 | 3.0 | 3.0 | 3.3 | 1.6 | 3.2 | 3.4 | 2.7 | 3.9 | 3.4 | 2.7 |
| 17 | ..... | 5.0 | 3.0 | 4.2 | 3.0 | 1.9 | 3.0 | 3.2 | 3.0 | 5.0 | 6.6 | 3.0 |
| 18 | ..... | 4.8 | 3.0 | 3.6 | 2.7 | 2.7 | 2.7 | 2.3 | 2.6 | 4.8 | 6.8 | 3.0 |
| 19 | 2.7 | 4.4 | 5.0 | 3.3 | 2.6 | 3.6 | 3.0 | 3.0 | 2.6 | 6.2 | 5.0 | 3.0 |
| 20 | 3.2 | 4.6 | 4.2 | 3.4 | 2.7 | 4.0 | 3.0 | 3.3 | 2.6 | 6.2 | 4.8 | 3.0 |
| 21 | 3.6 | 5.0 | 3.9 | 3.6 | 2.7 | 3.4 | 3.0 | 3.4 | 3.0 | 6.2 | 4.2 | 3.0 |
| 22 | 3.9 | 4.6 | 4.2 | 3.3 | 3.0 | 2.3 | 4.2 | 4.2 | 3.6 | 6.4 | 5.2 | ..... |
| 23 | 4.8 | 4.6 | 4.0 | 3.9 | 3.0 | 2.6 | 3.3 | 4.0 | 3.6 | 5.0 | 3.6 | 3.4 |
| 24 | 4.6 | ..... | 3.9 | 3.9 | 3.2 | 3.3 | 2.6 | 4.0 | 3.2 | 5.2 | 4.6 | 3.3 |
| 25 | 4.8 | ..... | 3.6 | 3.6 | 4.8 | 4.4 | 3.0 | 3.9 | 2.7 | 5.0 | 4.8 | 3.3 |
| 26 | 4.8 | 4.4 | 3.6 | 3.6 | ..... | 3.6 | 2.5 | 4.0 | 3.0 | 3.6 | 5.2 | 2.5 |
| 27 | 4.4 | 4.0 | 3.6 | 3.6 | ..... | 3.6 | 1.8 | 3.9 | 2.7 | 3.0 | 5.0 | 2.1 |
| 28 | 3.9 | 4.0 | 3.3 | 4.0 | ..... | 3.0 | 1.8 | 3.6 | 3.3 | 3.6 | 3.4 | 2.7 |
| 29 | 4.0 | 3.9 | 3.3 | 3.9 | ..... | 1.1 | 2.1 | ..... | 3.6 | 3.9 | 4.4 | 3.4 |
| 30 | 4.0 | 4.0 | 3.2 | 4.8 | ..... | 1.0 | 1.5 | ..... | 3.4 | 4.4 | 5.9 | 4.0 |
| 31 | 3.6 | ..... | ..... | ..... | ..... | 1.3 | 1.3 | ..... | 3.2 | ..... | 5.0 | ..... |

NOTE.—No flow on days for which discharge is not given. Discharge interpolated for Mar. 30 and June 29.

*Monthly discharge of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July (27 days) | 5.2 | ..... | 4.04 | 6.25 | 109 | 335 |
| August (28 days) | 5.7 | ..... | 4.48 | 6.93 | 126 | 385 |
| September (28 days) | 5.0 | ..... | 3.68 | 5.69 | 103 | 316 |
| October (23 days) | 4.8 | ..... | 3.44 | 5.32 | 79.2 | 243 |
| November (23 days) | 4.8 | ..... | 3.33 | 5.15 | 76.5 | 235 |
| December (25 days) | 4.4 | ..... | 2.38 | 3.68 | 59.6 | 183 |
| January (30 days) | 4.2 | ..... | 2.27 | 3.51 | 68.1 | 209 |
| February | 4.2 | 1.9 | 3.10 | 4.80 | 86.7 | 266 |
| March | 4.4 | 2.0 | 3.15 | 4.87 | 97.5 | 300 |
| April | 6.4 | 3.0 | 4.52 | 6.99 | 136 | 416 |
| May (28 days) | 6.8 | ..... | 4.99 | 7.72 | 140 | 429 |
| June (29 days) | 6.8 | ..... | 3.53 | 5.46 | 102 | 314 |
| The year (360 days) | 6.8 | ..... | 3.29 | 5.09 | 1,180 | 3,630 |

### KAMENEHUNE DITCH NEAR WAIMEA, KAUAI.

LOCATION.—200 feet below wire suspension bridge across Waimea River, 2 miles above Waimea; reached by wagon road up right side of Waimea River.

RECORDS AVAILABLE.—October 9, 1911, to June 30, 1919.

GAGE.—Vertical staff on right bank; read by Miss Kikuyo Yokotake.

DISCHARGE MEASUREMENTS.—Made from plank.

CHANNEL AND CONTROL.—Straight for 50 feet above and 30 feet below gage; mud bottom. Stage-discharge relation affected by growth of grass and weeds in channel; current sluggish.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.98 feet at 6 a. m. August 4 (discharge, 12.1 million gallons per day, or 18.7 second feet); minimum stage recorded, 0.60 foot at 6 a. m. November 29 (discharge, 0.9 million gallons per day, or 1.4 second feet).

1911–1919: Maximum stage recorded August 4, 1918; ditch occasionally dry.

DIVERSIONS.—Diverts from Waimea River.

REGULATION.—By headgates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve poorly defined. Gage readings in observer's book to hundredths twice daily, but gage probably not read more than three times a week. Records poor.

*Discharge measurements of Kamenehune ditch near Waimea, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Jan. 20 | W. V. Hardy | 0.91 | 3.3 | 2.2 |
| Feb. 28 | ....do | .81 | 2.3 | 1.5 |
| Mar. 26 | Y. Masato | .84 | 2.8 | 1.8 |
| Apr. 11 | W. V. Hardy | .84 | 3.4 | 2.2 |
| May 5 | ....do | 1.06 | 5.5 | 3.6 |

*Daily discharge, in million gallons, of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.2 | 3.5 | 5.6 | 3.3 | 4.1 | 1.6 | 2.7 | 1.5 | 2.7 | 1.8 | 3.2 | 2.8 |
| 2 | 4.2 | 3.5 | 5.3 | 3.4 | 4.1 | 1.3 | 2.2 | 1.4 | 2.1 | 2.0 | 3.0 | 2.2 |
| 3 | 6.3 | 3.9 | 6.1 | 2.9 | 4.1 | 4.4 | 1.2 | 1.3 | 1.8 | 1.8 | 2.8 | 3.6 |
| 4 | 6.2 | 7.0 | 4.8 | 3.5 | 4.2 | 3.0 | 2.1 | 1.3 | 1.5 | 1.7 | 2.7 | 2.8 |
| 5 | 5.8 | 4.4 | 1.4 | 3.0 | 4.2 | 2.3 | 2.3 | 1.1 | 1.3 | 2.2 | 2.0 | 2.8 |
| 6 | 5.9 | 4.8 | 2.2 | 3.5 | 2.9 | 4.0 | 2.5 | 1.3 | 2.6 | 1.6 | 2.0 | 2.1 |
| 7 | 4.9 | 3.5 | 3.5 | 3.6 | 3.3 | 3.2 | 2.1 | 2.3 | 3.2 | 2.2 | 3.6 | 1.8 |
| 8 | 3.8 | 4.2 | 2.7 | 3.6 | 3.0 | 3.0 | 1.3 | 2.0 | 2.8 | 2.2 | 3.3 | 2.4 |
| 9 | 4.8 | 2.7 | 2.9 | 2.8 | 3.0 | 2.2 | 1.2 | 4.2 | 2.4 | 2.2 | 2.5 | 2.2 |
| 10 | 5.1 | 3.2 | 3.9 | 2.2 | 3.5 | 2.5 | 1.2 | 2.6 | 1.9 | 2.0 | 3.5 | 1.8 |
| 11 | 4.7 | 4.2 | 3.8 | 2.9 | 3.5 | 1.8 | 1.8 | 2.2 | 3.6 | 2.1 | 3.3 | 1.8 |
| 12 | 4.4 | 3.6 | 3.6 | 2.9 | 5.3 | 1.3 | 1.8 | 2.2 | 3.5 | 3.5 | 2.8 | 1.7 |
| 13 | 4.4 | 3.3 | 3.6 | 3.8 | 5.1 | 1.5 | 3.4 | 2.3 | 2.5 | 2.1 | 2.7 | 2.2 |
| 14 | 5.0 | 4.2 | 4.2 | 5.6 | 4.2 | 1.2 | 2.5 | 2.0 | 2.2 | 1.1 | 2.2 | 1.7 |
| 15 | 5.2 | 3.5 | 3.0 | 4.9 | 2.9 | 1.2 | 1.8 | 2.2 | 2.0 | 1.0 | 2.2 | 1.7 |
| 16 | 5.2 | 3.6 | 3.3 | 4.6 | 3.5 | 1.4 | 1.8 | 1.8 | 2.0 | 2.1 | 4.4 | 1.4 |
| 17 | 4.8 | 4.0 | 2.9 | 4.2 | 3.3 | 1.6 | 2.1 | 1.7 | 2.0 | 3.8 | 4.2 | 1.4 |
| 18 | 4.2 | 4.1 | 2.9 | 4.2 | 2.3 | 1.9 | 2.1 | 2.3 | 1.3 | 4.4 | 3.5 | 1.4 |
| 19 | 4.2 | 3.4 | 4.0 | 4.2 | 2.3 | 1.7 | 1.9 | 2.2 | 1.3 | 4.2 | 2.0 | 1.2 |
| 20 | 3.8 | 3.3 | 4.3 | 4.2 | 2.3 | 1.6 | 1.3 | 1.6 | 1.2 | 3.5 | 2.3 | 1.1 |
| 21 | 4.4 | 4.3 | 4.2 | 4.1 | 2.7 | 1.3 | 1.6 | 1.3 | 1.1 | 3.5 | 2.3 | 2.1 |
| 22 | 4.3 | 4.2 | 4.2 | 4.1 | 2.7 | 1.3 | 3.5 | 3.2 | 3.6 | 3.5 | 2.2 | 3.2 |
| 23 | 4.2 | 4.4 | 4.2 | 3.6 | 2.2 | 1.3 | 2.4 | 2.5 | 2.8 | 3.5 | 1.2 | 2.7 |
| 24 | 4.6 | 4.6 | 4.2 | 3.6 | 3.8 | 1.3 | 1.8 | 2.2 | 2.2 | 3.8 | 1.0 | 2.1 |
| 25 | 4.3 | 5.1 | 4.2 | 3.5 | 6.0 | 1.3 | 1.8 | 1.6 | 2.2 | 2.9 | 1.3 | 2.0 |
| 26 | 4.3 | 4.2 | 4.2 | 3.5 | 4.7 | 1.2 | 1.6 | 2.1 | 1.8 | 2.8 | 1.6 | 1.7 |
| 27 | 4.2 | 4.1 | 4.1 | 3.5 | 3.8 | 1.1 | 1.5 | 1.4 | 1.7 | 2.6 | 1.4 | 2.1 |
| 28 | 4.2 | 3.6 | 2.9 | 3.5 | 2.3 | 2.4 | 1.4 | 1.8 | 1.4 | 3.3 | .9 | 1.8 |
| 29 | 4.2 | 3.5 | 3.5 | 3.3 | 1.3 | 3.9 | 1.6 | ..... | 1.2 | 3.0 | 2.3 | 2.1 |
| 30 | 4.2 | 2.9 | 3.3 | 4.4 | 1.7 | 4.2 | 1.6 | ..... | 2.7 | 2.8 | 2.2 | 2.0 |
| 31 | 2.9 | 4.8 | ..... | 4.4 | ..... | 2.8 | 1.1 | ..... | 2.2 | ..... | 1.9 | ..... |

*Monthly discharge of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 6.3 | 2.9 | 4.61 | 7.13 | 143 | 439 |
| August | 7.0 | 2.7 | 3.99 | 6.17 | 124 | 380 |
| September | 6.1 | 1.4 | 3.77 | 5.83 | 113 | 347 |
| October | 5.6 | 2.2 | 3.70 | 5.72 | 115 | 352 |
| November | 6.0 | 1.3 | 3.41 | 5.28 | 102 | 314 |
| December | 4.4 | 1.1 | 2.09 | 3.23 | 64.8 | 199 |
| January | 3.5 | 1.1 | 1.91 | 2.96 | 59.2 | 182 |
| February | 4.2 | 1.1 | 1.99 | 3.08 | 55.6 | 171 |
| March | 3.6 | 1.1 | 2.15 | 3.33 | 66.8 | 205 |
| April | 4.4 | 1.0 | 2.64 | 4.08 | 79.2 | 243 |
| May | 4.4 | .9 | 2.47 | 3.82 | 76.5 | 235 |
| June | 3.6 | 1.1 | 2.06 | 3.19 | 61.9 | 190 |
| The year | 7.0 | .9 | 2.91 | 4.50 | 1,060 | 3,260 |

### HANAPEPE RIVER AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—Immediately below junction with Manuahi Stream, 500 feet below siphon at Koula, and 5 miles north of Eleele.

RECORDS AVAILABLE.—May 13, 1917, to June 30, 1919. August 18, 1910, to December 15, 1916, at old site half a mile above present gage.

GAGE.—Vertical staff gage read by D. E. Horner. Friez water-stage recorder at old site carried away by flood of December 18, 1916.

DISCHARGE MEASUREMENTS.—Made by wading at gage.

CHANNEL AND CONTROL.—Boulders and gravel; shifting in floods. One channel at all stages; straight for 1,200 feet above and 300 feet below station. Left bank high and steep; right bank low and sloping; subject to overflow at high stages. Both banks covered with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.0 feet at 11 a. m. November 25 (discharge, 1,660 million gallons per day, or 2,570 second-feet); minimum stage recorded, 0.59 foot April 8–10 (discharge, 13 million gallons per day, or 20 second-feet).

1910–1919: Maximum stage at old station above inflow of Manuahi Stream occurred December 18, 1916 (water-stage recorder and shelter carried away by flood and stage not recorded, discharge in excess of 5,000 million gallons per day); minimum stage recorded, 0.95 foot December 30 and 31, 1913 (discharge, 7.1 million gallons per day, or 11 second-feet).

DIVERSIONS.—Hanapepe ditch and a small ditch for irrigation of rice divert part of flow above station.

REGULATION.—By diversions only.

UTILIZATION.—Part of flow diverted for irrigation of sugar cane, rice, and taro.

ACCURACY.—Stage-discharge relation not permanent, but shifts confined within narrow limits. Rating curve fairly well defined between 10 and 200 million gallons per day.

*Discharge measurements of Hanapepe River at Koula, near Eleele, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 2 | W. V. Hardy | 1.38 | 113 | 73 |
| Aug. 4 | do | 1.26 | 84 | 55 |
| Sept. 20 | do | .88 | 41 | 26.5 |
| Jan. 30 | do | .64 | 21.7 | 14.0 |
| Feb. 27 | do | .68 | 23.3 | 15.1 |
| Mar. 25 | Y. Masato | .66 | 20.2 | 13.1 |
| Apr. 10 | W. V. Hardy | .62 | 24.0 | 15.5 |
| May 19 | S. Takahayashi | .66 | 28.5 | 18.4 |

*Daily discharge, in million gallons, of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14.8 | 30 | 20 | 21 | 39 | 56 | 45 | 18.0 | 34 | 14.0 | 15.8 | 19.0 |
| 2 | 15.8 | 24 | 26 | 21 | 54 | 55 | 30 | 21 | 17.1 | 13.5 | 15.3 | 15.8 |
| 3 | 29 | 24 | 23 | 20 | 54 | 104 | 23 | 15.8 | 20 | 13.5 | 15.3 | 18.0 |
| 4 | 14.4 | 52 | 20 | 20 | 34 | 116 | 22 | 17.1 | 15.8 | 14.4 | 14.8 | 17.1 |
| 5 | 50 | 104 | 16.6 | 63 | 104 | 110 | 21 | 15.8 | 14.8 | 13.5 | 14.8 | 14.4 |
| 6 | 33 | 41 | 16.2 | 26 | 45 | 110 | 21 | 15.8 | 56 | 14.4 | 13.5 | 15.8 |
| 7 | 72 | 37 | 26 | 24 | 30 | 130 | 21 | 15.3 | 77 | 13.5 | 14.4 | 15.8 |
| 8 | 17.1 | 34 | 63 | 24 | 31 | 300 | 21 | 14.4 | 22 | 13.2 | 13.5 | 17.1 |
| 9 | 38 | 25 | 30 | 25 | 110 | 79 | 20 | 14.0 | 22 | 13.2 | 300 | 47 |
| 10 | 400 | 24 | 67 | 24 | 58 | 890 | 20 | 13.5 | 45 | 13.2 | 23 | 26 |
| 11 | 300 | 23 | 39 | 34 | 82 | 123 | 22 | 63 | 47 | 13.5 | 63 | 15.3 |
| 12 | 98 | 34 | 38 | 34 | 60 | 82 | 23 | 98 | 58 | 13.5 | 26 | 14.4 |
| 13 | 155 | 280 | 93 | 40 | 50 | 64 | 63 | 93 | 37 | 13.5 | 18.0 | 18.0 |
| 14 | 164 | 155 | 24 | 74 | 138 | 58 | 24 | 41 | 37 | 13.5 | 15.8 | 20 |
| 15 | 69 | 53 | 19.0 | 58 | 138 | 50 | 22 | 39 | 26 | 15.8 | 14.4 | 18.0 |
| 16 | 88 | 93 | 18.0 | 110 | 33 | 45 | 22 | 39 | 18.0 | 20 | 29 | 18.0 |
| 17 | 43 | 312 | 23 | 43 | 34 | 47 | 21 | 41 | 17.1 | 23 | 28 | 20 |
| 18 | 155 | 50 | 26 | 32 | 29 | 55 | 21 | 41 | 22 | 24 | 15.8 | 17.1 |
| 19 | 75 | 82 | 47 | 47 | 28 | 63 | 16.2 | 68 | 18.0 | 58 | 16.6 | 14.4 |
| 20 | 68 | 130 | 23 | 66 | 26 | 50 | 15.8 | 73 | 93 | 400 | 16.2 | 20 |
| 21 | 61 | 56 | 19.0 | 138 | 23 | 41 | 15.8 | 173 | 24 | 48 | 15.8 | 15.8 |
| 22 | 61 | 76 | 17.1 | 47 | 23 | 37 | 20 | 220 | 23 | 40 | 14.4 | 14.8 |
| 23 | 37 | 98 | 22 | 40 | 23 | 31 | 20 | 26 | 17.1 | 164 | 18.0 | 14.4 |
| 24 | 191 | 50 | 16.6 | 31 | 146 | 30 | 18.0 | 23 | 15.8 | 40 | 34 | 13.5 |
| 25 | 65 | 82 | 16.6 | 27 | 980 | 31 | 15.8 | 20 | 15.8 | 23 | 16.2 | 20 |
| 26 | 270 | 39 | 15.8 | 26 | 110 | 29 | 15.8 | 18.0 | 15.8 | 22 | 15.8 | 138 |
| 27 | 65 | 31 | 15.8 | 26 | 77 | 26 | 15.8 | 18.0 | 15.3 | 20 | 14.8 | 123 |
| 28 | 41 | 26 | 20 | 26 | 65 | 37 | 15.3 | 15.8 | 14.8 | 15.3 | 18.0 | 41 |
| 29 | 55 | 23 | 15.8 | 24 | 61 | 41 | 14.8 | ..... | 14.4 | 15.8 | 33 | 26 |
| 30 | 38 | 58 | 27 | 24 | 59 | 30 | 15.8 | ..... | 14.4 | 15.8 | 15.8 | 22 |
| 31 | 82 | 20 | ..... | 130 | ..... | 58 | 15.3 | ..... | 14.4 | ..... | 37 | ..... |

*Monthly discharge of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 400 | 14.4 | 92.4 | 143 | 2,870 | 8,790 |
| August | 312 | 20 | 69.9 | 108 | 2,170 | 6,650 |
| September | 93 | 15.8 | 28.1 | 43.5 | 844 | 2,590 |
| October | 138 | 20 | 43.4 | 67.1 | 1,340 | 4,130 |
| November | 980 | 23 | 91.5 | 142 | 2,740 | 8,420 |
| December | 890 | 26 | 96.1 | 149 | 2,980 | 9,140 |
| January | 63 | 14.8 | 21.8 | 33.7 | 676 | 2,070 |
| February | 220 | 13.5 | 45.4 | 70.2 | 1,270 | 3,900 |
| March | 93 | 14.4 | 28.4 | 43.9 | 882 | 2,700 |
| April | 400 | 13.2 | 37.8 | 58.5 | 1,140 | 3,480 |
| May | 300 | 13.5 | 29.5 | 45.6 | 916 | 2,810 |
| June | 138 | 13.5 | 27.0 | 41.8 | 810 | 2,490 |
| The year | 980 | 13.2 | 51.0 | 78.9 | 18,600 | 57,200 |

### HANAPEPE DITCH AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—At first flume below siphon at Koula, 4 miles below intake and 4½ miles north of Eleele.

RECORDS AVAILABLE.—January 25, 1910, to June 30, 1919.

GAGE.—Vertical staff; read by D. E. Horner.

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Wooden flume; straight for 50 feet and above and 100 feet below gage; some vegetal growth on bottom and sides of flume. Control fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.14 feet at 7.10 a. m. July 5 (discharge, 34 million gallons per day, or 53 second-feet); minimum, ditch occasionally dry.

Maximum stage recorded during period of record [1] 3.20 feet at 7 a. m. April 10, 1918 (discharge, 36 million gallons per day, or 56 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of Hanapepe River.

REGULATION.—By headgates.

UTILIZATION.—For domestic supply and for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths once daily. Records fair.

*Discharge measurements of Hanapepe ditch at Koula, near Eleele, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 20 | W. V. Hardy | 2.97 | 49.5 | 32 |
| Dec. 1 | D. E. Horner | .94 | 12.0 | 7.6 |
| 8 | do | 1.96 | 30 | 19.5 |
| Jan. 30 | W. V. Hardy | 2.20 | 33.5 | 21.6 |
| Feb. 27 | do | 2.61 | 41.5 | 26.5 |
| Mar. 25 | Y. Masato | 2.50 | 35.5 | 23.1 |
| Apr. 10 | W. V. Hardy | 2.19 | 33 | 21.4 |
| May 19 | S. Takabayashi | 2.26 | 35.5 | 22.9 |

*Daily discharge, in million gallons, of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 29 | 32 | 32 | 28 | 33 | 7.2 | 7.8 | 24 | 28 | 24 | 24 | 27 |
| 2 | 28 | 32 | 33 | 28 | 33 | 7.2 | 24 | 29 | 25 | 24 | 24 | 24 |
| 3 | 33 | 32 | 33 | 27 | 32 | ..... | 22 | 24 | 28 | 24 | 24 | 25 |
| 4 | 31 | 32 | 32 | 27 | 32 | ..... | 22 | 24 | 25 | 24 | 24 | 23 |
| 5 | 34 | 33 | 32 | 32 | 33 | ..... | 22 | 24 | 25 | 24 | 23 | 22 |
| 6 | 33 | 33 | 32 | 28 | 32 | 7 | 22 | 23 | 30 | 24 | 22 | 23 |
| 7 | 33 | 33 | 32 | 27 | 32 | 16.4 | 21 | 23 | 32 | 23 | 23 | 22 |
| 8 | 33 | 33 | 33 | 28 | 31 | 18.2 | 20 | 22 | 32 | 23 | 23 | 22 |
| 9 | 33 | 32 | 33 | 26 | 31 | 22 | 20 | 22 | 28 | 23 | 32 | 24 |
| 10 | 33 | 33 | 33 | 27 | 33 | 20 | 22 | 22 | 32 | 22 | 31 | 28 |
| 11 | 33 | 33 | 33 | 27 | 32 | 12.8 | 23 | 29 | 32 | 23 | 31 | 24 |
| 12 | 33 | 33 | 32 | 33 | 32 | 13.8 | 22 | ..... | 32 | 22 | 30 | 22 |
| 13 | 33 | 33 | 32 | 31 | 19 | 12.8 | 26 | ..... | 32 | 22 | 27 | 24 |
| 14 | 33 | 33 | 33 | 32 | 23 | 12.8 | 23 | ..... | 32 | 22 | 25 | 26 |
| 15 | 33 | 33 | 32 | 33 | ..... | 12.8 | 20 | ..... | 31 | 22 | 24 | 24 |
| 16 | 32 | 33 | 32 | 33 | 12 | 12.8 | 20 | ..... | 28 | 27 | 29 | 24 |
| 17 | 32 | 33 | 32 | 32 | 10 | 12.8 | 19.6 | ..... | 28 | 28 | 30 | 25 |
| 18 | 32 | 32 | 33 | 31 | 29 | 16.4 | 23 | ..... | 28 | 30 | 28 | 27 |
| 19 | 32 | 33 | 32 | 32 | 28 | 17.6 | 23 | ..... | 27 | 32 | 23 | 24 |
| 20 | 32 | 33 | 32 | 32 | 27 | 17.6 | 24 | ..... | 32 | 32 | 23 | 23 |
| 21 | 33 | 33 | 32 | 32 | 27 | 20 | 24 | 22 | 32 | 32 | 22 | 22 |
| 22 | 33 | 33 | 29 | 32 | 27 | 23 | 24 | 28 | 32 | 32 | 22 | 22 |
| 23 | 32 | 33 | 32 | 32 | 26 | 22 | 28 | 27 | 28 | 32 | 23 | 22 |
| 24 | 33 | 33 | 31 | 31 | 32 | 24 | 24 | 29 | 28 | 32 | 28 | 22 |
| 25 | 33 | 32 | 31 | 31 | 33 | 23 | 24 | 29 | 26 | 30 | 23 | 23 |
| 26 | 33 | 32 | 28 | 32 | ..... | 22 | 24 | 28 | 25 | 28 | 24 | 28 |
| 27 | 33 | 32 | 28 | 31 | ..... | 21 | 24 | 25 | 25 | 28 | 22 | 29 |
| 28 | 33 | 32 | 28 | 29 | ..... | 23 | 24 | 24 | 24 | 28 | 23 | 29 |
| 29 | 32 | 32 | 27 | 29 | ..... | 19.6 | 24 | ..... | 24 | 25 | 28 | 28 |
| 30 | 32 | 19 | 31 | 28 | ..... | 25 | 24 | ..... | 24 | 25 | 24 | 28 |
| 31 | 32 | 32 | ..... | 33 | ..... | ..... | 23 | ..... | 24 | ..... | 24 | ..... |

NOTE.—Flow for only part of day, Nov. 13, 14, 16, 17, and Dec. 6. No flow on days for which discharge is not given.

[1] Supersedes erroneous figures published in Water-Supply Papers 430, 445, 465, and 485.

*Monthly discharge of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 34 | 28 | 32.4 | 50.1 | 1,000 | 3,080 |
| August | 33 | 19 | 32.2 | 49.8 | 997 | 3,060 |
| September | 33 | 27 | 31.5 | 48.7 | 945 | 2,900 |
| October | 33 | 26 | 30.1 | 46.6 | 934 | 2,860 |
| November (22⅞ days) | 33 | 10 | 30.8 | 47.7 | 679 | 2,080 |
| December (26⅛ days) | 25 | 7 | 17.5 | 27.1 | 463 | 1,420 |
| January | 28 | 7.8 | 22.4 | 34.7 | 693 | 2,130 |
| February (19 days) | 29 | 22 | 25.2 | 39.0 | 478 | 1,470 |
| March | 32 | 24 | 28.4 | 43.9 | 879 | 2,700 |
| April | 32 | 22 | 26.2 | 40.5 | 787 | 2,410 |
| May | 32 | 22 | 25.3 | 39.1 | 783 | 2,410 |
| June | 29 | 22 | 24.5 | 37.9 | 736 | 2,260 |
| The year (343⅛ days) | 34 | 7 | 27.3 | 42.2 | 9,370 | 28,800 |

### MANUAHI STREAM AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—100 feet above confluence with Hanapepe River at Koula, 5 miles north of Eleele.

RECORDS AVAILABLE.—May 13, 1917, to June 30, 1919.

GAGE.—Vertical staff; read by D. E. Horner.

DISCHARGE MEASUREMENTS.—Made by wading at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage. Banks slope gently. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.80 feet at 10 a. m. December 10 (discharge, 204 million gallons per day, or 316 second-feet); minimum stage, 0.20 foot June 24 (discharge, 0.05 million gallons per day, or 0.08 second-foot).

1917–1919: Maximum stage recorded, 3.60 feet[1] at 5 p. m. March 11, 1918 (discharge, 350 million gallons per day, or 542 second-feet); minimum stage recorded in June, 1919.

DIVERSIONS.—No diversions above junction with Hanapepe River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined above 0.3 million gallons per day. Gage read to hundredths twice daily. Records fair.

*Discharge measurements of Manuahi Stream at Koula, near Eleele, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 1 | W. V. Hardy | 0.76 | 3.7 | 2.4 |
| Sept. 20 | do | .66 | 2.7 | 1.75 |
| Dec. 1 | D. E. Horner | .82 | 6.7 | 4.3 |
| 8 | do | 1.52 | 48 | 30.5 |
| Jan. 30 | W. V. Hardy | .41 | .65 | .4 |
| Feb. 27 | do | .54 | 1.5 | 1.0 |
| Mar. 25 | Y. Masato | .53 | 1.6 | 1.05 |
| Apr. 10 | W. V. Hardy | .35 | .35 | .2 |
| May 19 | S. Takabayashi | .43 | .9 | .6 |

[1] Determination of maximum discharge supersedes the figure published in Water-Supply Paper 485 and is based on a revision of the rating curve.

*Daily discharge, in million gallons, of Manuahi Stream at Koula, near Eleele, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.6 | 2.7 | 1.6 | 1.1 | 4.8 | 3.9 | 1.6 | 0.6 | 0.6 | 0.5 | 0.3 | 0.6 |
| 2 | .5 | 2.3 | 2.0 | .9 | 5.4 | 3.0 | 1.4 | .6 | .6 | .5 | .3 | .8 |
| 3 | 1.1 | 2.0 | 2.3 | .8 | 4.4 | 18.2 | 1.4 | .6 | .9 | .4 | .3 | 1.1 |
| 4 | .9 | 3.0 | 1.4 | .6 | 3.5 | 5.4 | 1.4 | .6 | .6 | .4 | .3 | .4 |
| 5 | 16.2 | 14.2 | 1.2 | .6 | 9.3 | 2.9 | 1.3 | .5 | .6 | .3 | .3 | .4 |
| 6 | 3.1 | 4.4 | 1.0 | .6 | 3.9 | 3.0 | 1.2 | .5 | 4.4 | .4 | .3 | .3 |
| 7 | 5.4 | 2.3 | .8 | .6 | 2.3 | 9.3 | 1.2 | .5 | 9.0 | .3 | .3 | .3 |
| 8 | 2.0 | 3.1 | 5.4 | .6 | 2.3 | 26 | 1.0 | .4 | 1.4 | .3 | .2 | .3 |
| 9 | 1.8 | 1.9 | 1.6 | .6 | 12.8 | 9.3 | 1.0 | .4 | 1.1 | .3 | .3 | .3 |
| 10 | 55 | 1.9 | 1.2 | .6 | 2.9 | 156 | 1.0 | .4 | 3.0 | .3 | 2.3 | .2 |
| 11 | 74 | 1.8 | 2.1 | .6 | 9.9 | 26 | 1.1 | .6 | 2.9 | .3 | 2.9 | .2 |
| 12 | 18.2 | 1.8 | 1.3 | 1.3 | 9.6 | 9.3 | 1.2 | 5.0 | 15.0 | .3 | 1.1 | .2 |
| 13 | 23 | 13.9 | 2.3 | 1.8 | 5.6 | 9.0 | 1.4 | 2.3 | 4.4 | .3 | .8 | .2 |
| 14 | 16.2 | 27 | 1.6 | 9.6 | 5.4 | 5.9 | 1.4 | 1.1 | 3.5 | .3 | .6 | .2 |
| 15 | 11.5 | 14.2 | 1.2 | 8.4 | 3.5 | 4.8 | 1.3 | 1.0 | 1.8 | .2 | .5 | .2 |
| 16 | 7.3 | 8.4 | 1.3 | 14.6 | 2.9 | 4.3 | 1.0 | .8 | 1.8 | .3 | .5 | .2 |
| 17 | 6.1 | 5.4 | 1.1 | 4.6 | 2.3 | 3.5 | .9 | .6 | 1.4 | .4 | .4 | .2 |
| 18 | 4.8 | 4.4 | 1.1 | 2.5 | 2.1 | 4.8 | .8 | .4 | 1.8 | .4 | .3 | .2 |
| 19 | 4.3 | 12.2 | 1.7 | 2.5 | 1.8 | 4.4 | .8 | 1.4 | 1.4 | .4 | .5 | .1 |
| 20 | 5.4 | 11.8 | 1.6 | 2.7 | 1.8 | 3.0 | .6 | .8 | 10.8 | .6 | .4 | .2 |
| 21 | 6.8 | 6.6 | 1.1 | 3.9 | 1.5 | 2.7 | 1.1 | 2.3 | 2.1 | 1.1 | .3 | .1 |
| 22 | 4.8 | 9.3 | .9 | 2.7 | 1.3 | 2.1 | 1.1 | 12.5 | 1.8 | 1.8 | .2 | .1 |
| 23 | 3.5 | 9.3 | .9 | 2.3 | 1.3 | 1.4 | .8 | 2.9 | 1.3 | 3.5 | .2 | .1 |
| 24 | 16.2 | 5.2 | .9 | 1.8 | 6.6 | 1.3 | .6 | 1.1 | .9 | 2.1 | .2 | .05 |
| 25 | 7.3 | 6.8 | .7 | 1.6 | 156 | 1.4 | .6 | 9.9 | .9 | 1.1 | .2 | .1 |
| 26 | 28 | 3.5 | .7 | 1.3 | 18.2 | 1.4 | .6 | 2.0 | .9 | .9 | .2 | .1 |
| 27 | 13.9 | 2.5 | .7 | 1.2 | 12.2 | 1.3 | .6 | 1.0 | .8 | .7 | .2 | 2.8 |
| 28 | 6.6 | 2.1 | .6 | 1.3 | 9.3 | 1.8 | .6 | .7 | .7 | .6 | .2 | 3.3 |
| 29 | 6.6 | 1.8 | .6 | 1.0 | 7.8 | 4.4 | .5 | ..... | .6 | .6 | .2 | 2.5 |
| 30 | 3.7 | 1.7 | 1.5 | .9 | 5.4 | 2.9 | .5 | ..... | .6 | .4 | .7 | 1.3 |
| 31 | 3.4 | 2.1 | ..... | 18.2 | ..... | 2.1 | .5 | ..... | .6 | ..... | .8 | ..... |

*Monthly discharge of Manuahi Stream at Koula, near Eleele, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 74 | 0.5 | 11.6 | 17.9 | 358 | 1,100 |
| August | 27 | 1.7 | 6.12 | 9.47 | 190 | 582 |
| September | 5.4 | .6 | 1.44 | 2.23 | 43.3 | 133 |
| October | 18.2 | .6 | 2.96 | 4.58 | 91.8 | 282 |
| November | 156 | 1.3 | 10.5 | 16.2 | 316 | 967 |
| December | 156 | 1.3 | 10.8 | 16.7 | 335 | 1,030 |
| January | 1.6 | .5 | .98 | 1.52 | 30.5 | 93 |
| February | 12.5 | .4 | 1.84 | 2.85 | 51.5 | 158 |
| March | 15.0 | .6 | 2.52 | 3.90 | 78.2 | 240 |
| April | 3.5 | .2 | .67 | 1.04 | 20.0 | 62 |
| May | 2.9 | .2 | .53 | .82 | 16.3 | 50 |
| June | 3.3 | .05 | .57 | .88 | 17.0 | 52 |
| The year | 156 | .05 | 4.24 | 6.56 | 1,550 | 4,750 |

### SOUTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

LOCATION.—Two-thirds mile above Waiehu Falls at original location; moved one-third mile downstream on November 18, 1918; 7 miles northeast of Lihue.

RECORDS AVAILABLE.—December 10, 1911, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder November 19, 1918, to June 30, 1919; Friez water-stage recorder December 10, 1911, to November 8, 1918.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Old location: One channel at all stages; straight for 600 feet above and below station; right bank steep and high, left bank slopes gently. Control composed of gravel and small boulders; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year (new gage), 6.85 feet at 1.40 p. m. November 25 (discharge, 6,180 million gallons per day, or 9,560 second-feet); minimum stage recorded (old gage), 2.06 feet at 6 p. m. October 7 (discharge, 2.8 million gallons per day, or 4.3 second-feet).

1911–1919: Maximum stage recorded, 17.85 feet at 9.30 a. m. March 11, 1918 (discharge, estimated from extension of rating curve, 17,000 million gallons per day, or 26,400 second-feet); minimum stage recorded October 7, 1918.

DIVERSIONS.—Several diversions above station for irrigation and development of power.

REGULATION.—By diversions above station.

UTILIZATION.—Water going to waste, except a small amount used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent at both locations during year. Rating curve well defined between 15 and 5,000 million gallons per day and applicable July 1 to November 8. Rating curve well defined between 8 and 15,000 million gallons per day, and applicable November 19 to June 30. Operation of Friez water-stage recorder satisfactory, except for short period given in footnote to table of daily discharge. Operation of Stevens continuous water-stage recorder unsatisfactory.

*Discharge measurements of South Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 12 | W. V. Hardy | 3.99 | 191 | ● 123 |
| Aug. 27 | do | 3.36 | 84 | 54 |
| Oct. 15 | do | 3.00 | 47 | 30.5 |
| 28 | do | 2.90 | 41 | 26.5 |
| Nov. 23 | do | 2.82 | 29 | 18.6 |
| 25 | do | 6.18 | 1,050 | 678 |
| 25 | do | 5.93 | 915 | 590 |
| 27 | do | 3.74 | 158 | 102 |
| Dec. 23 | do | 1.96 | 83 | 54 |
| Jan. 7 | do | 1.59 | 42 | 27.5 |
| Mar. 11 | Y. Masato | 1.88 | 74 | 48 |

*Daily discharge, in million gallons, of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 57 | 74 | 39 | 6.4 | 50 | ..... | ..... | 17.8 | ..... | 24 | 13.0 |
| 2 | 52 | 60 | 45 | 5.4 | 42 | ..... | ..... | 19.4 | ..... | 23 | 9.0 |
| 3 | 79 | 59 | 45 | 4.5 | 38 | ..... | ..... | 18.3 | ..... | 22 | 21 |
| 4 | 59 | 69 | 31 | 3.9 | 31 | ..... | ..... | 24 | ..... | 22 | 19.6 |
| 5 | 227 | 186 | 27 | 3.7 | 74 | ..... | ..... | 20 | 17.8 | 22 | 9.8 |
| 6 | 95 | 84 | 25 | 3.4 | 45 | 218 | ..... | 21 | 44 | 24 | 9.3 |
| 7 | 174 | 84 | 30 | 2.9 | 37 | 276 | 28 | 21 | 132 | 26 | 9.3 |
| 8 | 95 | 90 | 104 | 3.5 | 38 | 408 | 28 | 22 | 42 | 26 | 10.4 |
| 9 | 84 | 69 | 44 | 3.0 | ..... | 186 | 27 | 22 | 30 | 28 | 30 |
| 10 | 356 | 62 | 44 | 3.0 | ..... | 938 | 29 | 22 | 36 | 26 | 31 |
| 11 | 326 | 59 | 54 | 3.4 | ..... | 250 | 28 | 46 | 41 | 26 | 14.9 |
| 12 | 157 | 79 | 39 | 5.8 | ..... | 164 | 27 | 54 | 114 | 26 | 13.0 |
| 13 | 141 | 238 | 46 | 5.5 | ..... | ..... | 63 | 24 | 64 | 28 | 23 |
| 14 | 95 | 258 | 51 | 3.4 | ..... | ..... | 37 | 22 | 41 | 31 | 31 |
| 15 | 74 | 95 | 29 | 30 | ..... | ..... | 26 | ..... | 29 | 38 | 12.7 |
| 16 | 79 | 64 | 25 | 30 | ..... | ..... | 19.9 | ..... | 22 | 83 | 12.4 |
| 17 | 59 | 418 | 37 | 10.0 | ..... | ..... | 19.9 | ..... | 21 | 155 | 12.4 |
| 18 | ..... | 152 | 32 | 5.7 | ..... | ..... | 17.8 | ..... | 25 | 273 | 17.7 |
| 19 | ..... | 143 | 37 | 5.8 | ..... | ..... | 17.0 | ..... | 19.9 | ..... | 11.1 |
| 20 | ..... | 136 | 29 | 6.0 | 24 | ..... | 16.6 | ..... | 110 | ..... | 14.2 |
| 21 | 102 | 130 | 22 | 38 | 24 | ..... | 16.2 | ..... | 66 | ..... | 9.3 |
| 22 | 95 | 188 | 14.2 | 13.9 | 22 | ..... | 19.4 | ..... | 48 | ..... | 7.4 |
| 23 | 69 | 226 | 15.0 | 8.3 | 20 | ..... | 24 | ..... | 29 | ..... | 7.9 |
| 24 | 239 | ..... | 15.0 | 5.4 | 185 | ..... | 17.8 | ..... | 24 | ..... | 11.0 |
| 25 | 100 | ..... | 14.2 | 3.6 | 1,000 | ..... | 16.2 | ..... | 23 | ..... | 15.0 |
| 26 | 183 | ..... | 11.8 | 4.8 | ..... | ..... | 16.2 | ..... | 23 | ..... | 39 |
| 27 | 100 | 54 | 12.2 | 8.1 | ..... | ..... | 16.6 | ..... | 22 | ..... | 62 |
| 28 | 69 | 47 | 10.1 | 3.7 | ..... | ..... | 16.2 | ..... | 22 | ..... | 33 |
| 29 | 100 | 50 | 7.2 | 17.0 | ..... | ..... | 17.4 | ..... | 23 | ..... | 33 |
| 30 | 84 | 45 | 8.0 | 38 | ..... | ..... | 17.0 | ..... | 24 | ..... | 17.8 |
| 31 | 84 | 46 | ..... | 208 | ..... | ..... | 17.4 | ..... | 24 | ..... | ..... |

NOTE.—Water-stage recorder not operating and mean discharge estimated, July 18–20, 90 million gallons per day; Aug. 24–26, 100 million gallons per day. Intake stopped up and record valueless Nov. 26 to Dec. 5 and Dec. 13–23. Clock stopped Dec. 24 to Jan. 6, Feb. 15 to Mar. 4, and Apr. 19 to May 31.

*Monthly discharge of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum | Mean. | | | |
| July | 356 | 52 | 119 | 184 | 3,700 | 11,300 |
| August | 418 | 45 | 115 | 178 | 3,560 | 10,900 |
| September | 104 | 7.2 | 31.4 | 48.6 | 943 | 2,890 |
| October | 208 | 2.9 | 15.9 | 24.6 | 494 | 1,510 |
| June | 62 | 7.4 | 18.7 | 28.9 | 560 | 1,720 |

### HANAMAULU DITCH NEAR LIHUE, KAUAI.

LOCATION.—In flume 180 feet below point where Kauai Electric Co.'s power line crosses South Fork of Wailua River, 6 miles northwest of Lihue.

RECORDS AVAILABLE.—July 1, 1910, to June 30, 1919.

GAGE.—Vertical staff; read by S. Koike. New datum September 30, 1911.

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Wooden flume; straight for 20 feet above and 25 feet below gage. Control is rock section and tunnel at end of flume; permanent, except for débris which occasionally lodges in ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.84 feet at 3.20 p. m. August 17 (discharge, 28 million gallons per day, or 43 second-feet); minimum stage recorded, 0.82 foot at 6 a. m. December 14 (discharge, 3.1 million gallons per day, or 4.8 second-feet).

1910–1919: Maximum stage recorded, 2.80 feet August 6, 1913 (discharge, 36 million gallons per day, or 56 second-feet); ditch occasionally dry.

DIVERSIONS.—Ditch diverts part of flow of South Fork of Wailua River.

REGULATION.—By headgates.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Gage read to hundredths once daily. Records fair.

*Discharge measurements of Hanamaulu ditch near Lihue, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Nov. 24 | W. V. Hardy | 2.54 | 30.5 | 19.7 |
| 24 | do | 1.88 | 21.4 | 13.8 |
| 24 | do | 2.16 | 28 | 18.0 |
| 24 | do | 2.59 | 37.5 | 24.3 |
| Dec. 22 | do | 1.76 | 17.0 | 11.0 |
| 22 | do | 1.60 | 13.9 | 9.0 |
| 22 | do | 1.32 | 10.8 | 7.0 |
| Mar. 12 | Y. Masato | 2.62 | 36.5 | 23.5 |

*Daily discharge, in million gallons, of Hanamaulu ditch near Lihue, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18.2 | 20 | 20 | 21 | 23 | 4.3 | 12.6 | 16.0 | 19.0 | 16.8 | 20 | 16.8 |
| 2 | 20 | 20 | 21 | 22 | 22 | 4.0 | 12.0 | 16.8 | 22 | 16.8 | 19.5 | 16.0 |
| 3 | 20 | 20 | 21 | 22 | 22 | 5.8 | 12.0 | 14.6 | 22 | 16.0 | 19.5 | 18.2 |
| 4 | 21 | 20 | 20 | 21 | 23 | 5.0 | 12.0 | 14.6 | 20 | 16.0 | 19.0 | 17.5 |
| 5 | 28 | 22 | 20 | 24 | 22 | 4.3 | 12.0 | 14.0 | 19.5 | 16.8 | 19.5 | 16.8 |
| 6 | 20 | 21 | 20 | 22 | 22 | 3.9 | 11.4 | 14.0 | 22 | 16.0 | 19.0 | 17.5 |
| 7 | 23 | 20 | 24 | 21 | 22 | 3.7 | 11.4 | 16.8 | 25 | 15.3 | 19.0 | 17.5 |
| 8 | 20 | 20 | 22 | 20 | 23 | 4.0 | 11.4 | 16.8 | 22 | 14.6 | 19.0 | 16.0 |
| 9 | 20 | 20 | 21 | 20 | 23 | 3.9 | 10.8 | 16.0 | 22 | 14.6 | 19.0 | 20 |
| 10 | 25 | 19.5 | 22 | 21 | 22 | 5.0 | 10.8 | 16.0 | 21 | 14.6 | 19.0 | 20 |
| 11 | 22 | 19.5 | 21 | 23 | 22 | 3.7 | 10.8 | 20 | 21 | 14.6 | 20 | 17.5 |
| 12 | 20 | 21 | 22 | 22 | 22 | 3.6 | 10.8 | 20 | 22 | 15.3 | 20 | 17.5 |
| 13 | 21 | 24 | 21 | 22 | 23 | 3.2 | 16.8 | 19.0 | 22 | 14.6 | 19.0 | 16.8 |
| 14 | 23 | 20 | 21 | 26 | 22 | 3.1 | 16.0 | 18.2 | 21 | 14.0 | 18.2 | 22 |
| 15 | 22 | 20 | 20 | 22 | 22 | 5.6 | 16.0 | 16.0 | 21 | 14.6 | 19.0 | 19.5 |
| 16 | 23 | 22 | 22 | 27 | 22 | 16.0 | 16.0 | 15.3 | 20 | 19.0 | 20 | 20 |
| 17 | 22 | 28 | 22 | 23 | 23 | 16.0 | 15.3 | 15.3 | 20 | 25 | 20 | 22 |
| 18 | 23 | 23 | 22 | 22 | 22 | 14.6 | 15.3 | 15.3 | 21 | 25 | 19.0 | 20 |
| 19 | 24 | 23 | 21 | 23 | 22 | 14.0 | 14.6 | 16.0 | 20 | 26 | 18.2 | 19.0 |
| 20 | 22 | 22 | 21 | 22 | 22 | 13.3 | 14.6 | 19.5 | 24 | 25 | 19.0 | 22 |
| 21 | 23 | 22 | 21 | 25 | 22 | 12.6 | 15.3 | 21 | 22 | 16.8 | 18.2 | 20 |
| 22 | 22 | 22 | 21 | 22 | 22 | 12.0 | 15.3 | 19.0 | 22 | 16.8 | 17.5 | ..... |
| 23 | 22 | 24 | 21 | 23 | 22 | 12.0 | 14.6 | 19.0 | 20 | 19.0 | 18.2 | ..... |
| 24 | 23 | 22 | 21 | 22 | 25 | 10.8 | 14.6 | 19.0 | 20 | 20 | 19.0 | ..... |
| 25 | 20 | 24 | 20 | 22 | 10.2 | 10.8 | 15.3 | 20 | 19.5 | 20 | 18.2 | ..... |
| 26 | 21 | 22 | 21 | 22 | 9.7 | 10.8 | 14.6 | 20 | 19.5 | 19.5 | 17.5 | ..... |
| 27 | 20 | 22 | 21 | 24 | 5.0 | 10.2 | 14.6 | 19.5 | 19.0 | 19.5 | 17.5 | ..... |
| 28 | 21 | 22 | 22 | 22 | 4.7 | 10.8 | 16.0 | 19.0 | 19.0 | 19.0 | 18.2 | ..... |
| 29 | 21 | 21 | 21 | 22 | 4.4 | 10.8 | 15.3 | ..... | 18.2 | 19.0 | 19.0 | ..... |
| 30 | 20 | 20 | 23 | 24 | 4.2 | 13.3 | 15.3 | ..... | 18.2 | 19.0 | 19.5 | ..... |
| 31 | 21 | 21 | ..... | 25 | ..... | 13.3 | 14.6 | ..... | 17.5 | ..... | 19.5 | ..... |

NOTE.—No gage-height record June 22–30; discharge estimated at 19.5 million gallons per day.

*Monthly discharge of Hanamaulu ditch near Lihue, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 28 | 18.2 | 21.7 | 33.6 | 671 | 2,060 |
| August | 28 | 19.5 | 21.5 | 33.3 | 667 | 2,050 |
| September | 24 | 20 | 21.2 | 32.8 | 636 | 1,950 |
| October | 27 | 20 | 22.5 | 34.8 | 699 | 2,140 |
| November | 25 | 4.2 | 19.2 | 29.7 | 575 | 1,770 |
| December | 16.0 | 3.1 | 8.53 | 13.2 | 264 | 812 |
| January | 16.8 | 10.8 | 13.8 | 21.4 | 428 | 1,310 |
| February | 21 | 14.0 | 17.4 | 26.9 | 487 | 1,500 |
| March | 25 | 17.5 | 20.7 | 32.0 | 641 | 1,970 |
| April | 26 | 14.0 | 18.0 | 27.9 | 539 | 1,660 |
| May | 20 | 17.5 | 18.9 | 29.2 | 587 | 1,800 |
| June | 22 | 16.0 | 18.9 | 29.2 | 568 | 1,740 |
| The year | 28 | 3.1 | 18.5 | 28.6 | 6,760 | 20,800 |

### LIHUE DITCH NEAR LIHUE, KAUAI.

LOCATION.—Half a mile below intake and 6 miles northwest of Lihue.

RECORDS AVAILABLE.—June 30, 1917, to June 30, 1919. July 1, 1910, to April 30, 1917, at old site 1 mile below present gage.

GAGE.—Vertical staff; read by S. Koike.

DISCHARGE MEASUREMENTS.—Made in flume at gage.

CHANNEL AND CONTROL.—Wooden flume 50 feet long. Ditch enters a long tunnel 20 feet below gage. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.00 feet at 3.20 p. m. October 14 (discharge, 14.3 million gallons per day, or 22.1 second-feet); minimum stage recorded, 1.02 feet at 10 a. m. December 11 (discharge, 4.6 million gallons per day, or 7.1 second-feet).

1910–1919: Maximum stage recorded, October, 1918; ditch occasionally dry.

DIVERSIONS.—Ditch diverts part of flow of South Fork of Wailua River.

REGULATION.—By headgates.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to hundredths once daily. Records fair.

*Discharge measurements of Lihue ditch near Lihue, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Nov. 24 | W. V. Hardy | 1.76 | 16.5 | 10.6 |
| 24 | do | 1.54 | 14.6 | 9.4 |
| 24 | do | .92 | 5.9 | 3.8 |
| Dec. 22 | do | 1.18 | 10.4 | 6.7 |
| 22 | do | .94 | 6.0 | 3.9 |
| 22 | do | .54 | 2.0 | 1.3 |
| Mar. 12 | Y. Masato | 1.82 | 18.7 | 12.1 |

*Daily discharge, in million gallons, of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1919.*

| Date. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.5 | 7.4 | 9.8 | 12.1 | 13.2 | 5.4 | 8.8 | 8.6 | 12.0 | 12.3 | 11.9 | 12.3 |
| 2 | 6.3 | 8.4 | 10.6 | 12.1 | 11.0 | 5.2 | 8.6 | 8.8 | 12.3 | 12.3 | 11.9 | 12.1 |
| 3 | 7.2 | 8.2 | 10.4 | 12.3 | 13.0 | 5.9 | 8.4 | 8.4 | 12.5 | 12.1 | 11.7 | 13.0 |
| 4 | 7.0 | 8.6 | 10.2 | 12.0 | 12.8 | 5.2 | 8.2 | 8.2 | 12.3 | 12.1 | 11.9 | 12.5 |
| 5 | 8.6 | 9.6 | 10.6 | 13.2 | 12.5 | 5.0 | 8.0 | 8 0 | 12.1 | 12.5 | 12.1 | 12.1 |
| 6 | 7.2 | 8.8 | 10.5 | 12.5 | 12.5 | 4.9 | 8.4 | 7.8 | 12.8 | 12.3 | 11.9 | 12.3 |
| 7 | 8.8 | 8.6 | 11.4 | 12.3 | 12.3 | 4.7 | 8.2 | 9.6 | 13.4 | 12.1 | 11.9 | 12.4 |
| 8 | 7.8 | 8.4 | 10.6 | 12.8 | 12.1 | 5.2 | 8.0 | 9.4 | 12.3 | 11.9 | 11.9 | 12.1 |
| 9 | 7.6 | 8.2 | 10.4 | 12.8 | 12.1 | 4.9 | 8.0 | 9.4 | 12.1 | 12.3 | 12.1 | 13.0 |
| 10 | 9.0 | 8.0 | 10.6 | 12.5 | 11.4 | 5.6 | 8.2 | 9.4 | 12.3 | 12.1 | 11.9 | 12.5 |
| 11 | 8.2 | 7.8 | 10.8 | 13.2 | 11.2 | 4.6 | 8.0 | 10.0 | 12.1 | 12.5 | 12.3 | 12.3 |
| 12 | 7.8 | 8.0 | 11.0 | 13.0 | 11.0 | 6.3 | 8.0 | 10.2 | 12.5 | 12.3 | 8.0 | 12.1 |
| 13 | 8.2 | 9.4 | 10.8 | 12.8 | 10.8 | 6.1 | 11.2 | 9.8 | 12.5 | 12.1 | 7.2 | 11.9 |
| 14 | 8.8 | 8.2 | 10.6 | 14.3 | 10.6 | 5.9 | 9.0 | 10.2 | 12.3 | 12.1 | 6.6 | 12.8 |
| 15 | 8.4 | 8.0 | 10.4 | 13.2 | 10.8 | 5.7 | 8.8 | 12.1 | 12.1 | 12.1 | 12.5 | 12.3 |
| 16 | 8.4 | 9.0 | 10.8 | 13.4 | 11.0 | 6.5 | 8.6 | 12.1 | 12.1 | 12.8 | 13.2 | 12.5 |
| 17 | 8.2 | 10.2 | 10.0 | 13.2 | 10.8 | 6.3 | 8.4 | 11.9 | 11.9 | 13.0 | 13.0 | 12.8 |
| 18 | 8.4 | 8.8 | 9.8 | 13.2 | 10.8 | 6.1 | 8.2 | 11.9 | 12.8 | 11.0 | 13.0 | 12.5 |
| 19 | 8.6 | 9.0 | 9.6 | 13.0 | 10.6 | 5.9 | 8.2 | 12.3 | 12.3 | 13.4 | 12.8 | 12.3 |
| 20 | 8.8 | 8.8 | 10.6 | 13.0 | 10.6 | 5.7 | 8.0 | 12.1 | 13.2 | 12.1 | 12.8 | 12.8 |
| 21 | 9.2 | 8.6 | 10.4 | 13.4 | 10.8 | 6.6 | 8.4 | 12.5 | 12.8 | 11.7 | 12.5 | 12.5 |
| 22 | 9.0 | 8.2 | 10.2 | 13.0 | 11.0 | 6.5 | 8.6 | 11.9 | 12.5 | 11.0 | 12.5 | ..... |
| 23 | 8.8 | 9.4 | 10.0 | 13.2 | 10.8 | 6.3 | 8.6 | 12.1 | 12.3 | 11.7 | 12.8 | ..... |
| 24 | 9.4 | 8.6 | 10.8 | 13.0 | 10.4 | 6.5 | 8.2 | 12.1 | 12.1 | 11.2 | 13.2 | ..... |
| 25 | 9.0 | 9.6 | 10.6 | 13.0 | 6.6 | 6.6 | 8.4 | 12.5 | 12.1 | 11.0 | 13.0 | ..... |
| 26 | 9.2 | 8.0 | 11.2 | 12.8 | 6.1 | 6.5 | 8.2 | 12.3 | 11.9 | 12.3 | 12.8 | ..... |
| 27 | 9.0 | 7.4 | 10.8 | 13.4 | 6.1 | 7.0 | 8.0 | 12.1 | 11.9 | 12.1 | 12.5 | ..... |
| 28 | 8.6 | 7.4 | 11.9 | 13.2 | 5.9 | 6.8 | 8.8 | 12.1 | 11.8 | 12.3 | 12.8 | ..... |
| 29 | 8.2 | 7.0 | 11.7 | 13.0 | 5.7 | 6.6 | 8.6 | ..... | 11.8 | 12.1 | 12.8 | ..... |
| 30 | 7.8 | 7.4 | 12.3 | 13.6 | 5.6 | 9.2 | 8.4 | ..... | 11.7 | 12.1 | 13.2 | ..... |
| 31 | 7.6 | 7.6 | ..... | 13.9 | ..... | 9.0 | 8.2 | ..... | 12.5 | ..... | 12.8 | ..... |

NOTE.—No record June 22–30; observer sick. Discharge estimated at 12 million gallons per day.

*Monthly discharge of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 9.4 | 6.3 | 8.25 | 12.8 | 256 | 785 |
| August | 10.2 | 7.0 | 8.41 | 13.0 | 261 | 800 |
| September | 12.3 | 9.6 | 10.6 | 16.4 | 319 | 976 |
| October | 14.3 | 12.0 | 13.0 | 20.1 | 402 | 1,240 |
| November | 13.2 | 5.6 | 10.3 | 15.9 | 310 | 948 |
| December | 9.2 | 4.6 | 6.09 | 9.42 | 189 | 579 |
| January | 11.2 | 8.0 | 8.44 | 13.1 | 262 | 803 |
| February | 12.5 | 7.8 | 10.6 | 16.4 | 298 | 911 |
| March | 13.4 | 11.7 | 12.3 | 19.0 | 381 | 1,170 |
| April | 13.4 | 11.0 | 12.1 | 18.7 | 363 | 1,110 |
| May | 13.2 | 6.6 | 12.0 | 18.6 | 372 | 1,140 |
| June | ..... | ..... | 12.3 | 19.0 | 369 | 1,130 |
| The year | 14.3 | 4.6 | 10.4 | 16.1 | 3,780 | 11,600 |

**NORTH FORK OF WAILUA RIVER AT ELEVATION 650 FEET, NEAR LIHUE, KAUAI.**

LOCATION.—1½ miles above intake of Kanaha ditch and 10 miles northwest of Lihue.

RECORDS AVAILABLE.—September 21, 1914, to June 30, 1919. Records available for old station at elevation 500 feet August 1 to October 28, 1910, and December 28, 1910, to September 25, 1914.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 80 feet above and 50 feet below gage; right bank steep and high; left bank slopes gently. Control composed of boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.15 feet August 18 (discharge, 775 million gallons per day, or 1,200 second-feet); higher stage occurred about noon November 25 but recorder was not working properly; minimum stage recorded, 1.21 feet June 2 (discharge, 21 million gallons per day, or 32 second-feet).

1914–1919: Maximum stage recorded, 9.5 feet at 6.30 p. m. September 26, 1914 (discharge, computed from extension of rating curve, approximately 2,200 million gallons per day, or 3,400 second-feet); minimum stage recorded, 1.3 feet April, 1916 (discharge, 13 million gallons per day, or 20 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of flow diverted for irrigation of sugar cane, but most of it is wasted.

ACCURACY.—Stage-discharge relation changed during flood of November 25. Rating curves well defined above 20 million gallons per day. Operation of water-stage recorder unsatisfactory after October 19. Records good when water-stage recorder was operating.

*Discharge measurements of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 26 | W. V. Hardy | 1.62 | 60 | 38.5 |
| Dec. 8 | do | 2.92 | 301 | 195 |
| 19 | do | 1.52 | 61 | 39 |
| 20 | do | 1.61 | 70 | 45.5 |
| Jan. 7 | do | 1.23 | 35 | 22.6 |
| Mar. 4 | do | 1.32 | 38.5 | 24.8 |
| 10 | Y. Masato | 1.46 | 51 | 33 |

*Daily discharge, in million gallons, of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Dec. | Mar. | June. |
|---|---|---|---|---|---|---|---|
| 1 | 32 | 42 | 33 | 61 | ..... | ..... | 23 |
| 2 | 32 | 32 | 45 | 59 | ..... | ..... | 23 |
| 3 | 34 | 30 | 59 | 58 | ..... | ..... | ..... |
| 4 | 36 | 34 | 41 | 59 | ..... | ..... | ..... |
| 5 | 118 | 55 | 35 | 61 | ..... | 25 | ..... |
| 6 | 52 | 40 | 33 | 65 | ..... | 48 | ..... |
| 7 | 68 | 41 | 32 | 70 | ..... | 70 | ..... |
| 8 | 49 | 43 | 44 | 68 | ..... | 34 | ..... |
| 9 | 44 | 38 | 86 | 68 | 101 | ..... | ..... |
| 10 | 363 | 36 | 56 | 68 | 264 | ..... | ..... |
| 11 | 244 | 34 | 52 | 68 | 111 | 32 | ..... |
| 12 | 82 | 40 | 61 | 68 | 81 | 77 | ..... |
| 13 | 78 | 108 | 50 | 82 | 67 | 46 | ..... |
| 14 | 60 | 153 | 69 | 79 | 58 | 35 | ..... |
| 15 | 56 | 64 | 64 | 188 | 49 | 29 | ..... |
| 16 | 52 | 49 | 49 | 158 | 44 | 27 | ..... |
| 17 | 43 | 67 | 45 | 158 | 50 | 28 | ..... |
| 18 | 63 | 129 | 72 | 94 | 52 | 32 | ..... |
| 19 | 64 | 57 | 57 | 82 | ..... | 28 | ..... |
| 20 | 63 | 52 | 62 | ..... | ..... | 65 | ..... |
| 21 | 65 | 56 | 58 | ..... | ..... | 70 | ..... |
| 22 | 59 | 96 | 53 | ..... | ..... | 72 | ..... |
| 23 | 43 | 131 | 52 | ..... | ..... | ..... | ..... |
| 24 | 123 | 72 | 52 | ..... | ..... | ..... | ..... |
| 25 | 52 | 64 | 53 | ..... | ..... | ..... | ..... |
| 26 | 75 | 55 | 57 | ..... | ..... | ..... | ..... |
| 27 | 47 | 45 | 55 | ..... | ..... | ..... | ..... |
| 28 | 38 | 35 | 55 | ..... | ..... | ..... | ..... |
| 29 | 60 | 33 | 56 | ..... | ..... | ..... | ..... |
| 30 | 53 | 32 | 57 | ..... | ..... | ..... | ..... |
| 31 | 45 | 32 | ..... | ..... | ..... | ..... | ..... |

NOTE.—No record Dec. 19 to Mar. 4; clock weight-chain broken. Clock stopped for other periods of no record. Discharge interpolated for Aug. 26 and 27.

*Monthly discharge of North Fork of Wailua River, at elevation 650 feet, near Lihue, Kauai, for year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean | | | |
| July | 363 | 32 | 74.0 | 114 | 2,290 | 7,040 |
| August | 153 | 30 | 57.9 | 89.6 | 1,800 | 5,510 |
| September | 86 | 32 | 53.1 | 82.2 | 1,590 | 4,890 |

### KANAHA DITCH NEAR LIHUE, KAUAI.

LOCATION.—500 feet above point where Kauai Electric Co.'s power line crosses ditch and 9 miles north of Lihue.

RECORDS AVAILABLE.—August 6, 1910, to June 30, 1919.

GAGE.—Vertical staff; read by S. Koike. New datum May 28, 1913.

DISCHARGE MEASUREMENTS.—Made in wooden flume at gage.

CHANNEL AND CONTROL.—Gage in rectangular wooden flume; straight for 30 feet above and 10 feet below gage. Control composed of soft lava rock; fairly permanent between times of cleaning ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.52 feet at 8.45 a. m. October 31 and 11.12 a. m. November 24 (discharge, 19.7 million gallons per day, or 30 second-feet); minimum stage recorded during year, 0.80 foot, 8.12 a. m. December 15 (discharge, 6.0 million gallons per day, or 9.3 second-feet).

1910–1919: Maximum stage recorded, 2.6 feet July 24–26, 1913 (discharge, 22 million gallons per day, or 34 second-feet); ditch occasionally dry.

DIVERSIONS.—Ditch diverts part of flow of North Fork of Wailua River.

REGULATION.—By headgates.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths once daily. Records fair.

The following discharge measurement was made by Y. Masato:

March 10, 1919: Gage height, 2.19 feet; discharge, 24.8 second-feet, or 16.0 million gallons per day.

*Daily discharge, in million gallons, of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1919.*

| Day. | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13.0 | 17.0 | 17.0 | 17.9 | 18.7 | 8.3 | 11.0 | 14.6 | 17.0 | 17.0 | 17.9 | 17.9 |
| 2 | 14.6 | 16.2 | 16.2 | 17.9 | 18.7 | 7.9 | 10.6 | 14.6 | 17.9 | 17.0 | 17.9 | 16.2 |
| 3 | 17.0 | 17.0 | 17.9 | 17.9 | 18.7 | 9.1 | 9.8 | 15.4 | 17.9 | 17.0 | 17.9 | 17.0 |
| 4 | 15.4 | 17.0 | 17.0 | 17.9 | 17.9 | 7.5 | 10.6 | 14.6 | 17.0 | 17.0 | 17.9 | 17.9 |
| 5 | 17.9 | 17.0 | 17.9 | 18.7 | 18.7 | 7.3 | 10.2 | 13.8 | 17.0 | 17.0 | 17.9 | 17.9 |
| 6 | 16.2 | 16.2 | 17.9 | 17.9 | 18.7 | 7.2 | 11.4 | 13.8 | 17.9 | 16.2 | 17.9 | 17.0 |
| 7 | 17.0 | 15.4 | 18.7 | 17.9 | 18.7 | 7.0 | 11.4 | 13.8 | 17.9 | 17.0 | 17.9 | 17.9 |
| 8 | 15.4 | 17.0 | 17.9 | 17.9 | 18.7 | 7.2 | 12.2 | 13.8 | 17.0 | 16.2 | 17.9 | 17.9 |
| 9 | 16.2 | 17.0 | 17.9 | 17.9 | 18.7 | 7.0 | 11.4 | 16.2 | 16.2 | 17.0 | 17.9 | 18.7 |
| 10 | 17.0 | 15.4 | 17.9 | 17.9 | 18.7 | 7.5 | 11.4 | 14.6 | 17.0 | 17.0 | 17.9 | 18.7 |
| 11 | 17.0 | 16.2 | 17.9 | 18.7 | 18.7 | 6.9 | 12.2 | 17.0 | 17.9 | 17.9 | 17.9 | 17.9 |
| 12 | 13.8 | 17.0 | 17.9 | 18.7 | 17.9 | 6.7 | 11.4 | 17.0 | 17.0 | 17.0 | 18.7 | 17.9 |
| 13 | 16.2 | 17.9 | 17.9 | 17.9 | 18.7 | 6.6 | 14.6 | 16.2 | 17.9 | 15.4 | 17.9 | 18.7 |
| 14 | 16.2 | 17.0 | 17.9 | 18.7 | 18.7 | 6.1 | 13.0 | 16.2 | 17.9 | 16.2 | 17.0 | 18.7 |
| 15 | 15.4 | 17.0 | 17.0 | 18.7 | 18.7 | 6.0 | 12.2 | 16.2 | 17.9 | 16.2 | 17.9 | 17.9 |
| 16 | 13.0 | 16.2 | 17.9 | 18.7 | 18.7 | 8.3 | 12.2 | 15.4 | 17.9 | 16.2 | 18.7 | 18.7 |
| 17 | 17.0 | 17.0 | 17.9 | 18.7 | 18.7 | 8.3 | 12.2 | 16.2 | 17.9 | 17.0 | 17.9 | 17.9 |
| 18 | 16.2 | 13.8 | 17.9 | 18.7 | 18.7 | 8.3 | 12.2 | 16.2 | 17.9 | 17.9 | 17.9 | 18.7 |
| 19 | 16.2 | 17.9 | 17.0 | 18.7 | 18.7 | 7.9 | 12.2 | 16.2 | 17.9 | 18.7 | 17.9 | 17.9 |
| 20 | 16.2 | 17.0 | 17.9 | 18.7 | 17.9 | 7.9 | 13.0 | 17.9 | 17.9 | 18.7 | 17.0 | 19.5 |
| 21 | 16.2 | 17.0 | 17.9 | 19.5 | 18.7 | 8.7 | 14.6 | 17.9 | 17.9 | 17.9 | 17.9 | 17.9 |
| 22 | 15.4 | 17.9 | 17.0 | 17.9 | 18.7 | 6.7 | 14.6 | 17.0 | 17.9 | 17.9 | 17.0 | ..... |
| 23 | 17.0 | 17.0 | 18.7 | 18.7 | 18.7 | 8.7 | 14.6 | 17.0 | 17.0 | 17.9 | 17.9 | ..... |
| 24 | 17.0 | 17.9 | 17.9 | 17.9 | 19.5 | 8.3 | 13.8 | 16.2 | 17.9 | 17.9 | 18.7 | ..... |
| 25 | 17.0 | 17.9 | 17.0 | 18.7 | 12.2 | 8.3 | 14.6 | 17.9 | 17.9 | 18.7 | 17.9 | ..... |
| 26 | 17.0 | 17.0 | 17.9 | 18.7 | 9.1 | 8.7 | 13.8 | 17.9 | 17.9 | 17.9 | 17.0 | ..... |
| 27 | 17.0 | 17.0 | 17.0 | 18.7 | 9.1 | 11.4 | 13.8 | 17.0 | 17.9 | 17.9 | 15.4 | ..... |
| 28 | 16.2 | 16.2 | 17.0 | 19.5 | 8.3 | 11.4 | 14.6 | 17.0 | 17.9 | 17.9 | 18.7 | ..... |
| 29 | 17.0 | 17.0 | 17.0 | 18.7 | 7.5 | 10.6 | 14.6 | ..... | 17.9 | 17.9 | 18.7 | ..... |
| 30 | 17.0 | 17.0 | 17.9 | 18.7 | 8.3 | 12.2 | 13.8 | ..... | 17.0 | 17.9 | 17.9 | ..... |
| 31 | 17.0 | 17.0 | ..... | 19.5 | ..... | 11.4 | 13.8 | ..... | 17.0 | ..... | 18.7 | ..... |

NOTE.—No gage-height record June 22-30; daily discharge estimated at 18 million gallons.

*Monthly discharge of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 17.9 | 13.0 | 16.2 | 25.1 | 501 | 1,540 |
| August | 17.9 | 13.8 | 16.8 | 26.0 | 521 | 1,600 |
| September | 18.7 | 16.2 | 17.6 | 27.2 | 529 | 1,620 |
| October | 19.5 | 17.9 | 18.5 | 28.6 | 572 | 1,760 |
| November | 19.5 | 7.5 | 16.7 | 25.8 | 502 | 1,540 |
| December | 12.2 | 6.0 | 8.24 | 12.7 | 255 | 784 |
| January | 14.6 | 9.8 | 12.6 | 19.5 | 392 | 1,200 |
| February | 17.9 | 13.8 | 16.0 | 24.8 | 448 | 1,370 |
| March | 17.9 | 16.2 | 17.6 | 27.2 | 545 | 1,670 |
| April | 18.7 | 15.4 | 17.3 | 26.8 | 519 | 1,590 |
| May | 18.7 | 15.4 | 17.9 | 27.7 | 554 | 1,700 |
| June | 19.5 | ..... | 18.0 | 27.9 | 541 | 1,660 |
| The year | 19.5 | 6.0 | 16.1 | 24.9 | 5,880 | 18,000 |

**EAST BRANCH OF NORTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.**

LOCATION.—1,200 feet above confluence with North Fork and 8 miles north of Lihue.

RECORDS AVAILABLE.—July 27, 1912, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder, December 31, 1914, to June 30, 1918; staff 800 feet below present site July 27, 1912, to September 30, 1914.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 60 feet above and 400 feet below gage; banks low and wooded. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.43 feet about noon November 25 (discharge, approximately 1,320 million gallons per day, or 2,040 second-feet); minimum stage recorded, 1.78 feet 9.30 a. m. May 15 (discharge, 9.0 million gallons per day, or 13.9 second-feet).

1912–1919: Maximum stage recorded, 8.9 feet at 8 a. m. March 3, 1916 (discharge, approximately 3,000 million gallons per day, or 4,640 second-feet); minimum stage recorded, 1.6 feet March, 1915 (discharge, 7 million gallons per day, or 11 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—After joining North Fork of Wailua River, part of the water is diverted for irrigation of sugar cane, but most of it is wasted.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 15 and 100 million gallons per day. Operation of water-stage recorder unsatisfactory. Records fair when water-stage recorder was operating.

*Discharge measurements of East Branch of North Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 16 | W. V. Hardy | 2.18 | 45.5 | 29.5 |
| Aug. 26 | .....do | 2.22 | 49.5 | 32 |
| Dec. 7 | .....do | 2.84 | 147 | 95 |
| 13 | .....do | 2.38 | 76 | 49 |
| 18 | .....do | 2.17 | 43.5 | 28 |
| Mar. 5 | Y. Masato | 1.96 | 23.1 | 14.9 |

*Daily discharge, in million gallons, of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | June. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 19.2 | | 26 | | | | | | | 14.0 |
| 2 | 21 | | 25 | | | | | | | 16.0 |
| 3 | 22 | | 23 | | | | | | | 32 |
| 4 | 19.8 | | 22 | | | | | | | 18.6 |
| 5 | 25 | | 21 | | | | | | 16.5 | |
| 6 | 23 | | 20 | | | | | | 30 | |
| 7 | 25 | | 24 | 21 | 38 | 132 | | | 26 | |
| 8 | 22 | | 33 | 22 | 37 | 142 | | 36 | 19.2 | |
| 9 | 20 | | 25 | 14.0 | 30 | 82 | 24 | 30 | 19.2 | |
| 10 | 47 | | 25 | 13.0 | 32 | 186 | 23 | 29 | 19.2 | |
| 11 | 32 | | 24 | 13.0 | 28 | 94 | 19.8 | 29 | 15.0 | |
| 12 | 23 | | 30 | | 29 | 71 | 24 | 28 | 24 | |
| 13 | 27 | | 26 | | | 62 | 24 | 26 | 15.0 | |
| 14 | 25 | | 24 | | | 61 | 26 | 26 | 11.2 | |
| 15 | 34 | | | | | 57 | 26 | 25 | 9.5 | |
| 16 | 27 | | | | | 53 | 25 | 25 | 9.5 | |
| 17 | 23 | | | | | 55 | 22 | 24 | | |
| 18 | | | | | | 53 | 22 | | | |
| 19 | | | 17.5 | | | 48 | 28 | | | |
| 20 | | | 10.6 | | | 47 | 22 | | | |
| 21 | | | | | | 42 | 30 | | | |
| 22 | | | | | | 38 | 29 | | | |
| 23 | | | | | | 39 | 26 | | | |
| 24 | | | | | | | 25 | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | 29 | | | | | | | | |
| 28 | | 27 | | | | | | | | |
| 29 | | 25 | | | | | | | | |
| 30 | | 24 | | | | | | | | |
| 31 | | 26 | | | | | | | | |

NOTE.—Clock was stopped, except for days when discharge is given.

### KAPAHI DITCH NEAR KEALIA, KAUAI.

LOCATION.—500 feet below intake and 5 miles west of Kealia.

RECORDS AVAILABLE.—April 15, 1909, to May 2, 1914; July 1, 1915, to June 30, 1919.

GAGE.—Stevens 8-day water-stage recorder installed May 10, 1915, to replace original Watson recorder.

DISCHARGE MEASUREMENTS.—Made by 20-foot sharpcrested weir immediately below gage and from foot plank across box flume 100 feet below gage.

CHANNEL AND CONTROL.—Channel straight for 50 feet above weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.98 feet about noon June 3 (discharge, 118 million gallons per day, or 183 second-feet); minimum stage recorded, 0.14 foot October 14 (discharge, 2.4 million gallons per day, or 3.7 second-feet).

1915–1919: Maximum stage recorded during period of record, 1.98 feet[1] at 2 a. m. September 16, 1915, and June 3, 1919; minimum, water shut off November 23 and 24, 1916.

DIVERSIONS.—Ditch diverts part of flow of Kapaa River.

REGULATIONS.—Flow regulated by headgates.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 2 million gallons per day. Operation ofwater- stage recorder satisfactory, except as shown in footnote to table of daily discharge. Records excellent when water-stage recorder was operating; poor for estimated periods owing to control of flow by headgates.

[1]Determinations of maximum discharge supersede those published in Water-Supply Papers 430 and 485.

*Daily discharge, in million gallons, of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13.4 | 17.6 | 15.1 | 10.8 | 22 | 10.4 | 11.2 | 10.8 | 12.5 | 8.5 | 12 | ..... |
| 2 | 13.0 | 14.7 | 14.7 | 10.8 | 20 | 10.4 | 12.5 | 10.8 | 21 | 8.5 | 12 | ..... |
| 3 | 17.1 | 17.1 | 13.4 | 10.8 | 18.0 | 7.1 | 13.0 | 10.8 | 16.1 | 8.5 | 10.8 | ..... |
| 4 | 14.2 | 18.5 | 13.0 | 10.8 | 15.1 | 7.2 | 13.0 | 10.4 | 13.8 | 8.5 | 13.0 | ..... |
| 5 | 27 | 26 | 12.1 | ..... | 17.6 | 7.8 | 13.0 | 10.4 | 12.5 | 8.1 | 19.0 | ..... |
| 6 | 17.6 | 17.6 | 12.1 | ..... | 15.6 | 7.4 | 13.0 | 9.7 | 26 | 8.5 | 12.1 | ..... |
| 7 | 30 | 17.6 | 18.2 | ..... | 14.7 | 7.8 | 13.4 | 9.3 | 20 | 8.9 | 13.8 | ..... |
| 8 | 18.0 | 22 | 28 | ..... | 13.0 | 7.8 | 12.5 | 9.7 | 16.1 | 8.1 | 12.5 | ..... |
| 9 | 22 | 15.6 | 17.1 | ..... | 12.5 | 7.8 | 12.1 | 28 | 15.1 | 8.1 | 10.8 | ..... |
| 10 | 37 | 15.1 | 16.1 | ..... | 15.6 | 7.8 | 13.4 | 12.1 | 13.0 | 11.7 | 10.4 | ..... |
| 11 | 26 | 18.0 | 15.1 | ..... | 24 | 7.4 | 13.0 | 13.4 | 11.7 | 9.0 | 18.5 | ..... |
| 12 | 20 | 18.5 | 22 | 14.0 | 8.9 | 7.4 | 13.0 | 13.4 | 18.6 | 11.3 | 14.2 | ..... |
| 13 | 22 | 34 | 18.5 | 22 | 13.0 | 7.0 | 15.1 | 10.8 | 12.5 | 8.5 | 12.1 | ..... |
| 14 | 24 | 26 | 15.1 | 41 | 13.0 | 7.0 | 15.6 | 10.4 | 10.8 | 9.3 | 10.8 | ..... |
| 15 | 20 | 20 | 15.1 | 24 | 13.0 | 8.6 | 13.4 | 9.7 | 10.0 | 22 | 9.3 | ..... |
| 16 | 22 | 23 | 14.2 | 24 | 12.5 | 9.9 | 12.1 | 10.0 | 10.0 | 44 | 20 | ..... |
| 17 | 16.1 | 20 | 16.1 | 14.2 | 12.5 | 5.7 | 11.2 | 9.7 | 10.4 | 20 | 26 | ..... |
| 18 | 29 | 22 | 16 1 | 12.8 | 12.5 | 5.4 | 10.8 | 10.0 | 10.8 | 16 | 14.2 | ..... |
| 19 | 30 | 20 | 16.1 | 14.2 | 12.1 | 5.4 | 10.8 | 10.8 | 10.8 | 14.2 | 12.1 | ..... |
| 20 | 18.8 | 22 | 13.4 | 12.1 | 11.7 | 5.1 | 11.2 | 15.6 | 32 | 24 | 14.2 | ..... |
| 21 | 21 | 29 | 12.5 | 20 | 11 2 | 4.8 | 20 | 22 | 27 | 18.5 | 15.6 | 9.7 |
| 22 | 19.7 | 18.5 | 12.1 | 15.6 | 10.8 | 5.7 | 20 | 24 | 33 | 14.2 | 11 | 9.3 |
| 23 | 17.1 | 17.6 | 11.7 | 18.0 | 10.8 | 8.5 | 14.0 | 13.0 | 14.7 | 12.1 | 11 | 8.9 |
| 24 | 28 | 17.6 | 11.2 | 14.2 | 17.5 | 10.7 | 13.4 | 11.7 | 11.2 | 10.8 | 10.8 | 12.1 |
| 25 | 19.5 | 16.6 | 12.5 | 11.7 | 21 | 10.9 | 12.5 | 12.5 | 10.4 | 9.3 | 12.1 | 12.5 |
| 26 | 30 | 17.1 | 11.2 | 16.4 | 12.5 | 13.0 | 12.1 | 10.8 | 9.7 | ..... | 11.7 | 17.6 |
| 27 | 22 | 16.6 | 10.8 | 17.6 | 15.1 | 12.1 | 14.2 | 11.2 | 9.7 | ..... | 10.4 | 19.5 |
| 28 | 16.6 | 16.1 | 10.8 | 11.7 | 12.8 | 10.8 | 12.5 | 10.4 | 8.9 | ..... | 9.7 | 13.8 |
| 29 | 23 | 15.1 | 10.8 | 20 | 7.4 | 10.0 | 13.8 | ..... | 8.5 | ..... | ..... | 19.6 |
| 30 | 17.6 | 14.7 | 11.2 | 33 | 9.3 | 12.1 | 13.4 | ..... | 8.5 | ..... | ..... | 13.4 |
| 31 | 24 | 16.6 | ..... | 34 | ..... | 8.9 | 11.7 | ..... | 8.5 | ..... | ..... | ..... |

NOTE.—Owing to incorrect or no gage height record discharge estimated in million gallons per day as follows: Oct. 5–11, 12; Apr. 26–30, 14; May 29-31, 10; June 1–5, 15; June 6–10, 12; June 11–15, 10; June 16–20, 15. Discharge partly estimated Oct. 12; Apr. 11, 12, 16–19, 21–25; May 1–3, 16, 17, 21–24.

*Monthly discharge of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 37 | 13.0 | 21.8 | 33.7 | 676 | 2,070 |
| August | 34 | 14.7 | 19.4 | 30.0 | 601 | 1,850 |
| September | 28 | 10.8 | 14.5 | 22.4 | 436 | 1,330 |
| October | 41 | 10.8 | 16.7 | 25.8 | 518 | 1,590 |
| November | 24 | 7.4 | 14.2 | 22.0 | 426 | 1,310 |
| December | 13.0 | 4.8 | 8.32 | 12.9 | 258 | 792 |
| January | 20 | 10.8 | 13.3 | 20.6 | 411 | 1,270 |
| February | 28 | 9.3 | 12.6 | 19.5 | 351 | 1,080 |
| March | 33 | 8.5 | 14.6 | 22.6 | 454 | 1,390 |
| April | 44 | 8.1 | 13.3 | 20.6 | 400 | 1,220 |
| May | 26 | 9.3 | 12.9 | 20.0 | 400 | 1,230 |
| June | 19.6 | 8.9 | 13.2 | 20.4 | 396 | 1,220 |
| The year | 44 | 4.8 | 14.6 | 22.6 | 5,330 | 16,400 |

### ANAHOLA RIVER NEAR KEALIA, KAUAI.

LOCATION.—A quarter of a mile above dam at Kiokala and 6 miles northwest of Kealia.

RECORDS AVAILABLE.—August 22 to November 2, 1910; December 28, 1912, to June 30, 1919. Fragmentary record December 15, 1910, to December 28, 1912, at dam a quarter of a mile below present site.

GAGE.—Friez water-stage recorder August 22 to November 2, 1910, and December 23, 1912, to June 30, 1919.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 75 feet above and below gage; right bank steep and high and covered with underbrush; left bank low for about 40 feet from low-water channel then rises abruptly. Control composed of boulders; permanent for low and medium stages; shifts during floods.

EXTREMES OF DISCHARGE.—maximum stage recorded during year, 7.32 feet at 1.30 a.m. November 25 (discharge, approximately 956 million gallons per day, or, 1,480 second-feet); minimum stage recorded, 1.84 feet October 1–4 (discharge 5.0 million gallons per day, or 7.7 second-feet).

Maximum stage recorded during period of record, 12.9 feet at 7.30 p.m. September 26, 1914 (discharge, estimated from extension of rating curve, 1,450 million gallons per day, or 2,240 second-feet); minimum stage recorded, 1.3 feet February 27 and 28, 1915 (discharge, 2.0 million gallons per day, or 3.1 second-feet).

DIVERSIONS.—Part of flow diverted 3 miles above station.

REGULATION.—None except by diversions.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves fairly well defined below 15 million gallons per day applicable July 1 to November 24 and November 25 to June 30. Operation of water-stage recorder unsatisfactory, at times. Records fair when water-stage recorder was operating and discharge was less than 15 million gallons per day.

*Discharge measurements of Anahola River near Kealia, Kauai, during the year ending June 30, 1919.*

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | |
|---|---|---|---|
| | | Second-feet. | Million gallons per day. |
| July 14 | 1.97 | 12.5 | 8.1 |
| Jan. 8 | 2.03 | 6.8 | 4.4 |
| Mar. 3 | 2.00 | 5.4 | 3.5 |

*Daily discharge, in million gallons, of Anahola River near Kealia, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Jan. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.6 | ..... | 10.2 | 5.0 | 16.0 | ..... | ..... | 2.5 | 7.9 | 4.2 |
| 2 | 8.0 | ..... | 9.6 | 5.0 | 15.0 | ..... | ..... | 2.5 | 6.2 | 3.6 |
| 3 | 8.0 | ..... | 11.7 | 5.0 | 9.9 | ..... | ..... | 2.5 | 5.6 | 28 |
| 4 | 9.6 | ..... | 8.3 | 5.0 | 8.0 | ..... | 3.5 | 2.5 | 6.1 | 5.6 |
| 5 | 17.6 | ..... | 7.8 | 5.2 | 18.0 | 3.6 | 3.4 | 2.5 | 12.7 | 4.4 |
| 6 | 8.0 | ..... | 7.6 | 5.2 | 9.3 | 3.8 | 6.0 | 2.5 | 5.6 | 3.6 |
| 7 | 31 | ..... | 10.6 | 5.2 | 7.8 | 4.0 | 4.6 | 2.5 | 5.6 | 3.6 |
| 8 | 8.6 | ..... | 28 | 5.2 | 7.2 | 4.2 | 3.6 | 2.4 | 5.6 | 5.8 |
| 9 | 10.0 | ..... | 11.2 | 5.2 | 7.4 | 4.2 | 3.4 | 2.4 | 5.4 | 3.8 |
| 10 | 21 | ..... | 9.9 | 5.0 | 18.0 | 4.4 | 3.3 | 2.4 | 5.4 | 3.5 |
| 11 | 14.0 | ..... | 9.6 | 5.2 | 30 | 4.0 | 3.5 | 2.4 | 5.2 | 3.5 |
| 12 | 8.6 | ..... | 9.9 | 6.1 | 15.5 | ..... | 4.7 | 2.5 | 5.2 | 3.6 |
| 13 | 8.0 | ..... | 8.0 | 14.0 | 8.3 | ..... | 3.5 | 2.4 | 5.0 | 3.6 |
| 14 | ..... | ..... | 7.8 | 40 | 7.8 | ..... | 2.9 | 1.8 | 4.8 | 3.5 |
| 15 | 7.0 | ..... | 7.4 | 15.3 | 8.3 | ..... | 2.7 | 7.0 | 4.6 | 3.4 |
| 16 | 7.2 | ..... | 7.4 | 17.5 | 6.3 | ..... | 2.7 | 37 | 10.2 | 3.3 |
| 17 | 6.7 | ..... | 8.0 | 7.4 | 6.3 | ..... | 2.7 | 23 | 10.2 | 3.2 |
| 18 | 6.5 | ..... | 10.6 | 6.7 | 6.1 | ..... | 2.7 | 103 | 5.6 | 3.2 |
| 19 | 26 | ..... | 9.6 | 7.0 | 7.6 | ..... | 2.8 | 230 | 5.2 | 3.2 |
| 20 | 10.6 | ..... | 6.7 | 6.3 | ..... | ..... | 3.2 | 153 | 9.6 | 3.4 |
| 21 | ..... | ..... | 7.0 | 9.0 | ..... | ..... | 10.0 | 48 | 7.0 | 3.4 |
| 22 | ..... | ..... | 6.1 | 6.1 | ..... | ..... | 10.0 | 24 | 5.4 | 3.3 |
| 23 | ..... | ..... | 7.2 | 8.0 | 7.8 | ..... | 3.5 | 21 | 7.4 | 3.2 |
| 24 | ..... | 21 | 5.9 | 6.1 | 26 | | 3.0 | 15.4 | 5.4 | 3.4 |
| 25 | ..... | 38 | 5.3 | 5.6 | 289 | ..... | 2.8 | 12.5 | 4.8 | 3.5 |
| 26 | ..... | 15.5 | 5.3 | 14.0 | 83 | ..... | 2.8 | 9.7 | 4.8 | 3.6 |
| 27 | ..... | 12.2 | 5.2 | 15.0 | 26 | ..... | 2.7 | 7.6 | 4.0 | 5.0 |
| 28 | ..... | 10.6 | 5.2 | 6.3 | 11.7 | ..... | 2.5 | 6.8 | 4.0 | 4.8 |
| 29 | ..... | 9.3 | 5.2 | 5.9 | 9.7 | ..... | 2.5 | 6.2 | 3.8 | 3.5 |
| 30 | ..... | 8.6 | 5.4 | 66 | 8.9 | ..... | 2.5 | 17.5 | 3.8 | 3.4 |
| 31 | ..... | 20 | ..... | 73 | ..... | ..... | 2.5 | ..... | 3.6 | ..... |

NOTE.—Discharge partly estimated July 20, Aug. 24, Nov. 1, 2, 15, 16, 23, and 30. Discharge estimated in million gallons per day as follows: Nov. 20–22, 7.7; Mar. 1–3, 3.0. No record for days when discharge is not given.

*Monthly discharge of Anahola River near Kealia, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| September | 28 | 5.2 | 8.59 | 13.3 | 258 | 791 |
| October | 73 | 5.0 | 12.6 | 19.5 | 392 | 1,200 |
| November | 289 | 6.1 | 23.3 | 36.1 | 698 | 2,150 |
| March | 10.0 | 2.5 | 3.65 | 5.65 | 113 | 347 |
| April | 230 | 1.8 | 25.2 | 39.0 | 756 | 2,320 |
| May | 12.7 | 3.6 | 5.99 | 9.27 | 186 | 570 |
| June | 28 | 3.2 | 4.57 | 7.07 | 137 | 421 |

### ANAHOLA DITCH ABOVE KANEHA RESERVOIR, NEAR KEALIA, KAUAI.

LOCATION.—At lower end of third tunnel above Kaneha reservoir, 7 miles from Kealia.

RECORDS AVAILABLE.—May 30, 1915, to June 30, 1919.

GAGE.—Stevens 8-day water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from wooden footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage is short straight stretch of open ditch cut in firm earth between two tunnels. Control is timber sill on check gate below spillway and rock section of ditch; probably permanent when spillway is not in use.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.96 feet at 5 p. m. April 18 (discharge, 58 million gallons per day, or 90 second-feet); minimum stage recorded, 1.0 foot about noon September 28, 1918 (discharge, 1.3 million gallons per day, or 2.0 second-feet).

1915–1919: Maximum stage recorded, April 18, 1919; minimum stage recorded, 1.0 foot January 1, 1916 (discharge, 0.9 million gallons per day, or 1.4 second-feet).

DIVERSIONS.—Diverts from Anahola River.

REGULATION.—By headgates. When Kaneha reservoir is full, water is turned out of ditch at spillway just below gage. This affects the stage-discharge relation.

UTILIZATON.—Water is stored in Kaneha reservoir for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation not permanent. Curve used when spillway is closed, well defined below 20 million gallons per day; curve used when spillway is open, fairly well defined below 20 million gallons per day. Operation of water-stage recorder unsatisfatory. Results good when water was not wasting and recorder operating.

*Discharge measurements of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, during the year ending June 30, 1919.*

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|---|---|---|---|---|---|---|---|
| | | Second-feet. | Million gallons per day. | | | Second-feet. | Million gallons per day. |
| July 14 | 1.79 | 13.6 | 8.8 | Jan. 8 | 1.24 | 3.4 | 2.2 |
| Nov. 27 | 1.69 | 11.7 | 7.6 | Mar. 3 | 1.51 | 7.7 | 4.9 |

*Daily discharge, in million gallons, of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Jan. | Mar. | Apr. |
|---|---|---|---|---|---|---|---|
| 1 | 3.4 | ..... | 7.9 | 5.8 | ..... | ..... | 2.5 |
| 2 | 3.5 | ..... | 7.6 | 5.7 | ..... | ..... | 2.5 |
| 3 | 4.7 | ..... | 7.9 | 5.7 | ..... | ..... | 2.5 |
| 4 | 3.2 | 8.2 | 7.4 | ..... | ..... | ..... | 2.4 |
| 5 | 7.6 | 9.3 | 7.0 | ..... | 2.5 | ..... | 2.5 |
| 6 | 6.7 | 6.3 | 6.9 | 4.0 | 3.1 | ..... | 2.6 |
| 7 | 9.3 | 5.7 | ..... | 4.2 | 2.4 | ..... | 2.5 |
| 8 | 5.8 | 5.1 | 6.4 | 4.0 | 2.9 | ..... | 2.4 |
| 9 | 7.2 | ..... | 6.2 | 3.9 | 2.7 | 4.1 | 2.3 |
| 10 | 8.6 | ..... | ..... | 4.0 | 3.2 | 4.9 | 2.3 |
| 11 | 8.5 | 7.2 | ..... | 4.4 | 2.9 | 5.0 | 2.4 |
| 12 | ..... | 7.9 | ..... | 5.0 | 2.7 | 7.7 | 2.5 |
| 13 | ..... | 9.8 | ..... | 5.0 | 10.8 | 4.3 | ..... |
| 14 | ..... | 8.0 | ..... | 5.1 | 6.9 | 3.2 | ..... |
| 15 | ..... | 7.4 | 2.4 | 4.9 | ..... | 2.9 | ..... |
| 16 | ..... | ..... | 2.5 | 4.9 | ..... | 6.7 | ..... |
| 17 | ..... | ..... | 2.8 | 4.7 | ..... | 6.9 | ..... |
| 18 | ..... | 6.7 | 3.0 | ..... | ..... | 6.9 | ..... |
| 19 | ..... | 6.6 | ..... | ..... | 2.2 | 7.0 | ..... |
| 20 | ..... | 6.6 | ..... | ..... | 2.1 | 12.6 | ..... |
| 21 | ..... | 7.3 | ..... | ..... | 2.6 | 19.8 | ..... |
| 22 | ..... | 6.6 | 1.8 | ..... | 10.9 | 15.6 | ..... |
| 23 | ..... | 6.4 | 2.0 | ..... | 7.4 | 4.9 | ..... |
| 24 | ..... | ..... | 1.7 | ..... | 6.1 | 4.1 | ..... |
| 25 | ..... | 23 | 1.8 | ..... | 5.1 | 3.8 | ..... |
| 26 | ..... | 22 | 1.6 | ..... | 5.6 | 3.6 | ..... |
| 27 | ..... | 22 | 1.6 | ..... | 4.8 | 3.4 | ..... |
| 28 | ..... | 22 | ..... | ..... | 5.1 | 3.3 | ..... |
| 29 | ..... | 22 | 6.0 | ..... | ..... | 3.1 | ..... |
| 30 | ..... | 22 | 6.0 | ..... | ..... | 2.7 | ..... |
| 31 | ..... | ..... | ..... | ..... | ..... | 2.5 | ..... |

NOTE.—Recorder was not working properly except for days when discharge is given.

### KALIHIWAI RIVER NEAR HANALEI, KAUAI.

LOCATION.—At elevation 700 feet, 1 mile east of Kauai Electric Co.'s power line, 9 miles southeast of Hanalei.

RECORDS AVAILABLE.—March 13, 1914, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and 50 feet below gage; current sluggish at low stages; right bank low and wooded; left bank a high and nearly vertical cliff. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.28 feet at about noon November 25 (discharge, approximately 1,160 million gallons per day, or 1,790 second-feet); minimum stage recorded, 0.69 foot 4 p. m. June 22 (discharge, 7.8 million gallons per day, or 12.1 second-feet).

1914–1919: Maximum stage recorded, 14.4 feet at 6.30 a. m. September 25, 1914 (discharge, computed from extension of rating curve, approximately 4,000 million gallons per day, or 6,200 second-feet); minimum stage recorded, 0.95 foot March 13, 1914 (discharge, 6.5 million gallons per day, or 10 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of flow is diverted below station for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 70 million gallons per day. Operation of water-stage recorder unsatisfactory. Records good when water-stage recorder was operating.

*Discharge measurements of Kalihiwai River near Hanalei, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Dec. 15 | W. V. Hardy | 1.06 | 36 | 23.0 |
| 16 | ....do | 1.43 | 58 | 37 |
| Mar. 7 | Y. Masato | 1.02 | 33.5 | 21.7 |
| 8 | ....do | .97 | 27.5 | 17.7 |

*Daily discharge, in million gallons, of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1919.*

| Day. | Sept. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 19.0 | | | 23 | 15.5 | 21 | 21 |
| 2 | | | 28 | | | 27 | 16.5 | 17.5 | 22 |
| 3 | | | 94 | | 9.2 | | 17.0 | 15.5 | 39 |
| 4 | | | 27 | | 9.5 | | 17.5 | 21 | 31 |
| 5 | | | | 13.8 | 9.8 | | 17.5 | | |
| 6 | | | | 13.8 | 10.4 | | | | |
| 7 | | | | 12.6 | 9.5 | | | | |
| 8 | | | 103 | 12.6 | 9.8 | 19.5 | | | |
| 9 | | | 71 | 12.2 | 19.0 | 25 | | | |
| 10 | | | 187 | 13.4 | 53 | 22 | | | |
| 11 | | | 72 | 12.6 | 16.0 | 23 | | | |
| 12 | | | 52 | 43 | 36 | 41 | | | |
| 13 | | | 42 | 67 | 38 | 26 | | | |
| 14 | | | 36 | 20 | 24 | 21 | 19.0 | | |
| 15 | | 29 | 30 | 15.0 | 21 | 17.0 | 37 | | 10.4 |
| 16 | | 15.0 | 26 | 13.0 | 18.0 | 14.2 | 69 | | 12.6 |
| 17 | | | 30 | 11.8 | 13.8 | 15.5 | 66 | | 23 |
| 18 | 24 | | 29 | 11.0 | 13.8 | 17.0 | 150 | | 12.2 |
| 19 | 20 | | 21 | 10.7 | 15.0 | 13.8 | 256 | 19.0 | 15.0 |
| 20 | 15.0 | | 21 | 10.7 | 32 | 57 | 215 | 21 | 11.0 |
| 21 | 13.4 | | 20 | 58 | 56 | 41 | 98 | 29 | 9.8 |
| 22 | 11.4 | | 18.0 | 71 | 48 | 81 | 56 | 22 | 8.0 |
| 23 | 12.2 | | 16.5 | 42 | 29 | 27 | 57 | 25 | 10.4 |
| 24 | 11.0 | | 20 | 24 | 24 | 21 | 39 | 22 | 10.7 |
| 25 | | | 17.5 | 19.0 | 24 | 18.5 | 31 | 21 | 35 |
| 26 | | | 16.0 | 18.0 | 19.0 | 17.5 | 26 | 22 | 36 |
| 27 | | | 14.6 | 18.0 | 17.0 | 17.0 | 21 | 19.5 | 18.0 |
| 28 | | | 46 | 17.0 | 16.0 | 16.0 | 17.5 | 19.5 | 25 |
| 29 | | | 19.5 | | | 15.5 | 17.5 | 22 | 13.0 |
| 30 | | 21 | | | | 16.5 | 41 | 22 | 17.5 |
| 31 | | | | | | 15.5 | | 24 | |

NOTE.—Except for days when discharge is given there was either no record or no record of any value.

### HANALEI RIVER NEAR HANALEI, KAUAI.

LOCATION.—5 miles upstream from Hanalei.

RECORDS AVAILABLE.—December 28, 1911, to June 30, 1919.

GAGE.—Inclined and vertical staff on left bank read by Daniel Kamaka.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for a quarter of a mile above and 500 feet below gage; banks low, wooded, and not subject to overflow. Control, shifting boulder and gravel bar.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.99 feet at 10 a. m. November 25 (discharge, 5,970 million gallons per day, or 9,240 second-feet); minimum stage recorded, 6.56 feet June 24, 25, and 28 (discharge, 39 million gallons per day, or 60 second-feet).

1911–1919: Maximum stage recorded, 17.5 feet at 4 p. m. September 26, 1914 (discharge, computed from extension of rating curve, approximately 14,000 million gallons per day, or 21,700 second-feet); minimum stage recorded, 6.21 feet March 25, 1914 (discharge, 26 million gallons per day, or 40 second-feet).

DIVERSIONS.—China ditch diverts water above station.

UTILIZATION.—Most of the water passing the station is wasted, but a small amount is diverted for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation slightly shifting. Shifts not large enough to warrant drawing more than one curve. Rating curve fairly well defined. Gage read to hundredths twice daily. Records fair.

*Discharge measurements of Hanalei River near Hanalei, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 23 | W. V. Hardy | 6.48 | 168 | 108 |
| Mar. 22 | Y. Masato | 7.21 | 307 | 198 |

*Daily discharge, in million gallons, of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 80 | 117 | 111 | 64 | 260 | 117 | 72 | 72 | 85 | 47 | 80 | 82 |
| 2 | 78 | 114 | 163 | 60 | 246 | 100 | 68 | 76 | 76 | 44 | 70 | 76 |
| 3 | 275 | 111 | 85 | 129 | 178 | 475 | 76 | 74 | 72 | 44 | 64 | 57 |
| 4 | 120 | 102 | 80 | 105 | 105 | 219 | 74 | 74 | 68 | 44 | 163 | 57 |
| 5 | 568 | 350 | 80 | 129 | 250 | 280 | 72 | 68 | 64 | 47 | 138 | 55 |
| 6 | 92 | 228 | 76 | 129 | 142 | 535 | 90 | 60 | 60 | 44 | 100 | 50 |
| 7 | 415 | 156 | 149 | 60 | 98 | 705 | 72 | 60 | 214 | 44 | 105 | 47 |
| 8 | 255 | 156 | 265 | 111 | 95 | 850 | 70 | 58 | 64 | 43 | 85 | 163 |
| 9 | 270 | 135 | 117 | 102 | 315 | 535 | 68 | 250 | 62 | 42 | 325 | 70 |
| 10 | 505 | 123 | 123 | 62 | 305 | 1,050 | 82 | 80 | 60 | 42 | 85 | 72 |
| 11 | 149 | 108 | 108 | 58 | 475 | 385 | 72 | 100 | 58 | 42 | 345 | 64 |
| 12 | 275 | 305 | 117 | 66 | 228 | 265 | 66 | 224 | 970 | 42 | 149 | 68 |
| 13 | 280 | 1,010 | 135 | 64 | 170 | 228 | 202 | 88 | 129 | 40 | 82 | 72 |
| 14 | 224 | 367 | 108 | 305 | 156 | 178 | 72 | 76 | 90 | 40 | 70 | 64 |
| 15 | 219 | 214 | 74 | 325 | 149 | 149 | 72 | 72 | 72 | 90 | 64 | 57 |
| 16 | 160 | 325 | 74 | 275 | 123 | 142 | 70 | 95 | 68 | 228 | 142 | 54 |
| 17 | 123 | 1,170 | 74 | 120 | 92 | 135 | 68 | 90 | 66 | 265 | 132 | 55 |
| 18 | 163 | 228 | 74 | 117 | 80 | 142 | 68 | 85 | 64 | 600 | 72 | 54 |
| 19 | 210 | 194 | 74 | 123 | 76 | 117 | 68 | 82 | 64 | 670 | 60 | 47 |
| 20 | 219 | 246 | 74 | 391 | 72 | 111 | 64 | 126 | 325 | 1,510 | 57 | 44 |
| 21 | 219 | 345 | 74 | 194 | 70 | 105 | 232 | 219 | 149 | 535 | 117 | 43 |
| 22 | 156 | 325 | 72 | 111 | 68 | 100 | 475 | 132 | 290 | 237 | 92 | 42 |
| 23 | 129 | 246 | 135 | 88 | 66 | 98 | 246 | 92 | 123 | 255 | 80 | 40 |
| 24 | 535 | 214 | 72 | 76 | 186 | 98 | 117 | 102 | 90 | 149 | 72 | 39 |
| 25 | 210 | 198 | 70 | 80 | 3,570 | 95 | 98 | 74 | 72 | 123 | 68 | 42 |
| 26 | 505 | 166 | 72 | 102 | 367 | 95 | 98 | 70 | 68 | 105 | 68 | 80 |
| 27 | 163 | 345 | 68 | 325 | 132 | 95 | 105 | 70 | 64 | 100 | 64 | 42 |
| 28 | 156 | 105 | 68 | 108 | 163 | 90 | 105 | 70 | 60 | 95 | 62 | 44 |
| 29 | 170 | 100 | 66 | 68 | 174 | 206 | 95 | ..... | 57 | 85 | 80 | 44 |
| 30 | 149 | 95 | 64 | 409 | 132 | 90 | 90 | ..... | 54 | 320 | 66 | 50 |
| 31 | 117 | 90 | ..... | 810 | ..... | 210 | 85 | ..... | 50 | ..... | 64 | ..... |

*Monthly discharge of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 568 | 78 | 232 | 359 | 7,190 | 22,100 |
| August | 1,170 | 90 | 258 | 399 | 7,990 | 24,500 |
| September | 265 | 64 | 97.4 | 151 | 2,920 | 8,970 |
| October | 810 | 58 | 167 | 258 | 5,170 | 15,900 |
| November | 3,570 | 66 | 285 | 441 | 8,540 | 26,200 |
| December | 1,050 | 90 | 258 | 399 | 8,000 | 24,500 |
| January | 475 | 64 | 107 | 166 | 3,310 | 10,200 |
| February | 250 | 58 | 97.8 | 151 | 2,740 | 8,400 |
| March | 970 | 50 | 123 | 190 | 3,810 | 11,700 |
| April | 1,510 | 40 | 199 | 308 | 5,970 | 18,300 |
| May | 345 | 57 | 104 | 161 | 3,220 | 9,890 |
| June | 163 | 39 | 59.1 | 91.4 | 1,770 | 5,440 |
| The year | 3,570 | 39 | 166 | 257 | 60,600 | 186,000 |

### CHINA DITCH NEAR HANALEI, KAUAI.

LOCATION.—Just below intake, 4 miles south of Hanalei.

RECORDS AVAILABLE.—March 17, 1914, to June 30, 1919. December 28, 1911, to September 30, 1913, at old station a quarter of a mile below present station.

GAGE.—Vertical staff on right bank read by Daniel Kamaka.

DISCHARGE MEASUREMENTS.—Made from plank.

CHANNEL AND CONTROL.—Cut in clay and gravel; straight for 30 feet above and 50 feet below gage. Channel subject to growth of grass and weeds which affects stage discharge relation.

EXTREME OF DISCHARGE.—Maximum stage recorded during year, 2.22 feet at 4 p. m. August 17 (discharge, 34 million gallons per day, or 53 second-feet); minimum stage recorded during year, 0.80 foot January 28 (discharge, 4.6 million gallons per day, or 7.1 second-feet).

1911–1919: Maximum stage recorded, 3.09 feet at 8 a. m. April 3, 1919 (discharge, 56 million gallons per day, or 87 second-feet); minimum, ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of Hanalei River.

REGULATION.—By headgates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 10 and 25 million gallons per day applicable July 1 to April 19 and April 20 to June 30. Gage read to hundredths twice daily. Records fair.

The following discharge measurement was made by Y. Masato:

March 22, 1919: Gage height, 1.84 feet; discharge, 32 second-feet, or 20.6 million gallons per day.

*Daily discharge, in million gallons, of China ditch near Hanalei, Kauai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15.6 | 16.0 | 16.5 | 13.7 | 18.6 | 6.2 | 7.6 | 11.2 | 16.7 | 16.0 | 24 | 21 |
| 2 | 15.2 | 16.0 | 17.3 | 13.3 | 19.2 | 5.7 | 7.5 | 11.0 | 16.5 | 15.6 | 23 | 21 |
| 3 | 15.0 | 15.6 | 15.6 | 13.0 | 17.6 | 12.8 | 7.4 | 10.8 | 16.0 | 15.6 | 21 | 19.1 |
| 4 | 17.3 | 15.6 | 15.4 | 13.3 | 16.7 | 9.2 | 7.2 | 10.8 | 15.6 | 15.2 | 25 | 18.9 |
| 5 | 27 | 15.4 | 15.2 | 13.0 | 19.2 | 10.7 | 6.9 | 11.9 | 15.2 | 15.6 | 27 | 18.6 |
| 6 | 16.2 | 18.6 | 15.0 | 13.0 | 17.1 | 13.7 | 8.0 | 13.0 | 14.8 | 15.2 | 24 | 20 |
| 7 | 23 | 17.3 | 16.9 | 13.1 | 16.5 | 16.2 | 8.3 | 13.0 | 19.5 | 15.2 | 24 | 20 |
| 8 | 19.2 | 17.6 | 18.9 | 13.0 | 16.0 | 17.3 | 8.1 | 13.0 | 17.1 | 15.0 | 23 | 29 |
| 9 | 18.9 | 16.5 | 15.0 | 13.0 | 19.7 | 11.3 | 8.1 | 20 | 16.9 | 16.9 | 31 | 23 |
| 10 | 28 | 16.0 | 15.4 | 13.3 | 19.7 | 18.4 | 8.1 | 15.8 | 16.7 | 16.2 | 23 | 23 |
| 11 | 25 | 16.0 | 14.8 | 13.1 | 22 | 11.2 | 6.9 | 16.0 | 16.5 | 15.6 | 31 | 22 |
| 12 | 21 | 19.5 | 15.2 | 13.3 | 18.4 | 9.3 | 6.8 | 18.6 | 21 | 15.2 | 26 | 23 |
| 13 | 18.4 | 28 | 14.8 | 13.3 | 17.1 | 8.4 | 10.0 | 15.6 | 16.7 | 15.0 | 23 | 22 |
| 14 | 18.4 | 18.9 | 14.8 | 19.5 | 16.5 | 7.8 | 8.1 | 15.2 | 16.9 | 15.0 | 22 | 23 |
| 15 | 18.1 | 16.9 | 14.6 | 19.7 | 16.0 | 7.2 | 7.8 | 15.0 | 16.7 | 17.3 | 22 | 21 |
| 16 | 16.9 | 17.3 | 14.4 | 18.4 | 15.6 | 7.2 | 8.8 | 14.8 | 16.0 | 22 | 26 | 21 |
| 17 | 15.8 | 24 | 14.4 | 15.0 | 15.2 | 7.0 | 10.1 | 14.6 | 16.0 | 23 | 24 | 21 |
| 18 | 17.6 | 16.2 | 14.4 | 14.8 | 14.8 | 7.0 | 10.1 | 14.4 | 15.6 | 24 | 22 | 22 |
| 19 | 22 | 15.6 | 14.4 | 15.8 | 14.4 | 9.1 | 10.1 | 14.2 | 15.6 | 27 | 21 | 20 |
| 20 | 19.5 | 16.7 | 14.4 | 17.1 | 14.1 | 9.3 | 10.7 | 16.2 | 22 | 31 | 21 | 19.7 |
| 21 | 18.1 | 18.9 | 14.4 | 17.3 | 13.9 | 8.6 | 13.1 | 18.6 | 18.9 | 24 | 24 | 19.4 |
| 22 | 17.6 | 17.3 | 14.2 | 14.4 | 13.7 | 8.3 | 15.4 | 15.2 | 23 | 22 | 22 | 19.1 |
| 23 | 16.9 | 16.5 | 16.9 | 15.8 | 13.5 | 8.1 | 13.1 | 14.8 | 17.3 | 22 | 21 | 18.9 |
| 24 | 27 | 16.5 | 14.2 | 15.2 | 16.5 | 8.0 | 12.3 | 14.8 | 18.4 | 20 | 21 | 18.6 |
| 25 | 18.4 | 16.5 | 14.1 | 15.4 | 22 | 7.8 | 11.9 | 15.2 | 17.8 | 18.9 | 20 | 19.1 |
| 26 | 26 | 15.0 | 14.1 | 15.8 | 11.9 | 7.8 | 11.8 | 15.6 | 17.3 | 18.1 | 20 | 22 |
| 27 | 17.8 | 14.2 | 14.1 | 19.2 | 6.7 | 7.7 | 7.6 | 15.6 | 16.9 | 17.9 | 19.7 | 18.9 |
| 28 | 17.3 | 13.7 | 14.1 | 16.0 | 13.3 | 8.6 | 7.6 | 15.6 | 16.9 | 17.7 | 19.4 | 19.7 |
| 29 | 17.6 | 13.5 | 14.1 | 14.8 | 7.0 | 10.1 | 11.4 | ..... | 16.5 | 19.7 | 21 | 19.4 |
| 30 | 18.4 | 14.6 | 13.9 | 21 | 6.6 | 7.6 | 11.3 | ..... | 16.5 | 29 | 20 | 20 |
| 31 | 16.5 | 15.6 | ..... | 26 | ..... | 9.6 | 11.2 | ..... | 16.0 | ..... | 19.7 | ..... |

*Monthly discharge of China ditch near Hanalei, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 28 | 15.0 | 19.4 | 30.0 | 600 | 1,850 |
| August | 28 | 13.5 | 17.0 | 26.3 | 526 | 1,620 |
| September | 18.9 | 13.9 | 15.0 | 23.2 | 452 | 1,380 |
| October | 26 | 13.0 | 15.6 | 24.1 | 483 | 1,480 |
| November | 22 | 6.6 | 15.6 | 24.1 | 470 | 1,440 |
| December | 18.4 | 5.7 | 9.59 | 14.8 | 297 | 912 |
| January | 15.4 | 6.8 | 9.46 | 14.6 | 293 | 900 |
| February | 20 | 10.8 | 14.7 | 22.7 | 410 | 1,260 |
| March | 23 | 14.8 | 17.2 | 26.6 | 534 | 1,640 |
| April | 31 | 15.0 | 19.0 | 29.4 | 571 | 1,750 |
| May | 31 | 19.4 | 22.9 | 35.4 | 711 | 2,180 |
| June | 23 | 18.6 | 20.8 | 32.2 | 623 | 1,910 |
| The year | 31 | 5.7 | 16.4 | 25.4 | 5,970 | 18,300 |

### KUNA DITCH NEAR HANALEI, KAUAI.

LOCATION.—A quarter of a mile below intake and 3 miles southeast of Hanalei.

RECORDS AVAILABLE.—July 1, 1916, to June 30, 1919. January 17, 1912, to September 30, 1913, at old site 500 feet below intake.

GAGE.—Vertical staff read by Daniel Kamaka.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Channel about 5 feet wide and 3 feet deep cut in firm earth, straight for 20 feet above and 50 feet below gage. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.86 feet at 7 a. m., March 13 (discharge, 31 million gallons per day, or 48 second-feet); minimum stage recorded, 0.77 foot at 4 p. m., January 12 (discharge, 4.1 million gallons per day, or 6.3 second-feet).

1918–1919: Maximum stage recorded, 6.2 feet December 3, 1912 (discharge, 39 million gallons per day, or 60 second-feet); minimum stage recorded, 3.1 feet January and February, 1913 (discharge, 2.9 million gallons per day, or 4.5 second-feet).

DIVERSIONS.—Ditch diverts part of flow of Hanalei River.

REGULATION.—By headgates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation changed during flood of November 25. Rating curve applicable July 1 to November 24 well defined above 4 million gallons per day. Rating curve applicable November 25 to June 30 fairly well defined above and poorly defined below 15 million gallons per day.

*Discharge measurements of Kuna ditch near Hanalei, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 7 | W. V. Hardy | 2.65 | 28.5 | 18.5 |
| Mar 22 | Y. Masato | 2.76 | 45 | 29 |

*Daily discharge, in million gallons, of Kuna ditch near Hanalei, Kauai, for year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18.6 | 17.4 | 9.5 | 8.9 | 20 | 13.8 | 11.4 | 7.1 | 25 | 17.9 | 24 | 23 |
| 2 | 18.4 | 17.1 | 10 | 8.7 | 20 | 13.2 | 11.4 | 8.0 | 25 | 17.9 | 22 | 22 |
| 3 | 18.3 | 15.6 | 8.9 | 8.6 | 9.1 | ..... | 8.1 | 12.6 | 25 | 17.2 | 22 | 21 |
| 4 | 20 | 15.5 | 8.9 | 8.8 | 7.5 | ..... | 5.3 | 17.9 | 24 | 17.2 | 30 | 21 |
| 5 | 20 | 18 | 7.6 | 8.6 | 20 | ..... | 4.9 | 17.2 | 24 | 17.2 | 30 | 21 |
| 6 | 18.8 | 18 | 8.6 | 8.6 | 8.7 | ..... | 5.1 | 7.4 | 23 | 17.2 | 25 | 21 |
| 7 | ..... | 17.7 | 10 | 8.7 | 7.0 | ..... | 4.5 | 7.2 | 30 | 17.2 | 25 | 20 |
| 8 | ..... | 17.7 | 10 | 8.6 | 6.5 | ..... | 4.4 | 7.2 | 24 | 20 | 22 | 30 |
| 9 | ..... | 16.5 | 8.7 | 8.6 | ..... | ..... | 4.4 | 25 | 24 | 20 | 30 | 25 |
| 10 | ..... | 16.5 | 8.9 | 8.8 | ..... | ..... | 4.9 | 19.3 | 24 | 20 | 23 | 25 |
| 11 | ..... | 16.4 | 8.4 | 8.7 | ..... | ..... | 4.9 | 19.3 | 24 | 20 | 30 | 24 |
| 12 | ..... | ..... | 8.7 | 8.7 | 10.3 | 15.8 | 4.2 | 25 | 30 | 20 | 26 | 24 |
| 13 | 15.2 | ..... | 8.3 | 8.9 | 9.1 | 15.2 | 10.0 | 19.3 | 30 | 20 | 25 | 28 |
| 14 | 14.4 | ..... | 8.5 | ..... | 8.2 | 14.5 | 4.7 | 16.5 | 25 | 20 | 22 | 27 |
| 15 | 14.0 | 16.5 | 8.3 | ..... | 7.2 | 14.5 | 4.6 | 16.5 | 24 | 22 | 22 | 27 |
| 16 | 13.1 | ..... | 8.3 | ..... | 7.0 | 13.8 | 5.2 | 16.5 | 24 | 30 | 28 | 26 |
| 17 | 18.6 | ..... | 8.3 | 11.0 | 6.9 | 13.8 | 5.8 | 15.8 | 24 | ..... | 28 | 27 |
| 18 | 18.6 | 15.6 | 8.3 | 11.0 | 6.8 | 13.8 | 5.7 | 15.8 | 24 | ..... | 24 | 27 |
| 19 | ..... | 15.4 | 8.3 | 11.2 | 6.6 | 13.2 | 5.7 | 15.8 | 24 | ..... | 22 | 24 |
| 20 | ..... | ..... | 8.3 | 15 | 7.0 | 12.6 | 6.3 | 17.9 | 30 | ..... | 22 | 24 |
| 21 | ..... | ..... | 8.3 | 15 | 6.4 | 12.0 | ..... | 25 | 28 | ..... | 26 | 23 |
| 22 | 17.7 | ..... | 8.2 | 11.8 | 6.3 | 12.6 | ..... | 19.3 | 30 | 25 | 24 | 23 |
| 23 | 17.4 | ..... | 10 | 11.2 | 6.3 | 12.0 | ..... | 18.6 | 26 | 23 | 23 | 23 |
| 24 | ..... | ..... | 8.2 | 10.3 | ..... | 12.0 | 7.6 | 15.8 | 23 | 22 | 22 | 22 |
| 25 | ..... | ..... | 8.0 | 10.5 | ..... | 12.0 | 7.2 | 15.8 | 22 | 18.6 | 22 | 22 |
| 26 | ..... | 11.0 | 8.0 | 11.5 | ..... | 12.0 | 7.1 | 15.8 | 21 | 25 | 22 | 25 |
| 27 | 18.0 | 10.5 | 8.0 | 15 | 11.4 | 12.0 | 7.2 | 15.8 | 21 | 24 | 22 | 22 |
| 28 | 17.6 | 10.0 | 8.0 | 12.0 | 15.2 | 11.4 | 7.1 | 15.8 | 20 | 24 | 22 | 25 |
| 29 | 20 | 9.8 | 7.9 | 9.8 | 15.2 | 20 | 6.5 | ..... | 19.3 | 23 | 24 | 25 |
| 30 | 17.1 | 9.6 | 8.4 | 15 | 14.5 | 11.4 | 6.3 | ..... | 18.6 | 30 | 22 | 25 |
| 31 | 16.8 | 9.1 | ..... | 15 | ..... | 20 | 6.2 | ..... | 18.6 | ..... | 22 | ..... |

NOTE.—On account of high water, gage could not be reached by observer, at one or both daily trips, as follows: July 5, 7–12, 19–21, 24–26, 29; Aug. 5, 6, 12–14, 16, 17, 20–25; Sept. 2, 7, 8, 23; Oct. 14–16, 20, 21, 27, 30, 31; Nov. 1, 2, 5, 9–11, 24–26; Dec. 3–11, 29, 31; Jan. 13, 21–23; Feb. 9, 12, 21; Mar. 7, 12, 20, 22; Apr. 17–21, 30; May 4, 5, 9, 11, and June 8. The discharge has been estimated for all the periods enumerated. For periods not given in table, discharge has been estimated in million gallons per day as follows: July, 20; Aug., 18; Oct., 15; Nov. and Dec., 20; Jan., 10; Apr., 30.

*Monthly discharge of Kuna ditch near Hanalei, Kauai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | ..... | 13.1 | 18.5 | 28.6 | 573 | 1,760 |
| August | ..... | 9.1 | 15.9 | 24.6 | 492 | 1,510 |
| September | ..... | 7.6 | 8.59 | 13.3 | 258 | 791 |
| October | ..... | 8.6 | 11.1 | 17.2 | 344 | 1,060 |
| November | ..... | 6.3 | 12.1 | 18.7 | 364 | 1,110 |
| December | ..... | 11.4 | 15.5 | 24.0 | 481 | 1,470 |
| January | 11.4 | 4.2 | 6.67 | 10.3 | 207 | 635 |
| February | ..... | 7.1 | 16.0 | 24.8 | 449 | 1,370 |
| March | ..... | 18.6 | 24.3 | 37.6 | 754 | 2,310 |
| April | ..... | 17.2 | 22.6 | 35.0 | 678 | 2,080 |
| May | ..... | 22 | 24.3 | 37.6 | 753 | 2,310 |
| June | ..... | 20 | 24.1 | 37.3 | 722 | 2,220 |
| The year | ..... | 4.2 | 16.6 | 25.7 | 6,070 | 18,600 |

### WAIOLI STREAM NEAR HANALEI, KAUAI.

LOCATION.—3 miles above mouth of stream and 4 miles from Hanalei.

RECORDS AVAILABLE.—June 30, 1914, to June 30, 1919. Data from December 19, 1916, to June 30, 1918, have been revised in this report.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 30 feet above and 20 feet below gage; right bank steep; left bank slopes gently. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.00 feet at 5 p. m. August 18 (discharge, 345 million gallons per day, or 534 second-feet). Higher stage occurred November 25 but water-stage recorder not operating; minimum stage recorded, 0.76 foot October 11 (discharge, 3.7 million gallons per day, or 5.7 second-feet).

1914–1919: Maximum stage recorded, 6.15 feet at 6.30 a. m. December 19, 1916 (discharge, computed from extension of rating curve, approximately 955 million gallons per day,[1] or 1,480 second-feet); minimum stage recorded, 0.6 foot July 22, 1914 (discharge, 2.0 million gallons per day, or 3.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Small part of flow is diverted for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined but dates of shifts somewhat uncertain. Curves applicable as follows: December 19, 1916, to September 16, 1917; September 17, 1917, to March 11, 1918; March 12, 1918, to April 19, 1919; and April 20 to June 30, 1919. Operation of water-stage recorder satisfactory, except November 3, 1918, to April 23, 1919, and for a few short periods. Records fair when water-stage recorder was operating.

*Discharge measurements of Waioli Stream near Hanalei, Kauai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 6 | W. V. Hardy | 2.33 | 109 | 70.4 |
| Mar. 20 | Y. Masato | 1.52 | 30 | 19.3 |
| 21 | .....do | 1.32 | 19.9 | 12.9 |
| May 11 | W. V. Hardy | 1.27 | 24.8 | 16.0 |

[1] Supersedes figures published in Water-Supply Papers 465 and 485.

*Daily discharge, in million gallons, of Waioli Stream near Hanalei, Kauai, for the years ending June 30, 1917–1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1916–17. | | | | | | | | | | | | |
| 1 | 19.0 | 13.5 | 9.5 | 13.5 | 16.0 | 32 | 12.5 | 10.5 | 10.5 | 12.5 | 54 | ..... |
| 2 | 13.5 | 13.5 | 9.5 | 13.5 | 13.5 | 28 | 30 | 15.0 | 9.0 | 13.8 | 27 | ..... |
| 3 | 13.5 | 16.0 | 9.5 | 11.0 | 19.0 | 16.0 | 33 | 10.5 | 9.0 | 13.8 | 18.5 | 50 |
| 4 | 13.5 | 13.5 | 11.0 | 11.0 | 28 | 72 | 50 | 9.8 | 18.5 | 12.5 | 16.8 | ..... |
| 5 | 32 | 13.5 | 13.5 | 11.0 | 48 | 19.0 | 20 | 9.0 | 20 | 11.5 | 15.0 | ..... |
| 6 | 19.0 | 13.5 | 11.0 | 11.0 | 35 | 11.0 | 20 | 9.0 | 22 | 10.5 | 13.8 | ..... |
| 7 | 25 | 13.5 | 11.0 | 9.5 | 25 | 25 | 12.5 | 9.0 | 24 | 9.8 | 12.5 | ..... |
| 8 | 25 | 13.5 | 9.5 | 9.5 | 39 | 13.5 | 10.5 | 9.0 | 18.5 | 9.8 | 12.5 | ..... |
| 9 | 13.5 | 22 | 11.0 | 11.0 | 35 | 16.0 | 10.5 | 9.0 | 18.5 | 9.8 | 11.5 | ..... |
| 10 | 11.0 | 22 | 9.5 | 11.0 | 16.0 | 35 | 8.2 | 9.0 | 12.5 | 9.8 | 11.5 | 13.8 |
| 11 | 11.0 | 32 | 9.5 | 11.0 | 11.0 | 11.0 | 15.0 | 9.0 | 11.5 | 10.5 | 11.5 | 12.5 |
| 12 | 22 | 19.0 | 9.5 | 11.0 | 9.5 | 16.0 | 12.5 | 9.0 | 12.5 | 10.5 | 11.5 | ..... |
| 13 | 32 | 13.5 | 9.5 | 13.5 | 6.0 | 19.0 | 10.5 | 9.0 | 36 | 10.5 | 11.5 | ..... |
| 14 | 19.0 | 32 | 11.0 | 11.0 | 25 | 22 | 9.8 | 18.5 | 46 | 10.5 | 15.0 | 12.1 |
| 15 | 28 | 22 | 16.0 | 9.5 | 11.0 | 11.0 | 9.0 | 10.5 | 22 | 12.5 | 12.5 | 13.8 |
| 16 | 32 | 13.5 | 11.0 | 16.0 | ..... | 16.0 | 54 | 9.8 | 16.8 | 15.0 | 22 | 32 |
| 17 | 43 | 13.5 | 11.0 | 16.0 | ..... | 32 | 117 | 9.0 | 15.0 | 13.8 | 22 | 33 |
| 18 | 25 | 13.5 | 13.5 | 16.0 | ..... | 59 | 22 | 9.0 | 11.5 | 12.5 | 95 | 21 |
| 19 | 25 | 13.5 | 11.0 | 28 | 336 | 168 | 58 | 12.5 | 13.8 | 12.5 | 75 | 15.7 |
| 20 | 35 | 16.0 | 8.0 | 22 | 336 | 22 | 33 | 9.8 | 15.0 | 10.5 | 33 | 13.2 |
| 21 | 39 | 16.0 | 8.0 | 19.0 | 179 | 18.5 | 15.0 | 13.8 | 22 | 10.5 | 20 | 11.9 |
| 22 | 43 | 53 | 8.0 | 39 | 28 | 20 | 12.5 | 11.5 | 15.0 | 10.5 | 15.0 | 11.5 |
| 23 | 48 | 19.0 | 8.0 | 25 | 13.5 | 39 | 11.5 | 9.8 | 15.0 | 12.5 | 15.0 | 10.9 |
| 24 | 53 | 19.0 | 8.0 | 53 | 11.0 | 90 | 33 | 9.0 | 11.5 | 15.0 | 15.0 | 10.4 |
| 25 | 35 | 25 | 9.5 | 59 | 16.0 | 36 | 13.8 | 9.0 | 12.5 | 13.8 | 16.8 | 10.0 |
| 26 | 19.0 | 22 | 11.0 | 48 | 19.0 | 12.5 | 12.5 | 9.0 | 50 | 12.5 | 15.0 | 9.9 |
| 27 | 22 | 28 | 13.5 | 43 | 11.0 | 10.5 | 12.5 | 9.8 | 22 | 16.8 | ..... | 9.8 |
| 28 | 16.0 | 22 | 16.0 | 59 | 43 | 15.0 | 18.5 | 20 | 18.5 | 16.8 | ..... | 11.5 |
| 29 | 16.0 | 16.0 | 9.5 | 78 | 48 | 46 | 20 | ..... | 15.0 | 16.8 | ..... | 11.1 |
| 30 | 11.0 | 13.5 | 13.5 | 25 | 86 | 22 | 15.0 | ..... | 11.5 | 27 | ..... | 10.4 |
| 31 | 16.0 | 11.0 | ..... | 22 | ..... | 15.0 | 11.5 | ..... | 11.5 | ..... | ..... | ..... |
| 1917–18. | | | | | | | | | | | | |
| 1 | 12.5 | 15.0 | 11.5 | 9.5 | 7.8 | 8.6 | 6.2 | 10.4 | 17.8 | 15.0 | 5.0 | 22 |
| 2 | 11.5 | 10.5 | 9.0 | 8.6 | 39 | 8.6 | 6.2 | 8.6 | 16.0 | 36 | 5.0 | 18.5 |
| 3 | 22 | 12.5 | 9.0 | 8.6 | 95 | 8.6 | 6.2 | 7.0 | 24 | 70 | 6.2 | 13.5 |
| 4 | 24 | 10.5 | 9.0 | 7.8 | 22 | 8.6 | 7.0 | 26 | 39 | 160 | 7.6 | 10.8 |
| 5 | 18.5 | 10.5 | 9.0 | 9.5 | 19.6 | 8.6 | 6.2 | 7.8 | 117 | 100 | 6.2 | 8.6 |
| 6 | 12.5 | 10.5 | 9.0 | 8.6 | 13.0 | 19.6 | 6.2 | 7.8 | 95 | 46 | 6.2 | 8.6 |
| 7 | 15.0 | 10.5 | 9.0 | 8.6 | 8.6 | 47 | 6.2 | 7.8 | 29 | 22 | 6.2 | 8.6 |
| 8 | 16.8 | 10.5 | 9.0 | 7.8 | 8.6 | 14.5 | 7.0 | 8.6 | 19.6 | 22 | 6.2 | 12.0 |
| 9 | 54 | 9.8 | 9.0 | 7.0 | 7.8 | 22 | 6.2 | 13.0 | 19.6 | 20 | 7.6 | 24 |
| 10 | 27 | 9.8 | 9.8 | 7.0 | 10.4 | 13.0 | 6.2 | 19.6 | 14.5 | 24 | 6.9 | 27 |
| 11 | 10.5 | 9.8 | 12.5 | 7.0 | 7.8 | 13.0 | 13.0 | 32 | 152 | 117 | 6.2 | 24 |
| 12 | 10.5 | 10.5 | 18.5 | 7.0 | 7.8 | 14.5 | 10.4 | 24 | 145 | 50 | 6.2 | 46 |
| 13 | 13.8 | 10.5 | 13.8 | 9.5 | 7.0 | 17.8 | 10.4 | 24 | 62 | 39 | 5.6 | 42 |
| 14 | 11.5 | 9.8 | 11.5 | 9.5 | 7.0 | 16.0 | 26 | 14.5 | 62 | 16.8 | 6.9 | 27 |
| 15 | 10.5 | 18.5 | ..... | 8.6 | 7.0 | 10.4 | 26 | 10.4 | 90 | 13.5 | 7.6 | 27 |
| 16 | 10.5 | 22 | ..... | 43 | 17.8 | 9.5 | 10.4 | 9.5 | 90 | 13.5 | 10.8 | 27 |
| 17 | 10.5 | 13.8 | ..... | 16.0 | 16.0 | 8.6 | 8.6 | 13.0 | 66 | 12.0 | 9.6 | 18.5 |
| 18 | 10.5 | 11.5 | ..... | 10.4 | 10.4 | 8.6 | 7.8 | 14.5 | 24 | 13.5 | 8.6 | 15.0 |
| 19 | 10.5 | 10.5 | ..... | 8.6 | 11.7 | 7.8 | 11.7 | 14.5 | 18.5 | 9.6 | ..... | 18.5 |
| 20 | 10.5 | 10.5 | ..... | 8.6 | 11.7 | 7.8 | 16.0 | 22 | 15.0 | 9.6 | ..... | 24 |
| 21 | 12.5 | 10.5 | ..... | 8.6 | 13.0 | 11.7 | 10.4 | 60 | 13.5 | 9.6 | ..... | 30 |
| 22 | 11.5 | 10.5 | ..... | 7.8 | 8.6 | 7.8 | 14.5 | 24 | 12.0 | 8.6 | ..... | 18.5 |
| 23 | 10.5 | 9.8 | ..... | 9.5 | 8.6 | 7.8 | 14.5 | 13.0 | 10.8 | 7.6 | 30 | 16.8 |
| 24 | 18.5 | 12.5 | ..... | 7.8 | 13.0 | 7.0 | 10.4 | 10.4 | 12.0 | 7.6 | 27 | 15.0 |
| 25 | 18.5 | 10.5 | ..... | 8.6 | 9.5 | 7.0 | 10.4 | 10.4 | 62 | 7.6 | 20 | 12.0 |
| 26 | 24 | 9.8 | ..... | 10.4 | 8.6 | 7.0 | 26 | 14.5 | 24 | 6.2 | 24 | 13.5 |
| 27 | 12.5 | 9.8 | ..... | 8.6 | 8.6 | 7.0 | 152 | 11.7 | 20 | 6.2 | 33 | 15.0 |
| 28 | 10.5 | 9.0 | 17.8 | 7.8 | 7.8 | 7.0 | 29 | 19.6 | 20 | 6.2 | 39 | 12.0 |
| 29 | 10.5 | 9.0 | 17.8 | 9.5 | 9.5 | 7.0 | 16.0 | ..... | 33 | 5.6 | 62 | 9.6 |
| 30 | 11.5 | 9.0 | 11.7 | 10.4 | 7.8 | 7.0 | 17.8 | ..... | 62 | 5.6 | 42 | 7.6 |
| 31 | 10.5 | 9.0 | ..... | 8.6 | ..... | 7.0 | 13.0 | ..... | 20 | ..... | 27 | ..... |

*Daily discharge, in million gallons, of Waioli Stream near Hanalei, Kauai, for the years ending June 30, 1917–1919*—Continued.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1918–19. | | | | | | | | | | | | |
| 1 | 6.2 | 9.2 | 19.9 | 9.8 | 68 | | | | | | 17.9 | 25 |
| 2 | 5.8 | 7.8 | 18.5 | 9.2 | 22 | | | | | | 14.8 | 16.7 |
| 3 | 22 | 7.2 | 22 | 9.2 | 28 | | | | | | 18.0 | 20 |
| 4 | 10.8 | 8.8 | 21 | 8.8 | | | | | | | 32 | 16.2 |
| 5 | 40 | 17.4 | 19.6 | 8.6 | | | | | | | 25 | 14.8 |
| 6 | 23 | | 19.6 | 8.2 | | | | | | | 15.4 | 14.1 |
| 7 | 50 | | 20 | 7.2 | | | | | | | 26 | 13.9 |
| 8 | 26 | 31 | 24 | 6.6 | | | | | | | 18.2 | 14.1 |
| 9 | 24 | 22 | 42 | 5.6 | | | | | | | 24 | 16.5 |
| 10 | 71 | 22 | 28 | 5.1 | | | | | | | 17.0 | 15.1 |
| 11 | 131 | 19.2 | 28 | 5.2 | | | | | | | 18.8 | 15.1 |
| 12 | 52 | 22 | 33 | 10.7 | | | | | | | 16.2 | 14.8 |
| 13 | 28 | 24 | 26 | 7.5 | | | | | | | 17.6 | 26 |
| 14 | 33 | 69 | 26 | 29 | | | | | | | 15.6 | 16.2 |
| 15 | 32 | 49 | 22 | 37 | | | | | | | 15.4 | 15.4 |
| 16 | 29 | 19.9 | 22 | 12.6 | | | | | | | 38 | 16.5 |
| 17 | 24 | 60 | 21 | 10.3 | | | | | | | 52 | 16.5 |
| 18 | 20 | 66 | 25 | 9.4 | | | | | | | 21 | 15.9 |
| 19 | 34 | 31 | 31 | 9.8 | | | | | | | 17.0 | 17.0 |
| 20 | 28 | 24 | 39 | 13.2 | | | | | | | 21 | 17.0 |
| 21 | 24 | 28 | 22 | 13.2 | | | | | | | 25 | 16.5 |
| 22 | 24 | 71 | 17.8 | 14.4 | | | | | | | 17.6 | 15.9 |
| 23 | 24 | 34 | 18.2 | 12.6 | | | | | | | 17.6 | 15.1 |
| 24 | 36 | 34 | 16.4 | 12.3 | | | | | | 22 | 17.6 | 14.3 |
| 25 | 50 | 26 | 14.4 | 12.3 | | | | | | 19.7 | 16.7 | 16.7 |
| 26 | 42 | 47 | 12.9 | 12.3 | | | | | | 18.2 | 20 | 15.1 |
| 27 | 62 | 22 | 12.9 | 33 | | | | | | 17.0 | 14.6 | 17.0 |
| 28 | 20 | 18.2 | 12.0 | 17.8 | | | | | | 15.4 | 16.2 | 21 |
| 29 | 15.7 | 15.4 | 10.8 | 14.4 | | | | | | 18.5 | 15.4 | 15.4 |
| 30 | 15 0 | 16.0 | 10.3 | 34 | | | | | | 38 | 14.6 | 17.0 |
| 31 | 10.6 | 21 | | 133 | | | | | | | 21 | |

NOTE.—No record, Nov. 16–18, 1916; discharge estimated at 150 million gallons per day. No record May 27 to June 13, 1917, except June 3, 10, and 11; discharge estimated in million gallons per day as follows: May 27–31, 17; June 1 and 2, 2.5; June 4–9, 20; June 12 and 13, 12. No record Sept. 15–27, 1917; discharge estimated in million gallons per day as follows: Sept. 15–20, 20; Sept. 21–27, 15. No record May 19–22, 1918: discharge estimated at 15 million gallons per day. Recorder not operating properly Aug. 6–7, 1918, and Nov. 3, 1918, to Apr. 23, 1919; no estimate of discharge made.

*Monthly discharge of Waioli Stream near Hanalei, Kauai, for the years ending June 30, 1917–1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| 1916–17. | | | | | | |
| July | 53 | 11.0 | 25.0 | 38.7 | 775 | 2,380 |
| August | 53 | 11.0 | 19.0 | 29.4 | 588 | 1,810 |
| September | 16.0 | 8.0 | 10.7 | 16.6 | 320 | 985 |
| October | 78 | 9.5 | 23.7 | 36.7 | 736 | 2,250 |
| November | 336 | 6.0 | 63.8 | 98.7 | 1,910 | 5,870 |
| December | 168 | 10.5 | 30.9 | 47.8 | 958 | 2,940 |
| January | 117 | 8.2 | 23.3 | 36.1 | 724 | 2,220 |
| February | 20 | 9.0 | 10.6 | 16.4 | 298 | 911 |
| March | 50 | 9.0 | 18.3 | 28.3 | 567 | 1,740 |
| April | 27 | 9.8 | 12.8 | 19.8 | 385 | 1,180 |
| May | 95 | 11.5 | 22.0 | 34.0 | 684 | 2,030 |
| June | 50 | 9.8 | 17.3 | 26.8 | 518 | 1,590 |
| The year | 336 | 6.0 | 23.2 | 35.9 | 8,460 | 25,900 |

*Monthly discharge of Waioli Stream near Hanalei, Kauai, for the years ending June 30, 1917–1919*—Continued.

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| 1917–18. | | | | | | |
| July | 54 | 10.5 | 15.3 | 23.7 | 474 | 1,460 |
| August | 22 | 9.0 | 11.2 | 17.3 | 347 | 1,070 |
| September | ..... | 9.0 | 14.1 | 21.8 | 422 | 1,300 |
| October | 43 | 7.0 | 9.96 | 15.4 | 309 | 948 |
| November | 95 | 7.0 | 14.4 | 22.3 | 431 | 1,330 |
| December | 47 | 7.0 | 11.5 | 17.8 | 356 | 1,090 |
| January | 152 | 6.2 | 16.7 | 25.8 | 518 | 1,590 |
| February | 60 | 7.0 | 16.4 | 25.4 | 459 | 1,410 |
| March | 152 | 10.8 | 45.3 | 70.1 | 1,410 | 4,310 |
| April | 160 | 5.6 | 29.3 | 45.3 | 880 | 2,700 |
| May | 62 | 5.0 | 15.8 | 24.4 | 489 | 1,500 |
| June | 46 | 7.6 | 19.1 | 29.6 | 573 | 1,760 |
| The year | 160 | 5.0 | 18.3 | 28.3 | 6,660 | 20,500 |
| 1918–19. | | | | | | |
| July | 131 | 5.8 | 32.7 | 50.6 | 1,010 | 3,110 |
| September | 42 | 10.3 | 21.8 | 33.7 | 655 | 2,010 |
| October | 133 | 5.1 | 17.2 | 26.6 | 532 | 1,640 |
| May | 52 | 14.6 | 20.6 | 31.9 | 637 | 1,960 |
| June | 26 | 13.9 | 16.7 | 25.8 | 501 | 1,540 |

### MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Kauai at points other than regular gaging stations are listed below.

*Miscellaneous measurements on Kauai during the year ending June 30, 1919.*

| Date. | Stream. | Locality. | Gage height (feet). | Discharge. | |
|---|---|---|---|---|---|
| | | | | Second-feet. | Million gallons per day. |
| Sept. 30 | Kapahi ditch | 30 feet below diversion weir, near Kapaa | ..... | 9.2 | 5.9 |
| 30 | Tunnel ditch | 50 feet below diversion weir, near Kapaa | ..... | 7.3 | 4.7 |

## ISLAND OF OAHU.

### KALIHI STREAM NEAR HONOLULU, OAHU.

LOCATION.—At Kioi Pool, three-eighths mile above Catholic Orphanage, 3 miles up Kalihi Road from King Street car line, and 5 miles north of Honolulu post office.

RECORDS AVAILABLE.—September 8, 1913, to June 30, 1919.

GAGE.—Gurley 7-day water-stage recorder installed June 25, 1918. Friez recorder used September 8 to November 22, 1913, and Gurley printing recorder used December 4, 1913, to June 25, 1918.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 500 feet above gage.

CHANNEL AND CONTROL.—Water drops over a 10-foot fall into pool at gage. Channel is solid rock with steep, high banks; two channels for gage heights of 6.0 feet and over. The high-water control is solid rock; low-water control is concrete dam completed January 11, 1919.

EXTREMES OF DISCHARGE.—1913–1919: Maximum stage recorded, 12.53 feet at 8.30 p. m. December 6, 1918 (discharge, 1,150 million gallons per day, or 1,780 second-feet); minimum stage recorded, 2.13 feet at 8 p. m. October 29, 1918 (discharge, 0.69 million gallons per day, or 1.07 second-feet).

Minimum stage recorded during year, 2.13 feet (discharge, 0.69 million gallons per day, or 1.07 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of water diverted 400 feet below station for development of power; remaining low-water flow is diverted further downstream for irrigation of taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to November 28 well defined between 1 and 200 million gallons per day. Rating curve used January 11 to June 30 well-defined between 1 and 50 million gallons per day; shifting-channel methods used November 29 to January 10 while concrete control was being installed. Operation of water-stage recorder satisfactory. Records good.

*Discharge measurements of Kalihi Stream near Honolulu, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 5 | R. D. Klise | 3.12 | 18.5 | 12.0 |
| 5 | ....do | 3.01 | 15.1 | 9.8 |
| 5 | ....do | 2.93 | 13.9 | 9.0 |
| Oct. 29 | J. E. Stewart | 2.14 | .95 | .6 |
| Nov. 18 | C. T. Bailey | 2.24 | 2.0 | 1.3 |
| 25 | J. E. Stewart | 3.64 | 33 | 21.4 |
| Dec. 2 | A. H. Wong | 2.88 | 5.6 | 3.6 |
| 17 | ....do | 2.46 | 5.1 | 3.3 |
| 27 | ....do | 3.39 | 2.6 | 1.65 |
| Jan. 11 | J. E. Stewart | 2.94 | 2.4 | 1.5 |
| 11 | ....do | 2.94 | 2.5 | 1.6 |
| Feb. 3 | A. H. Wong | 3.00 | 3.1 | 2.0 |
| Mar. 12 | ....do | 3.94 | 32 | 20.3 |
| 12 | ....do | 3.62 | 19.3 | 12.5 |
| Apr. 23 | ....do | 3.32 | 9.7 | 6.2 |
| May 30 | J. E. Stewart | 2.99 | 2.8 | 1.85 |
| June 28 | ....do | 2.99 | 2.8 | 1.85 |

*Daily discharge, in million gallons, of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.3 | 2.1 | 5.0 | 1.2 | 3.4 | 3.3 | 1.6 | 2.8 | 1.6 | 1.6 | 3.1 | 3.6 |
| 2 | 2.4 | 2.3 | 3.2 | 1.2 | 1.9 | 17.0 | 1.6 | 2.0 | 1.6 | 1.6 | 3.0 | 5.4 |
| 3 | 2.2 | 1.9 | 2.2 | 1.2 | 1.6 | 49 | 1.6 | 1.9 | 1.6 | 1.5 | 2.8 | 2.9 |
| 4 | 2.1 | 2.1 | 1.9 | 1.2 | 2.6 | 8.9 | 1.6 | 1.7 | 1.7 | 1.5 | 5.6 | 2.4 |
| 5 | 4.0 | 5.7 | 1.8 | 1.9 | 2.2 | 6.2 | 1.6 | 1.6 | 1.8 | 1.5 | 3.3 | 2.2 |
| 6 | 2.2 | 2.2 | 1.8 | 3.8 | 1.6 | 87 | 1.6 | 1.6 | 2.3 | 1.6 | 2.7 | 2.0 |
| 7 | 2.2 | 1.9 | 1.9 | 1.2 | 1.5 | 36 | 1.6 | 1.5 | 3.6 | 1.6 | 3.0 | 2.0 |
| 8 | 1.9 | 1.9 | 2.4 | 1.1 | 1.5 | 13.5 | 1.6 | 1.5 | 2.1 | 1.5 | 2.9 | 8.2 |
| 9 | 3.0 | 2.8 | 1.9 | 1.0 | 1.5 | 9.5 | 1.6 | 3.0 | 1.9 | 1.5 | 3.9 | 2.2 |
| 10 | 31 | 1.8 | 1.6 | 1.0 | 1.4 | 10.1 | 1.6 | 1.6 | 1.9 | 1.5 | 27 | 1.9 |
| 11 | 10.8 | 1.6 | 1.5 | .9 | 1.9 | 8.0 | 1.5 | 1.8 | 1.8 | 1.5 | 5.6 | 17.5 |
| 12 | 4.3 | 1.5 | 1.5 | .8 | 2.3 | 6.0 | 1.7 | 2.0 | 6.3 | 1.5 | 4.0 | 3.1 |
| 13 | 6.7 | 26 | 1.6 | 1.0 | 1.4 | 4.8 | 1.8 | 1.6 | 5.0 | 1.1 | 4.6 | 2.5 |
| 14 | 3.7 | 3.9 | 1.5 | 1.2 | 1.2 | 4.2 | 1.6 | 1.6 | 4.6 | 1.0 | 3.4 | 2.1 |
| 15 | 3.3 | 2.3 | 1.6 | 1.0 | 1.2 | 3.3 | 1.5 | 1.5 | 2.4 | 2.0 | 3.1 | 2.3 |
| 16 | 2.9 | 42 | 1.6 | 1.0 | 1.2 | 3.0 | 1.5 | 1.4 | 2.1 | 3.0 | 3.8 | 2.0 |
| 17 | 2.6 | 32 | 1.6 | 1.2 | 1.0 | 2.7 | 1.5 | 1.5 | 1.9 | 5.2 | 6.0 | 5.8 |
| 18 | 2.8 | 6.8 | 1.5 | 1.1 | 1.1 | 2.4 | 1.5 | 1.4 | 1.7 | 7.4 | 3.0 | 2.7 |
| 19 | 2.5 | 4.8 | 1.5 | 2.5 | 1.0 | 2.0 | 1.5 | 1.4 | 1.8 | 27 | 3.0 | 2.3 |
| 20 | 2.3 | 6.1 | 1.4 | 1.0 | 1.0 | 2.9 | 1.5 | 2.7 | 1.7 | 16.5 | 3.0 | 2.2 |
| 21 | 6.5 | 13.4 | 1.5 | 1.0 | 1.0 | 2.0 | 1.5 | 1.7 | 3.6 | 8.0 | 3.0 | 2.1 |
| 22 | 2.4 | 5.8 | 1.5 | 1.0 | 1.1 | 1.8 | 2.7 | 1.7 | 40 | 5.8 | 2.5 | 1.8 |
| 23 | 2.2 | 4.4 | 1.4 | .8 | 1.1 | 2.3 | 14.6 | 1.7 | 3.6 | 7.6 | 2.4 | 1.8 |
| 24 | 4.4 | 4.6 | 1.2 | .8 | 2.6 | 2.3 | 2.3 | 1.8 | 2.6 | 7.1 | 2.3 | 2.0 |
| 25 | 2.5 | 4.3 | 1.4 | .7 | 46 | 1.6 | 2.0 | 1.6 | 2.4 | 4.6 | 2.2 | 3.0 |
| 26 | 2.1 | 4.0 | 1.3 | 1.0 | 24 | 1.3 | 1.7 | 1.6 | 2.3 | 4.6 | 2.1 | 3.6 |
| 27 | 2.0 | 3.8 | 1.3 | .8 | 4.9 | 1.4 | 3.4 | 1.6 | 2.2 | 3.8 | 2.2 | 2.4 |
| 28 | 5.5 | 5.0 | 1.3 | .8 | 3.2 | 1.6 | 3.0 | 1.5 | 2.1 | 3.6 | 2.0 | 1.9 |
| 29 | 5.3 | 4.3 | 2.7 | .8 | 11.5 | 2.2 | 2.3 | ..... | 2.0 | 3.5 | 2.0 | 5.4 |
| 30 | 2.5 | 3.7 | 1.4 | 46 | 3.3 | 2.7 | 1.9 | ..... | 1.9 | 3.4 | 2.1 | 2.2 |
| 31 | 2.4 | 3.4 | ..... | 8.1 | ..... | 1.7 | 4.6 | ..... | 1.7 | ..... | 21 | ..... |

NOTE.—May 18-21 float caught and record of no value; discharge estimated 3.0 million gallons per day.

*Monthly discharge of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 31 | 1.9 | 4.29 | 6.64 | 133 | 408 |
| August | 42 | 1.5 | 6.74 | 10.4 | 209 | 641 |
| September | 5.0 | 1.2 | 1.80 | 2.79 | 54.0 | 166 |
| October | 46 | .7 | 2.85 | 4.41 | 88.3 | 271 |
| November | 46 | 1.0 | 4.37 | 6.76 | 131 | 402 |
| December | 87 | 1.3 | 9.70 | 15.0 | 301 | 923 |
| January | 14.6 | 1.5 | 2.31 | 3.57 | 71.6 | 220 |
| February | 3.0 | 1.4 | 1.76 | 2.72 | 49.3 | 151 |
| March | 40 | 1.6 | 3.67 | 5.68 | 114 | 349 |
| April | 27 | 1.0 | 4.45 | 6.89 | 134 | 410 |
| May | 27 | 2.0 | 4.54 | 7.02 | 141 | 432 |
| June | 17.5 | 1.8 | 3.38 | 5.23 | 102 | 311 |
| The year | 87 | .7 | 4.18 | 6.47 | 1,530 | 4,680 |

**NUUANU STREAM BELOW RESERVOIR No. 2 WASTEWAY, NEAR HONOLULU, OAHU.**

LOCATION.—On Pali Road in upper Nuuanu Valley, 1 mile above end of car line and 5 miles from Honolulu post office.

RECORDS AVAILABLE.—October 21, 1913, to June 30, 1918.

GAGE.—Gurley weekly water-stage recorder installed April 12, 1918, at same location as old inclined staff; datum unchanged.

DISCHARGE MEASUREMENTS.—Low-water discharge measured by 2-foot sharp-crested weir with end contractions; flood discharge measured by 12-foot sharp-crested weir with end contractions, which with small weir, gives total flood discharge. Both weirs set in concrete. Crest of small weir is 1 foot lower than that of large weir. The weirs were reconstructed April 10–27, 1914, but original dimensions were maintained.

CHANNEL AND CONTROL.—Channel is solid rock; straight for about 75 feet above and below weir; banks high and covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.41 feet at 10.15 p. m. August 16 (discharge, 227 million gallons per day, or 351 second-feet); minimum stage recorded, 0.14 foot at noon February 28 (discharge, 0.37 million gallons per day, or 0.57 second-feet).

1913–1918: Maximum stage recorded, 6.0 feet at 4 p. m. April 5, 1914 (no estimate of discharge possible, as entire weir was overflowed); minimum stage recorded, 0.10 foot in November, 1913, September, 1915, July and August, 1916, and during 1917 (discharge, 0.15 million gallons per day, or 0.25 second-feet).

DIVERSIONS.—Most of the flow at low and medium stages is diverted above station for domestic supply and for development of power. An irrigation ditch diverts low-water discharge at point 300 feet below station.

REGULATION.—Amount diverted above station varies.

UTILIZATION.—Station measures the waste water and seepage from reservoirs Nos. 2, 3, and 4, and the Laukaha weir. This waste water is used for irrigation of taro and rice.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined below and well defined above 1 million gallons per day. Operation of water-stage recorder satisfactory, but intake to well not low enough prior to February 6, 1919. Prior to this date certain portions of the low-water record are not a record of the elevation of the water surface of the stream. Flow for these periods have been estimated. Records excellent when water-stage recorder was operating; fair when estimated.

*Discharge measurements of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, during the year ending June 30, 1919.*

[Made by J. E. Stewart.]

| Date. | | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Dec. 3 | | 1.42 | 27 | 17.4 |
| Jan. 15 | | .39 | 1.8 | 1.2 |
| June 2 | | .19 | .7 | .4 |

*Daily discharge, in million gallons, of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.3 | 3.7 | 2.6 | 1.2 | 1.8 | 1.9 | 1.6 | 0.6 | 0.4 | 0.5 | 1.6 | 0.6 |
| 2 | 6.1 | 3.7 | 2.5 | 1.2 | 1.4 | 2.2 | 1.8 | .6 | .4 | .5 | 1.4 | 2.8 |
| 3 | 5.8 | 3.5 | 2.4 | 1.1 | 1.2 | 23 | 1.7 | .6 | .5 | .5 | 1.4 | 2.0 |
| 4 | 5.8 | 3.2 | 2.2 | 1.0 | 1.7 | 5.5 | 1.4 | .5 | .4 | .5 | 1.5 | 1.0 |
| 5 | 7.5 | 5.7 | 2.3 | 1.0 | 1.4 | 3.1 | 1.4 | .5 | .4 | .6 | 1.4 | .8 |
| 6 | 5.9 | 3.2 | 2.2 | 1.0 | 1.2 | 11.9 | 1.4 | .5 | .5 | .6 | 1.3 | .6 |
| 7 | 6.1 | 3.0 | 2.0 | 1.0 | 1.0 | 12.8 | 1.3 | .5 | .6 | .5 | 1.5 | .5 |
| 8 | 5.2 | 2.6 | 2.2 | 1.0 | 1.4 | 5.8 | 1.3 | .5 | .6 | .5 | 1.7 | 1.4 |
| 9 | 5.5 | 2.7 | 1.8 | 1.0 | 1.7 | 5.0 | 1.2 | .7 | .5 | .5 | 2.7 | .8 |
| 10 | 14.9 | 2.6 | 1.6 | 1.0 | 1.0 | 4.5 | 1.2 | .6 | .7 | .4 | 2.6 | .6 |
| 11 | 7.8 | 2.8 | 1.4 | 1.0 | .9 | 3.7 | 1.2 | .6 | .6 | .4 | 2.5 | 7.5 |
| 12 | 5.9 | 2.7 | 1.4 | 1.0 | .7 | 3.2 | 1.2 | .9 | 1.1 | .5 | 2.1 | 2.5 |
| 13 | 7.4 | 9.5 | 1.8 | .8 | .5 | 3.0 | 1.3 | .6 | 1.3 | .5 | 2.0 | 2.2 |
| 14 | 5.9 | 4.6 | 1.4 | .7 | .4 | 3.0 | 1.3 | .6 | .7 | .5 | 1.5 | 1.9 |
| 15 | 5.6 | 3.2 | 1.4 | .6 | .4 | 3.0 | 1.3 | .6 | .6 | .5 | 1.2 | 2.0 |
| 16 | 5.5 | 16.9 | 1.4 | .5 | .4 | 2.9 | 1.3 | .5 | .5 | .6 | .7 | 1.6 |
| 17 | 5.5 | 16.4 | 1.3 | .5 | .4 | 3.2 | 1.3 | .5 | .5 | 1.8 | .9 | 1.4 |
| 18 | 5.6 | 4.6 | 1.3 | .5 | .4 | 3.2 | 1.3 | .5 | .5 | 1.6 | .8 | 1.4 |
| 19 | 5.8 | 4.0 | 1.3 | .6 | .4 | 3.1 | 1.1 | .5 | .5 | 4.6 | 1.5 | 1.3 |
| 20 | 4.9 | 4.0 | 2.0 | .6 | .4 | 2.9 | 1.0 | 1.0 | .6 | 4.8 | 1.3 | .9 |
| 21 | 7.6 | 7.4 | 1.4 | .5 | .4 | 2.8 | .9 | .8 | .7 | 2.9 | .7 | .8 |
| 22 | 6.5 | 5.1 | 1.4 | .5 | .4 | 2.5 | .8 | .8 | 3.0 | 2.4 | .6 | .8 |
| 23 | 5.9 | 4.1 | 1.4 | .5 | .4 | 2.4 | 1.8 | .6 | 1.0 | 3.3 | .6 | .7 |
| 24 | 6.1 | 4.3 | 1.4 | .5 | .6 | 2.3 | .7 | .7 | 1.4 | 2.7 | .6 | .7 |
| 25 | 5.3 | 4.1 | 1.4 | .5 | 4.8 | 2.0 | .5 | .7 | 1.4 | 2.4 | .6 | .7 |
| 26 | 4.6 | 3.9 | 1.4 | .5 | 3.6 | 1.9 | .5 | .5 | 1.4 | 2.2 | .5 | 1.4 |
| 27 | 4.1 | 3.7 | 1.4 | ..... | 2.5 | 1.8 | .5 | .4 | 1.3 | 2.0 | .5 | 1.1 |
| 28 | 5.1 | 4.0 | 1.4 | ..... | 2.0 | 1.9 | .5 | .4 | 1.3 | 1.8 | .5 | .8 |
| 29 | 5.9 | 3.3 | 1.3 | ..... | 2.0 | 1.9 | .6 | ..... | .8 | 1.8 | .4 | .9 |
| 30 | 4.4 | 3.0 | 1.3 | 5.6 | 2.0 | 1.9 | .6 | ..... | .6 | 1.8 | .4 | .8 |
| 31 | 4.0 | 2.8 | ..... | 2.9 | ..... | 1.7 | .6 | ..... | .6 | ..... | .7 | ..... |

NOTE.—Sept. 3 to Nov. 23 and Jan. 4 to Feb. 6; water below intake most of time. Records for these two periods have been obtained as follows: Sept. 3–21 graph record corrected and used. Sept. 22 to Oct. 15 discharge interpolated between observers weekly readings. Oct. 16–26 daily staff gage readings by observer. Oct. 27–29 discharge estimated at 0.5 million gallons per day. Nov. 2–8 most of graph estimated. Nov. 10–23 daily staff gage readings by observer. Jan. 4 to Feb. 6 discharge interpolated between weekly staff gage readings by observer except Jan. 23, discharge estimated.

*Monthly discharge of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 14.9 | 4.0 | 6.08 | 9.41 | 188 | 578 |
| August | 16.9 | 2.6 | 4.78 | 7.40 | 148 | 455 |
| September | 2.6 | 1.3 | 1.68 | 2.60 | 50.3 | 155 |
| October | 5.6 | ..... | .98 | 1.52 | 30.3 | 93 |
| November | 4.8 | .4 | 1.25 | 1.93 | 37.4 | 115 |
| December | 23 | 1.7 | 4.19 | 6.48 | 130 | 399 |
| January | 1.8 | .5 | 1.12 | 1.73 | 34.6 | 107 |
| February | 1.0 | .4 | .60 | .93 | 16.8 | 52 |
| March | 3.0 | .4 | .82 | 1.27 | 25.4 | 78 |
| April | 4.8 | .4 | 1.47 | 2.27 | 44.2 | 135 |
| May | 2.7 | .4 | 1.22 | 1.89 | 37.7 | 116 |
| June | 7.5 | .5 | 1.42 | 2.20 | 42.5 | 131 |
| The year | 23 | .4 | 2.15 | 3.33 | 785 | 2,410 |

### MAOLE DITCH, MAUKA STATION, NEAR HONOLULU, OAHU.

LOCATION.—In Nuuanu Valley, 200 feet below lower portal of Hillebrand Glen tunnel at ditch intake, 6 miles from Honolulu post office.

RECORDS AVAILABLE.—October 6, 1917, to June 30, 1919.

GAGE.—Gurley weekly water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Ditch is an earth cut, with bottom lining of concrete, with an elliptical concrete control 15 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.62 feet at 4.15 a. m., June 11 (discharge, 34 million gallons per day or 53 second-feet); minimum stage recorded during year, ditch dry.

1917–1919: Maximum stage recorded, 2.86 feet at 5.30 a. m., April 19, 1918 (discharge, estimated from extension of rating curve, 41 million gallons[1] per day, or 63 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch diverts water from Maole Stream into Nuuanu reservoir No. 4.

REGULATION.—By headgates.

UTILIZATION.—For city water supply and development of power.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 10 million gallons per day. Operation of water-stage recorder satisfactory. Records good for low stages but may be considerably in error for high stages.

*Discharge measurements of Maole ditch, mauka station, near Honolulu, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Dec. 3 | J. E. Stewart | 0.75 | 3.6 | 2.3 |
| Jan. 15 | do | .10 | .07 | .04 |
| Feb. 20 | A. H. Wong | .34 | .45 | .3 |
| Apr. 26 | do | .31 | .45 | .3 |
| June 1 | J. E. Stewart | .16 | .07 | .04 |

[1] Supersedes figures published in Water-Supply Paper 485.

*Daily discharge, in million gallons, of Maole ditch, mauka station, near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.09 | 0.15 | 0.15 | 0.02 | 0.25 | 0.4 | 0.02 | 0.08 | ..... | 0.01 | 0.25 | 0.2 |
| 2 | .2 | .2 | .06 | .01 | .1 | 1.2 | .02 | .06 | ..... | .01 | .15 | .08 |
| 3 | .08 | .1 | .06 | .01 | .06 | 3.2 | .03 | .06 | ..... | .01 | .1 | .3 |
| 4 | .15 | .06 | .06 | .01 | .35 | .5 | .03 | .06 | ..... | .01 | .55 | .09 |
| 5 | .45 | .45 | .06 | .15 | .2 | .35 | .03 | .02 | ..... | .01 | .3 | 07 |
| 6 | .2 | .1 | .05 | .3 | .07 | 9.3 | .02 | .01 | ..... | .01 | .15 | .04 |
| 7 | .4 | .07 | .03 | .04 | .06 | 2.7 | .02 | .01 | ..... | .02 | .25 | .02 |
| 8 | .2 | .07 | .07 | .03 | .04 | .55 | .02 | .01 | ..... | .01 | .25 | .35 |
| 9 | .95 | .1 | .03 | .01 | .06 | .35 | .01 | .3 | 0.08 | .01 | .55 | .07 |
| 10 | 3.9 | .08 | .03 | .01 | .03 | .7 | .03 | .05 | .1 | .01 | 1.6 | .04 |
| 11 | .9 | .15 | .03 | .01 | .2 | .4 | .02 | .07 | .07 | .01 | .4 | 1.9 |
| 12 | .35 | .08 | .02 | .01 | .15 | .25 | .04 | .08 | 1.1 | .04 | .2 | .3 |
| 13 | .5 | 2.0 | .08 | .01 | .04 | .2 | .06 | .03 | .95 | .01 | .5 | .09 |
| 14 | .2 | .4 | .06 | .02 | .03 | .2 | .03 | .03 | .35 | .01 | .15 | .06 |
| 15 | .1 | .2 | .04 | .05 | .03 | .15 | .03 | .01 | .1 | .25 | .09 | .08 |
| 16 | .1 | 2.2 | .03 | .02 | .01 | .15 | .01 | .01 | .07 | .5 | .25 | .06 |
| 17 | .1 | 1.6 | .03 | .06 | .01 | .1 | .01 | .01 | .06 | 5.1 | 1.2 | .35 |
| 18 | .15 | .5 | .03 | .02 | .01 | .1 | .01 | .01 | .04 | 1.6 | .15 | .1 |
| 19 | .15 | .3 | .01 | .15 | .01 | .1 | .01 | .01 | .04 | 2.5 | .08 | .08 |
| 20 | .2 | .9 | .01 | .02 | .01 | .2 | .01 | .3 | .05 | 1.3 | .05 | .09 |
| 21 | 1.0 | 1.7 | .01 | .01 | .01 | .1 | .2 | .09 | .45 | .5 | .05 | .06 |
| 22 | .3 | .45 | .01 | .02 | .01 | .1 | .55 | ..... | 6.3 | .4 | .05 | .05 |
| 23 | .3 | .25 | .02 | .01 | .01 | .15 | 1.6 | ..... | .45 | .4 | .05 | .04 |
| 24 | .6 | .2 | .01 | .01 | .25 | .06 | .2 | ..... | .2 | .6 | .06 | .03 |
| 25 | .3 | .09 | .01 | .01 | 4.0 | .07 | .09 | ..... | .1 | .25 | .06 | .25 |
| 26 | .25 | .09 | .01 | .03 | 1.3 | .07 | .06 | ..... | .07 | .3 | .06 | .3 |
| 27 | .1 | .1 | .01 | .01 | .2 | .07 | .45 | ..... | .06 | .35 | .07 | .09 |
| 28 | .8 | .2 | .01 | .01 | .2 | .1 | .5 | ..... | .05 | .4 | .07 | .06 |
| 29 | .8 | .15 | .2 | .01 | .6 | .1 | .15 | ..... | .04 | .3 | .06 | .3 |
| 30 | .2 | .1 | .04 | 3.7 | .15 | .2 | .07 | ..... | .01 | .3 | .07 | .07 |
| 31 | .15 | .09 | ..... | .45 | ..... | .06 | .35 | ..... | .01 | ..... | 1.0 | ..... |

*Monthly discharge of Maole ditch, mauka station, near Honolulu, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 3.9 | 0.08 | 0.46 | 0.71 | 14.2 | 44 |
| August | 2.2 | .06 | .42 | .65 | 13.1 | 40 |
| September | .2 | .01 | .04 | .06 | 1.3 | 4 |
| October | 3.7 | .01 | .17 | .26 | 5.2 | 16 |
| November | 4.0 | .01 | .28 | .43 | 8.4 | 26 |
| December | 9.3 | .06 | .72 | 1.11 | 22.2 | 68 |
| January | 1.6 | .01 | .15 | .23 | 4.7 | 14 |
| February | .3 | .01 | .06 | .09 | 1.5 | 5 |
| March | 6.3 | .01 | .36 | .56 | 11.1 | 34 |
| April | 5.1 | .01 | .51 | .79 | 15.2 | 47 |
| May | 1.6 | .05 | .28 | .43 | 8.8 | 27 |
| June | 1.9 | .02 | .19 | .29 | 5.6 | 17 |
| The year | 9.3 | .01 | .31 | .48 | 111 | 342 |

NOTE.—Feb. 22 to Mar. 8; record sheets lost and discharge estimated in million gallons per day as follows: Feb. 22–25, 0.05; Feb. 26 to Mar. 5, 0.01; Mar. 6–8, 0.1.

### MAOLE DITCH, MAKAI STATION, NEAR HONOLULU, OAHU.

LOCATION.—In Nuuanu Valley, 150 feet from Pali Road, opposite reservoir No. 4, into which the ditch empties, and 6½ miles from Honolulu post office.

RECORDS AVAILABLE.—October 5, 1917, to June 30, 1919.

GAGE.—Gurley weekly water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Ditch is earth cut with bottom lining of concrete. At the gage a section 50 feet long, 5½ feet wide, and 3 feet deep is constructed of concrete, with concrete control at lower end.

EXTREMES OF DISCHARGE.—Maximum stage during year 3.08 feet at 3 p. m. June 11 (discharge, 85 million gallons per day, or 132 second-feet); minimum stage recorded, ditch occasionally dry.

1917–1919: Maximum stage recorded, 3.45 feet at 4 a. m. April 19, 1918 (discharge, 108 million gallons per day, or 167 second-feet).

DIVERSIONS.—Ditch diverts water from Maole Stream and a few intermittent streams into Nuuanu reservoir No. 4.

REGULATION.—By headgates.

UTILIZATION.—City water supply and development of power.

ACCURACY.—Stage-discharge relation permanent, except during unusually high stages, when the concrete control is not effective on account of the large amount of silt carried. Rating curve is well defined between 1 and 10 million gallons per day. Operation of water-stage recorder satisfactory. Records good for low stages; poor for high stages.

*Discharge measurements of Maole ditch, makai station, near Honolulu, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Dec. 3 | A. H. Wong | 0.85 | 6.7 | 4.3 |
| 3 | do | .80 | 5.6 | 3.6 |
| 3 | do | .74 | 4.7 | 3.0 |
| Jan. 15 | J. E. Stewart | .06 | .01 | .005 |
| Feb. 20 | A. H. Wong | .34 | .55 | .35 |
| Apr. 26 | do | .26 | .3 | .20 |
| June 1 | J. E. Stewart | .09 | .03 | .02 |

*Daily discharge, in million gallons, of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.1 | 0.2 | 0.1 | 0.02 | 0.2 | 0.25 | 0.04 | 0.09 | ..... | 0.01 | 0.15 | 0.1 |
| 2 | .2 | .3 | .07 | .02 | .08 | .6 | 03 | .05 | ..... | .0 | .1 | .2 |
| 3 | .1 | .1 | .05 | .01 | .05 | 9.8 | .04 | .06 | ..... | .0 | .08 | .1 |
| 4 | .1 | .09 | .05 | .01 | .35 | .35 | .02 | .04 | ..... | .0 | .4 | .05 |
| 5 | .8 | .7 | .04 | .1 | .25 | .3 | .03 | .01 | ..... | .01 | .2 | .02 |
| 6 | .2 | .1 | .04 | .6 | .07 | 3.5 | .02 | .01 | ..... | .01 | .08 | .02 |
| 7 | .3 | .09 | .05 | .04 | .04 | 2.2 | .02 | .0 | ..... | .005 | .15 | .02 |
| 8 | .09 | .08 | .1 | .03 | .03 | .5 | .02 | .0 | ..... | .005 | .15 | .85 |
| 9 | .6 | .2 | .04 | .02 | .04 | .3 | .02 | .3 | .07 | .0 | .4 | .06 |
| 10 | 4.2 | .08 | .04 | .01 | .01 | .55 | .02 | .07 | .09 | .0 | 1.5 | .02 |
| 11 | .7 | .2 | .04 | .0 | .15 | .3 | .02 | .1 | .07 | .005 | .45 | 5.4 |
| 12 | .2 | .1 | .03 | .0 | .15 | .25 | .05 | .07 | 1.2 | .05 | .2 | .2 |
| 13 | .4 | 3.8 | .1 | .0 | .02 | .2 | .05 | .02 | 1.3 | .005 | .45 | .05 |
| 14 | .2 | .5 | .07 | .02 | .01 | .15 | .02 | .02 | .4 | .0 | .15 | .02 |
| 15 | .15 | .25 | .05 | .01 | .005 | .15 | .01 | .0 | .1 | .2 | .09 | .02 |
| 16 | .1 | 5.3 | .04 | .0 | .0 | .1 | .01 | .0 | .08 | .5 | .25 | .01 |
| 17 | .09 | 3.8 | .04 | .1 | .0 | .09 | .01 | .0 | .08 | 8.1 | 1.4 | .25 |
| 18 | .1 | .5 | .04 | .04 | .0 | .1 | .02 | .0 | .05 | 2.0 | .2 | .05 |
| 19 | .1 | .25 | .02 | .2 | .0 | .1 | .005 | .0 | .02 | 3.1 | .1 | .02 |
| 20 | .2 | .4 | .02 | .02 | .0 | .2 | .0 | .25 | .01 | 1.2 | .04 | .04 |
| 21 | 1.2 | 2.8 | .02 | .01 | .0 | .15 | .1 | .08 | .45 | .2 | .03 | .02 |
| 22 | .2 | .35 | .02 | .02 | .0 | .1 | .4 | ..... | 12.7 | .3 | .02 | .01 |
| 23 | .2 | .15 | .03 | .01 | .0 | .2 | 1.2 | ..... | .3 | .4 | .03 | .01 |
| 24 | .6 | .15 | .02 | .0 | .2 | .1 | .1 | ..... | .1 | .6 | .02 | .01 |
| 25 | .2 | .1 | .01 | .0 | 5.8 | .09 | .08 | ..... | .06 | .2 | .02 | .2 |
| 26 | .1 | .08 | .01 | .02 | 3.8 | .08 | .03 | ..... | .04 | .3 | .02 | .25 |
| 27 | .09 | .09 | .005 | .005 | .2 | .07 | .35 | ..... | .02 | .3 | .03 | .08 |
| 28 | .9 | .3 | .0 | .0 | .09 | .08 | .45 | ..... | .01 | .35 | .02 | .02 |
| 29 | .9 | .2 | .2 | .0 | .5 | .1 | .1 | ..... | .01 | .25 | .01 | .2 |
| 30 | .2 | .1 | .03 | 5.6 | .08 | .25 | .05 | ..... | .005 | .25 | .01 | .005 |
| 31 | .15 | .08 | ..... | .45 | ..... | .06 | .3 | ..... | .01 | ..... | 1.2 | ..... |

NOTE.—Feb. 22 to Mar. 8, record sheets lost and discharge estimated by comparing with Nuuanu Stream below reservoir No. 2 as follows: Feb. 22–25, 0.05 million gallons per day; Feb. 26 to March. 5, ditch dry; Mar. 6–8, 0.1 million gallons per day; Mar. 13, 14, also April 9, 10, clock stopped and discharge estimated.

*Monthly discharge of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 4.2 | 0.09 | 0.44 | 0.68 | 13.7 | 42 |
| August | 5.3 | .08 | .69 | 1.07 | 21.4 | 66 |
| September | .2 | .00 | .05 | .08 | 1.4 | 5 |
| October | 5.6 | .00 | .24 | .37 | 7.4 | 23 |
| November | 5.8 | .00 | .40 | .62 | 12.1 | 37 |
| December | 9.8 | .06 | .69 | 1.07 | 21.3 | 66 |
| January | 1.2 | .00 | .12 | .19 | 3.6 | 11 |
| February | .25 | .00 | .05 | .08 | 1.4 | 4 |
| March | 12.7 | .00 | .56 | .87 | 17.5 | 53 |
| April | 8.1 | .00 | .61 | .94 | 18.4 | 56 |
| May | 1.5 | .01 | .26 | .40 | 8.0 | 25 |
| June | 5.4 | .005 | .28 | .43 | 8.3 | 26 |
| The year | 12.7 | .00 | .37 | .57 | 134 | 414 |

### MANOA STREAM AT COLLEGE OF HAWAII, NEAR HONOLULU, OAHU.

LOCATION.—In gorge half a mile southeast of College of Hawaii and 3 miles east of Honolulu post office.

RECORDS AVAILABLE.—March 23, 1909, to November 24, 1910; November 1, 1912, to April 26, 1913; September 10, 1913, to September 30, 1918, when station was discontinued.

GAGE.—Vertical staff on left bank. The weir used during 1909 and 1910 was destroyed by flood of November 24, 1910. Several changes in gage datum previous to 1912.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel straight and confined in the vicinity of station; stream bed composed of rock; clean and fairly permanent; left bank composed of rock nearly vertical; right bank has a gentle slope, covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.00 feet at 5 p. m., August 15 (discharge, 106 million gallons per day, or 164 second-feet); minimum stage recorded, 0.90 foot several times in July and September (discharge, 2.9 million gallons per day, or 4.5 second-feet).

1909–1919: Maximum stage recorded, 9.0 feet from high-water mark of flood of March 19, 1917 (discharge, from extension of rating curve, 850 million gallons per day, or 1,320 second-feet); minimum daily discharge, March, 1914 (0.2 million gallons per day, or 0.3 second-foot).

DIVERSIONS.—Nearly all the low-water flow is diverted above and below the station for irrigation.

REGULATION.—None.

UTILIZATION.—Records show water available for storage at this reservoir site; the low-water flow of the stream is extensively used for irrigation of rice and taro in upper and lower parts of Manoa Valley.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 2 and 40 million gallons per day. Gage read twice daily to tenths. Records good.

*Discharge measurements of Manoa Stream at College of Hawaii, near Honolulu, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Nov. 21 | C. T. Bailey | 0.68 | 2.6 | 1.65 |
| 26 | J. E. Stewart | 2.37 | 54 | 35 |
| Feb. 7 | A. H. Wong | .73 | 2.6 | 1.7 |
| Mar. 21 | .....do | 1.02 | 5.7 | 3.7 |
| Apr. 20 | .....do | 1.70 | 20.5 | 13.2 |

*Daily discharge, in million gallons, of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Day. | July. | Aug. | Sept. | Day. | July. | Aug. | Sept. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.3 | 6.0 | 4.3 | 11 | 19.0 | 5.4 | 2.9 | 21 | 2.9 | 6.0 | 2.9 |
| 2 | 4.3 | 6.0 | 3.8 | 12 | 8.6 | 4.8 | 3.8 | 22 | 2.9 | 3.8 | 2.9 |
| 3 | 3.8 | 6.0 | 3.8 | 13 | 7.2 | 4.3 | 3.8 | 23 | 2.9 | 4.8 | 2.9 |
| 4 | 5.4 | 7.9 | 3.8 | 14 | 4.3 | 6.0 | 2.9 | 24 | 3.4 | 3.8 | 2.9 |
| 5 | 4.3 | 8.6 | 4.8 | 15 | 4.3 | 42 | 2.9 | 25 | 3.8 | 4.3 | 2.9 |
| 6 | 3.8 | 7.9 | 3.8 | 16 | 4.8 | 22 | 3.8 | 26 | 3.8 | 4.8 | 2.9 |
| 7 | 3.8 | 6.0 | 3.8 | 17 | 6.0 | 8.6 | 3.8 | 27 | 3.8 | 4.8 | 5.4 |
| 8 | 4.3 | 5.4 | 2.9 | 18 | 3.8 | 7.2 | 3.8 | 28 | 3.4 | 6.0 | 3.8 |
| 9 | 5.4 | 3.8 | 2.9 | 19 | 3.8 | 6.0 | 2.9 | 29 | 5.4 | 4.8 | 3.8 |
| 10 | 42 | 3.8 | 2.9 | 20 | 2.9 | 6.0 | 2.9 | 30 | 4.3 | 4.8 | 3.8 |
| | | | | | | | | 31 | 4.8 | 3.8 | ..... |

*Monthly discharge of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 42 | 2.9 | 6.05 | 9.36 | 188 | 576 |
| August | 42 | 3.8 | 7.27 | 11.2 | 225 | 692 |
| September | 5.4 | 2.9 | 3.48 | 5.38 | 104 | 320 |
| The period | | | | | 417 | 1,590 |

**WEST BRANCH OF MANOA STREAM NEAR HONOLULU, OAHU.**

LOCATION.—At diversion dam at R. W. Shingle's bungalow, 300 feet above highway bridge, one-eighth mile above confluence with East Branch of Manoa Stream, and 4 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder. Watson water-stage recorder in use June 17 to October 20, 1914; replaced October 20, 1914, by a Friez water-stage recorder; replaced May 9, 1915, by a Stevens 8-day water-stage recorder which was replaced August 15, 1917, by a Stevens continuous water-stage recorder. Vertical staff gage (at different datum) 150 feet upstream from highway bridge, about 25 feet above small irrigation ditch diverting from right bank, read from May 29, 1913, to June 16, 1914.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Small masonry diversion dam with rounded crest acts as control and forms a large quiet pool in the vicinity of the gage for low and medium stages. Leaves and small débris lodge on control and growth of grass on sides at times affects the discharge relation slightly. Channel clean and confined in the vicinity of the gage. A short distance upstream the natural slope is steep and channel is filled with boulders.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.04 feet at 10.15 p. m. August 16 (discharge, 286 million gallons per day, or 443 second-feet); minimum stage recorded, 0.99 foot at 9.45 a. m. April 13 (discharge, 0.3 million gallons per day, or 0.45 second-foot).

1913–1919: Maximum stage recorded, 4.65 feet 12.15 a. m. March 20, 1917 (discharge, 540 million gallons per day, or 837 second-feet; revised); minimum stage recorded, December, 1913 (discharge, 0.05 million gallons per day, or 0.08 second-foot).

DIVERSIONS.—None.

REGULATION.—At low water, pool at gage is lowered slightly for short periods by the operation of a small hydraulic ram used for pumping water for domestic use and also for filling a swimming pool.

UTILIZATION.—Records on West and East branches of Manoa Stream together show amount of surface water available in upper Manoa Valley, above nearly all diversions. Practically the entire low-water flow of Manoa Stream is utilized at lower elevation in Manoa Valley for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 50 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records good while water-stage recorder was operating and fair at other times.

*Discharge measurements of West Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Oct. 24 | A. H. Wong | 1.04 | 0.4 | 0.25 |
| 30 | J. E. Stewart | 1.93 | 53 | 34.5 |
| Nov. 21 | C. T. Bailey | 1.04 | .8 | .5 |
| Jan. 14 | J. E. Stewart | 1.035 | .3 | .2 |
| Feb. 13 | A. H. Wong | 1.07 | 1.0 | .65 |
| Mar. 21 | do | 1.11 | 1.45 | .95 |
| Apr. 23 | do | 1.36 | 9.6 | 6.2 |
| May 30 | J. E. Stewart | 1.06 | .75 | .5 |

*Daily discharge, in million gallons, of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.8 | 1.6 | 1.5 | ..... | 2.1 | 1.1 | ..... | 1.5 | 1.0 | 0.9 | 1.8 | 1.0 |
| 2 | 1.3 | 1.6 | 1.1 | ..... | 1.2 | 3.1 | ..... | 1.2 | 1.4 | .8 | 1.6 | 5.1 |
| 3 | .9 | 1.5 | .9 | ..... | 1.5 | 34 | ..... | 1.2 | 3.0 | .8 | 1.4 | 3.3 |
| 4 | .7 | 2.4 | .9 | ..... | 4.4 | 4.0 | ..... | 1.1 | 1.5 | .8 | 1.5 | 1.1 |
| 5 | 3.6 | 7.5 | .9 | 1.1 | 3.3 | 2.7 | ..... | .9 | 1.1 | .8 | 1.5 | .9 |
| 6 | 1.1 | 1.6 | .9 | 1.4 | 1.7 | 22 | ..... | .9 | 1.7 | .9 | 1.2 | .8 |
| 7 | 1.4 | 1.4 | .9 | ..... | 1.4 | 9.7 | ..... | .8 | 2.2 | .8 | 1.7 | .7 |
| 8 | .9 | 1.1 | 1.0 | ..... | 1.5 | 5.1 | ..... | .7 | 1.6 | .8 | 2.0 | 2.4 |
| 9 | 1.3 | 1.2 | .9 | ..... | 1.2 | 3.8 | ..... | 1.3 | 1.4 | .7 | 2.7 | 1.1 |
| 10 | 18.3 | 1.0 | .7 | .6 | 1.1 | 4.5 | ..... | .8 | 1.5 | .6 | 3.3 | .9 |
| 11 | 3.5 | 1.8 | .6 | .6 | 1.8 | 3.4 | ..... | .9 | 1.2 | .6 | 2.0 | 8.0 |
| 12 | 1.7 | 1.4 | .7 | .8 | 1.5 | 2.7 | ..... | .9 | 3.3 | .8 | 2.5 | 1.4 |
| 13 | 5.4 | 8.4 | 1.2 | .7 | 1.2 | 2.1 | 0.6 | .8 | 3.6 | .6 | 1.7 | 1.0 |
| 14 | 1.7 | 2.5 | .9 | .8 | 1.0 | 2.0 | .6 | 1.1 | 1.5 | .6 | 1.4 | .9 |
| 15 | 1.5 | 1.9 | .6 | .8 | .9 | 1.7 | .6 | .8 | 1.2 | 1.1 | 1.2 | .8 |
| 16 | 1.4 | 20 | .6 | .6 | .9 | 1.7 | .5 | .7 | .9 | 2.0 | 3.0 | .7 |
| 17 | 1.2 | 15.5 | .7 | .9 | .9 | 1.6 | .5 | .7 | .9 | 13.7 | 1.7 | 1.8 |
| 18 | 1.1 | 3.6 | .6 | .8 | .9 | 1.6 | .5 | .6 | .8 | 6.4 | 1.5 | 1.0 |
| 19 | 1.0 | 2.2 | .6 | 1.7 | .9 | 1.5 | .4 | .6 | .9 | 8.3 | 1.2 | .8 |
| 20 | 1.0 | 3.1 | .6 | .9 | .9 | 2.9 | .4 | 2.7 | .9 | 9.8 | 1.1 | .7 |
| 21 | 5.4 | 8.7 | .7 | ..... | ..... | 1.5 | 2.0 | 1.4 | 4.2 | 6.4 | 1.0 | .6 |
| 22 | 2.0 | 2.4 | .8 | ..... | ..... | 1.4 | 2.9 | 1.7 | 8.8 | 4.0 | .9 | .6 |
| 23 | 1.1 | 1.8 | .9 | ..... | ..... | 1.2 | 9.0 | 1.6 | 1.8 | 6.8 | .8 | .6 |
| 24 | 4.3 | 2.3 | ..... | .6 | ..... | 1.4 | 1.8 | 2.0 | 2.0 | 3.6 | .8 | .6 |
| 25 | 1.5 | 1.7 | ..... | .6 | ..... | 1.1 | 1.2 | 1.5 | 1.1 | 2.4 | .8 | 1.6 |
| 26 | 1.2 | 1.5 | ..... | .7 | ..... | 1.0 | .9 | 1.2 | 1.1 | 2.1 | .9 | 2.9 |
| 27 | 1.0 | 1.5 | ..... | .6 | ..... | 1.0 | 1.5 | 1.2 | 1.0 | 2.1 | .9 | 1.8 |
| 28 | 3.0 | 1.7 | ..... | .6 | ..... | 1.4 | 4.0 | .9 | 1.0 | 1.8 | .9 | 1.0 |
| 29 | 8.6 | 1.4 | ..... | .5 | ..... | 1.1 | 1.8 | ..... | 1.0 | 1.7 | .8 | 2.7 |
| 30 | 1.6 | 1.4 | ..... | 24 | ..... | .9 | 1.2 | ..... | .9 | 2.8 | .7 | 1.1 |
| 31 | 1.6 | 1.0 | ..... | 4.3 | ..... | .8 | 2.6 | ..... | .9 | ..... | 2.1 | ..... |

NOTE.—No record and discharge estimated in million gallons per day from adjacent streams as follows: Sept. 24 to Oct. 4, Oct. 7–9, Oct. 21–23, and Jan. 7–12, 0.7; Oct. 5–6, Dec. 1, 2, 30, and 31, as shown; Nov. 21–30, 2.1; and Jan. 1–6, 0.8.

*Monthly discharge of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 18.3 | 0.7 | 2.62 | 4.05 | 81.1 | 249 |
| August | 20 | 1.0 | 3.44 | 5.32 | 107 | 327 |
| September | 1.5 | ..... | .80 | 1.24 | 24.1 | 74 |
| October | 24 | ..... | 1.63 | 2.52 | 50.6 | 155 |
| November | ..... | ..... | 1.71 | 2.65 | 51.3 | 157 |
| December | 34 | ..... | 4.00 | 6.19 | 124 | 381 |
| January | 9.0 | ..... | 1.35 | 2.09 | 42.0 | 128 |
| February | 2.7 | .6 | 1.13 | 1.75 | 31.7 | 97 |
| March | 8.8 | .8 | 1.79 | 2.77 | 55.4 | 170 |
| April | 13.7 | .6 | 2.85 | 4.41 | 85.5 | 262 |
| May | 3.3 | .7 | 1.50 | 2.32 | 46.6 | 143 |
| June | 8.0 | .6 | 1.60 | 2.48 | 47.9 | 147 |
| The year | 34 | ..... | 2.05 | 3.17 | 747 | 2,290 |

**EAST BRANCH OF MANOA STREAM NEAR HONOLULU, OAHU.**

LOCATION.—At highway bridge 400 feet above confluence with West Branch of Manoa Stream, in upper Manoa Valley, 5 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder. Watson water-stage recorder used from May 5, 1913, to September 28, 1914, and Stevens 8-day water-stage recorder used from October 11, 1915, to August 15, 1917. Vertical staff gage 200 feet upstream on right bank at different datum was read from May 29, 1913, to May 19, 1914.

DISCHARGE MEASUREMENTS.—Made by wading for low and ordinary high-water stages; flood measurements may be made from highway bridge.

CHANNEL AND CONTROL.—Channel steep just above gage, but slope is reduced for 30 feet past gage to control which is a riffle of small boulders and gravel; control shifts considerably. At low and medium stages stream past gage is fairly wide and deep and velocity is well distributed. Banks are fairly steep and covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.41 feet at 10 p. m. August 14 (discharge, 285 million gallons per day, or 441 second-feet); minimum stage recorded, 1.28 feet at 1 a. m. April 4 to 11 a. m. April 9 (discharge, 1.0 million gallons per day, or 1.6 second-feet).

1913–1919: Maximum stage recorded, 5.2 feet at 4 p. m. March 19, 1917 (discharge, from extension of rating curve, 470 million gallons per day, or 727 second-feet); minimum daily discharge occurred during 1919.

DIVERSIONS.—East Manoa ditch diverts water a quarter of a mile above station for irrigation.

REGULATION.—None.

UTILIZATION.—Records on East and West branches of Manoa Stream together show amount of surface water available in upper Manoa Valley above nearly all diversions. Practically the entire low-water flow of Manoa Stream is utilized at lower elevations in Manoa Valley for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 2 and 80 million gallons per day. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records good when water-stage recorder was operating; poor at other times.

*Discharge measurements of East Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Oct. 24 | A. H. Wong | 1.36 | 2.3 | 1.5 |
| 30 | J. E. Stewart | 2.50 | 58 | 37.5 |
| 31 | A. H. Wong | 1.50 | 5.0 | 3.2 |
| Nov. 21 | C. T. Bailey | 1.38 | 1.95 | 1.25 |
| Jan. 14 | J. E. Stewart | 1.32 | 2.2 | 1.4 |
| Feb. 13 | A. H. Wong | 1.34 | 2.3 | 1.45 |
| Mar. 21 | do | 1.34 | 2.1 | 1.4 |
| Apr. 23 | do | 1.58 | 7.0 | 4.6 |
| May 30 | J. E. Stewart | 1.32 | 2.0 | 1.3 |

*Daily discharge, in million gallons, of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.0 | 3.6 | 2.6 | 1.8 | 2.5 | 2.6 | 1.8 | 1.9 | 1.5 | 1.2 | 2.1 | 1.6 |
| 2 | 3.6 | 3.7 | 2.2 | 1.8 | 2.0 | 4.0 | 1.7 | 1.8 | 1.6 | 1.2 | 2.0 | 2.0 |
| 3 | 3.0 | 3.6 | 2.2 | 1.8 | 1.9 | 29 | 1.7 | 1.8 | 2.4 | 1.1 | 1.8 | 1.9 |
| 4 | 3.0 | 3.8 | 2.2 | 1.9 | 3.2 | 4.7 | 1.7 | 1.8 | 1.8 | 1.1 | 2.3 | 1.6 |
| 5 | 5.9 | 6.3 | 2.2 | 2.1 | 2.4 | 4.3 | 1.7 | 1.8 | 1.7 | 1.3 | 2.1 | 1.6 |
| 6 | 3.1 | 3.4 | 2.3 | 2.9 | 1.9 | 13.7 | 1.6 | 1.8 | 1.7 | 1.3 | 1.8 | 1.5 |
| 7 | 3.3 | 2.9 | 2.3 | 1.7 | 1.8 | 7.0 | 1.6 | 1.7 | 2.0 | 1.3 | 2.4 | 1.4 |
| 8 | 2.9 | 2.3 | 2.3 | 1.6 | 1.8 | 4.3 | 1.6 | 1.2 | 1.9 | 1.3 | 2.5 | 2.1 |
| 9 | 3.1 | 2.2 | 2.2 | 1.6 | 1.8 | 3.6 | 1.6 | 1.9 | 1.8 | 1.2 | 2.6 | 1.6 |
| 10 | 12.9 | 2.2 | 2.2 | 1.6 | 1.8 | 3.8 | 1.6 | 1.6 | 1.8 | 1.1 | 3.7 | 1.6 |
| 11 | 4.1 | ..... | 2.3 | 1.6 | 2.1 | 3.1 | 1.5 | 1.8 | 1.8 | 1.2 | ..... | 3.3 |
| 12 | 3.1 | ..... | 2.3 | 1.6 | 1.9 | 2.8 | 1.7 | 1.6 | 2.0 | 1.3 | ..... | 1.6 |
| 13 | 5.5 | 4.9 | 2.3 | 1.6 | 1.8 | 2.6 | 1.6 | 1.5 | 2.0 | 1.2 | ..... | 1.4 |
| 14 | 3.4 | 2.7 | 2.9 | 1.6 | 1.8 | 2.4 | 1.4 | 1.8 | 1.8 | 1.2 | ..... | 1.4 |
| 15 | 3.1 | 2.3 | 2.3 | 1.6 | 1.8 | 2.3 | 1.4 | 1.6 | 1.6 | 1.8 | ..... | 1.5 |
| 16 | 3.0 | 16.6 | 2.4 | 1.6 | 1.8 | 2.3 | 1.4 | 1.5 | 1.6 | 2.6 | ..... | 1.4 |
| 17 | 2.9 | 14.7 | 2.6 | ..... | 1.8 | 2.3 | 1.4 | 1.4 | 1.4 | 22 | ..... | 1.8 |
| 18 | 2.8 | 4.1 | 2.4 | ..... | 1.8 | 2.3 | 1.5 | 1.4 | 1.4 | 7.5 | ..... | 1.4 |
| 19 | 2.8 | 3.3 | 2.3 | ..... | 1.8 | 2.0 | 1.4 | 1.4 | 1.3 | 5.8 | ..... | 1.3 |
| 20 | 3.0 | 5.9 | 2.2 | ..... | 1.8 | 3.2 | 1.4 | 1.9 | 1.5 | 6.7 | ..... | 1.3 |
| 21 | 6.0 | 8.3 | 2.2 | ..... | 1.8 | 2.4 | 2.6 | 1.6 | 4.3 | 4.0 | ..... | 1.3 |
| 22 | 3.6 | 3.6 | 2.1 | ..... | 1.7 | 2.1 | 3.6 | 1.6 | 8.8 | 2.9 | ..... | 1.1 |
| 23 | 3.4 | 3.1 | 2.0 | ..... | 1.8 | 2.3 | 7.9 | 1.5 | 1.9 | 5.1 | ..... | 1.1 |
| 24 | 5.4 | 3.0 | 2.0 | 1.6 | 2.1 | 2.2 | 2.1 | 1.8 | 1.6 | 2.9 | 1.6 | 1.2 |
| 25 | 3.6 | 2.8 | 1.9 | 1.7 | 7.6 | 2.1 | 1.8 | 1.6 | 1.6 | 2.4 | 1.6 | 1.5 |
| 26 | 3.3 | 2.7 | 1.9 | 1.8 | 8.2 | 2.0 | 1.7 | 1.6 | 1.5 | 2.4 | 1.6 | 1.7 |
| 27 | 3.1 | 2.7 | 1.9 | 1.6 | 2.1 | 2.0 | 2.4 | 1.6 | 1.4 | 2.4 | 1.7 | 1.6 |
| 28 | 4.7 | 2.8 | 1.8 | 1.7 | 1.8 | 2.0 | 4.0 | 1.6 | 1.4 | 2.1 | 1.6 | 1.3 |
| 29 | 8.3 | 2.7 | 1.8 | 1.6 | 4.5 | 2.1 | 2.1 | ..... | 1.3 | 2.2 | 1.4 | 1.8 |
| 30 | 3.6 | 2.6 | 1.8 | 23 | 2.2 | 2.0 | 1.8 | ..... | 1.3 | 2.3 | 1.4 | 1.3 |
| 31 | 3.8 | 2.4 | ..... | 3.4 | ..... | 1.8 | 2.5 | ..... | 1.3 | ..... | 1.8 | ..... |

NOTE.—No record and discharge estimated in million gallons per day by comparison with records for West Branch of Manoa and Kalihi Stream as follows: Aug. 11–12, 3.3; Oct. 17–23, 2; May 11–15, 4; May 16–20, 3; May 21–23, 2.

*Monthly discharge of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 12.9 | 2.8 | 4.07 | 6.30 | 126 | 387 |
| August | 16.6 | 2.2 | 4.22 | 6.53 | 131 | 401 |
| September | 2.9 | 1.8 | 2.20 | 3.40 | 66.1 | 203 |
| October | 23 | 1.6 | 2.54 | 3.93 | 78.8 | 242 |
| November | 8.2 | 1.7 | 2.44 | 3.78 | 73.3 | 225 |
| December | 29 | 1.8 | 4.04 | 6.25 | 125 | 384 |
| January | 7.9 | 1.4 | 2.06 | 3.19 | 63.8 | 196 |
| February | 1.9 | 1.2 | 1.65 | 2.55 | 46.1 | 142 |
| March | 8.8 | 1.3 | 1.97 | 3.05 | 61.0 | 187 |
| April | 22 | 1.1 | 3.07 | 4.75 | 92.1 | 283 |
| May | ..... | 1.4 | 2.48 | 3.84 | 77.0 | 236 |
| June | 3.3 | 1.1 | 1.57 | 2.43 | 47.2 | 145 |
| The year | 29 | 1.1 | 2.71 | 4.19 | 988 | 3,030 |

### EAST MANOA DITCH NEAR HONOLULU, OAHU.

LOCATION.—1,000 feet below intake. Ditch diverts from East Branch of Manoa Stream 1,000 feet above gaging station on that stream, 4 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 24, 1915, to December 31, 1916; January 26, 1918, to June 30, 1919.

GAGE.—Gurley weekly water-stage recorder. Vertical staff May 24, 1915, to December 31, 1916. Stevens weekly water-stage recorder January 25, 1918, to April 20, 1918.

DISCHARGE MEASUREMENTS.—Made by a 2.5-foot sharp-crested Cippoletti weir. Old staff gage station rated with current meter.

CHANNEL AND CONTROL.—Weir basin about 6 feet wide, 30 feet long, and 2 feet deep below weir crest. Ditch in earth cut. Wooden weir with metal crest.

EXTREMES OF DISCHARGE.—1915–1919: Maximum stage recorded 2.10 feet at 9.30 p. m. August 16, 1918 (discharge, 19 million gallons per day, or 29 second-feet). Minimum stage recorded 0.03 foot at 3 p. m. March 16, 1919 (discharge, 0.05 million gallons per day, or 0.08 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—For irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent except for short periods when water was leaking around the weir. Operation of water-stage recorder satisfactory. Records good.

*Discharge measurements of East Manoa ditch near Honolulu, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Oct. 24 | A. H. Wong | 0.29 | 1.65 | 1.05 |
| 31 | .....do | .49 | 2.9 | 1.9 |
| Jan. 14 | J. E. Stewart | .345 | 1.7 | 1.1 |
| Feb. 13 | A. H. Wong | .33 | 1.45 | .95 |
| Mar. 21 | .....do | .34 | 1.6 | 1.05 |
| Apr. 23 | .....do | .50 | 3.0 | 1.95 |

*Daily discharge, in million gallons, of East Manoa ditch near Honolulu, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.2 | 0.8 | 1.4 | 1.2 | 1.5 | 1.3 | 1.2 | 1.2 | 1.0 | 0.8 | 1.2 | 1.2 |
| 2 | 1.3 | .8 | 1.3 | 1.2 | 1.2 | 1.6 | 1.2 | 1.0 | 1.2 | .8 | 1.1 | 1.2 |
| 3 | 1.2 | .7 | 1.3 | 1.4 | 1.2 | 3.4 | 1.2 | 1.1 | 1.4 | .8 | 1.0 | 1.2 |
| 4 | 1.2 | .7 | 1.3 | 1.4 | 1.5 | 1.1 | 1.2 | 1.1 | 1.1 | .8 | 1.2 | 1.2 |
| 5 | 1.6 | .9 | 1.3 | 1.5 | 1.4 | 1.2 | 1.0 | 1.0 | 1.0 | .8 | 1.1 | 1.1 |
| 6 | 1.3 | .7 | 1.3 | 1.6 | 1.2 | 2.7 | 1.2 | 1.0 | 1.2 | .8 | 1.0 | 1.1 |
| 7 | 1.3 | 1.0 | 1.3 | 1.2 | 1.2 | 2.2 | 1.2 | 1.0 | 1.2 | .8 | 1.2 | 1.0 |
| 8 | 1.2 | 1.5 | 1.3 | 1.2 | 1.2 | 1.5 | 1.2 | 1.0 | 1.1 | .8 | 1.2 | 1.5 |
| 9 | 1.2 | 1.5 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.0 | .8 | 1.4 | 1.2 |
| 10 | 2.2 | 1.5 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 1.0 | .8 | 1.7 | 1.0 |
| 11 | 1.4 | 1.6 | 1.3 | 1.0 | 1.4 | 1.2 | 1.2 | 1.2 | 1.0 | .8 | 1.4 | 2.1 |
| 12 | 1.2 | 1.5 | 1.3 | .8 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | .9 | 1.2 | 1.2 |
| 13 | 1.5 | 2.7 | 1.4 | .8 | 1.2 | 1.2 | 1.2 | 1.0 | 1.3 | .8 | 1.0 | 1.1 |
| 14 | 1.2 | 1.8 | 1.2 | .8 | 1.2 | 1.2 | 1.0 | 1.1 | 1.1 | .8 | 1.0 | 1.0 |
| 15 | 1.2 | 1.7 | 1.3 | .8 | 1.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.2 | 1.2 | 1.0 |
| 16 | 1.2 | 3.5 | 1.3 | .9 | 1.2 | 1.0 | 1.0 | .9 | .8 | 1.6 | 1.2 | 1.0 |
| 17 | 1.2 | 3.3 | 1.3 | 1.0 | 1.2 | 1.0 | .9 | .9 | .9 | 3.5 | 2.9 | 1.2 |
| 18 | 1.1 | 1.9 | 1.3 | .9 | 1.3 | 1.1 | 1.0 | .8 | .9 | 2.5 | 1.7 | 1.0 |
| 19 | 1.0 | 1.6 | 1.3 | 1.2 | 1.3 | 1.2 | .8 | .9 | .9 | 2.5 | 1.6 | .9 |
| 20 | 1.0 | 1.8 | 1.2 | .8 | 1.3 | 1.5 | .8 | 1.2 | 1.0 | 2.4 | 1.4 | .9 |
| 21 | 1.2 | 2.8 | 1.3 | .8 | 1.3 | 1.4 | 1.1 | 1.0 | 1.7 | 2.0 | 1.4 | .7 |
| 22 | 1.0 | 2.0 | 1.2 | .8 | 1.3 | 1.3 | 1.5 | 1.4 | 2.5 | 1.7 | 1.4 | .9 |
| 23 | 1.0 | 1.9 | 1.3 | .8 | 1.2 | 1.4 | 2.2 | 1.2 | 1.4 | 2.1 | 1.4 | .9 |
| 24 | 1.2 | 1.7 | 1.3 | .8 | 1.4 | 1.4 | 1.1 | 1.2 | 1.2 | 1.5 | 1.2 | .9 |
| 25 | 1.0 | 1.6 | 1.5 | .8 | 2.6 | 1.3 | 1.0 | 1.0 | 1.0 | 1.4 | 1.0 | 1.2 |
| 26 | 1.0 | 1.5 | 1.4 | 1.0 | 2.8 | 1.2 | 1.0 | 1.0 | 1.0 | 1.4 | 1.0 | 1.2 |
| 27 | .9 | 1.5 | 1.4 | 1.0 | 1.5 | 1.2 | 1.4 | 1.1 | 1.0 | 1.3 | 1.0 | 1.1 |
| 28 | 1.0 | 1.5 | 1.4 | .9 | 1.4 | 1.4 | 1.8 | 1.0 | 1.0 | 1.2 | 1.0 | 1.0 |
| 29 | 1.0 | 1.4 | 1.4 | .8 | 2.0 | 1.4 | 1.2 | ..... | .9 | 1.2 | 1.0 | 1.4 |
| 30 | .8 | 1.4 | 1.2 | 4.8 | 1.3 | 1.4 | 1.1 | ..... | .8 | 1.2 | 1.0 | 1.1 |
| 31 | .8 | 1.4 | ..... | 1.8 | ..... | 1.2 | 1.4 | ..... | .8 | ..... | 1.4 | ..... |

*Monthly discharge of East Manoa ditch near Honolulu, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 2.2 | 0.8 | 1.18 | 1.83 | 36.6 | 112 |
| August | 3.5 | .7 | 1.62 | 2.51 | 50.2 | 154 |
| September | 1.5 | 1.2 | 1.31 | 2.03 | 39.4 | 121 |
| October | 4.8 | .8 | 1.17 | 1.81 | 36.4 | 111 |
| November | 2.8 | 1.2 | 1.41 | 2.18 | 42.2 | 130 |
| December | 3.4 | 1.0 | 1.41 | 2.18 | 43.6 | 134 |
| January | 2.2 | .8 | 1.18 | 1.83 | 36.7 | 112 |
| February | 1.4 | .8 | 1.06 | 1.64 | 29.8 | 91 |
| March | 2.5 | .8 | 1.12 | 1.73 | 34.6 | 107 |
| April | 3.5 | .8 | 1.33 | 2.06 | 40.0 | 122 |
| May | 2.9 | 1.0 | 1.27 | 1.96 | 39.5 | 121 |
| June | 2.1 | .7 | 1.12 | 1.73 | 33.5 | 103 |
| The year | 4.8 | .7 | 1.27 | 1.96 | 462 | 1,420 |

### HAIKU STREAM NEAR HEEIA, OAHU.

LOCATION.—60 feet above intake of Reservoir ditch, 1½ miles west of Heeia.

RECORDS AVAILABLE.—January 29, 1914, to June 30, 1919.

GAGE.—Gurley printing water-stage recorder installed June 14, 1919. Stevens continuous water-stage recorder used April 28, 1914, to June 14, 1919, at same location and datum as staff gage; original staff gage datum was raised 0.88 foot March 29, 1914.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 20 feet above and 40 feet below station; banks steep and high; stream bed of solid rock. Control is smooth solid-rock ledge; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.55 feet at 12.45 a. m. December 7 (discharge, 294 million gallons per day, or 455 second-feet); minimum stage recorded 0.59 foot at 3.45 p. m. June 20, 1919 (discharge, 1.2 million gallons per day, or 1.9 second-feet).

1914–1919.—Maximum stage recorded, 6.5 feet at 1 a. m. March 20, 1917 (estimated discharge, 250 million gallons per day, or 390 second-feet); minimum stage in June, 1919.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Low flow diverted below station for domestic supply and for irrigation of taro and rice.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 6 and June 6–30 fairly well defined between 1 and 20 million gallons per day. Shifting-channel methods used March 7 to June 5. Operation of water-stage recorder satisfactory except as shown in footnote to table of daily discharge. Records good when water-stage recorder was operating and when rating curve was applicable; poor at other times.

*Discharge measurements of Haiku Stream near Heeia, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 7... | A. H. Wong | 0.735 | 4.2 | 2.7 |
| Oct. 17.. | ....do | .77 | 4.2 | 2.7 |
| Nov. 19. | J. E. Stewart | .75 | 3.3 | 2.2 |
| Jan. 26.. | ....do | .72 | 3.8 | 2.5 |
| Mar. 6... | A. H. Wong | .70 | 3.2 | 2.1 |
| Apr. 21.. | ....do | .82 | 4.3 | 2.8 |
| June 6... | H. A. R. Austin | .675 | 2.9 | 1.9 |

*Daily discharge, in million gallons, of Haiku Stream near Heeia, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.9 | 2.8 | 2.8 | 2.9 | 2.9 | 2.7 | 2.4 | 1.9 | 1.9 | 2.1 | 2.1 | 2.4 |
| 2 | 3.0 | 2.6 | 2.8 | 2.9 | 2.7 | 2.7 | 2.3 | 1.9 | 1.9 | 2.1 | 2.0 | ..... |
| 3 | 3.0 | 2.8 | 2.7 | 3.0 | 2.8 | 5.6 | 2.6 | 1.8 | 2.1 | 2.0 | 2.0 | ..... |
| 4 | 2.9 | 2.8 | 2.4 | 3.1 | 2.8 | 2.8 | 2.4 | 1.9 | 2.1 | 2.0 | 2.1 | ..... |
| 5 | 3.0 | 2.9 | 2.6 | 3.1 | 2.8 | 2.7 | 2.4 | 1.9 | 2.1 | 2.0 | 2.2 | ..... |
| 6 | 3.1 | 2.7 | 2.6 | 3.2 | 2.8 | 22 | 2.6 | 1.9 | 2.0 | 2.0 | 2.0 | ..... |
| 7 | 3.4 | 2.8 | 2.6 | 3.2 | 2.8 | 14.7 | 2.3 | 1.9 | 2.0 | 2.1 | 2.1 | ..... |
| 8 | 3.2 | 2.6 | 2.6 | 3.1 | 2.8 | 3.2 | 2.2 | 1.9 | 2.0 | 2.0 | 1.9 | ..... |
| 9 | 3.5 | 3.3 | 2.6 | 2.9 | 2.7 | 2.8 | 2.2 | 2.0 | 2.0 | 2.0 | 2.0 | ..... |
| 10 | 4.1 | 2.6 | 2.6 | 2.9 | 2.7 | 2.8 | 2.3 | 2.0 | 2.0 | 1.9 | 7.7 | ..... |
| 11 | 3.4 | 2.7 | 2.6 | 2.9 | 2.8 | 2.7 | 2.3 | 2.0 | 1.9 | 1.9 | 2.6 | ..... |
| 12 | 3.1 | 2.7 | 2.6 | 2.7 | 2.8 | 2.7 | 2.4 | 1.9 | 2.1 | 1.9 | 2.0 | ..... |
| 13 | 3.0 | 2.6 | 2.6 | 2.8 | 2.6 | 2.6 | 2.4 | 2.0 | 2.3 | 1.9 | 2.1 | ..... |
| 14 | 3.0 | 2.6 | 2.6 | 2.8 | 2.4 | 2.7 | 2.2 | 2.2 | 2.7 | 1.9 | 1.9 | 1.8 |
| 15 | 3.0 | 2.7 | 2.4 | 2.8 | 2.4 | 2.7 | 2.2 | 2.1 | 2.2 | 4.2 | 1.9 | 1.8 |
| 16 | 3.1 | 5.1 | 2.6 | 2.8 | 2.4 | 2.7 | 2.4 | 2.1 | 2.1 | ..... | 1.9 | 1.8 |
| 17 | 3.0 | 9.7 | 2.4 | 2.8 | 2.6 | 2.7 | 2.3 | 2.0 | 2.1 | ..... | 2.2 | 1.8 |
| 18 | 3.0 | 3.0 | 2.4 | 2.8 | 2.4 | 2.6 | 2.1 | 1.9 | 2.1 | ..... | 2.0 | 1.8 |
| 19 | 3.0 | 2.7 | 2.4 | 3.0 | 2.6 | 2.6 | 2.1 | 2.0 | 2.1 | ..... | 2.0 | 1.8 |
| 20 | 3.0 | 2.6 | 2.4 | 2.9 | 2.6 | 2.6 | 2.1 | 1.9 | 2.1 | ..... | 1.9 | 1.7 |
| 21 | 3.0 | 3.6 | 2.4 | 2.9 | 2.6 | 2.7 | 2.2 | 1.9 | 2.2 | 2.7 | 1.9 | 1.8 |
| 22 | 3.0 | 3.9 | 2.6 | 3.0 | 2.6 | 2.4 | 2.2 | 1.9 | 9.4 | 2.6 | 1.9 | 1.8 |
| 23 | 2.9 | 2.9 | 2.6 | 2.8 | 2.7 | 2.6 | 3.4 | 1.9 | 2.8 | 2.6 | 1.9 | 1.8 |
| 24 | 2.9 | 2.8 | 2.6 | 2.9 | 3.2 | 2.6 | 2.3 | 1.9 | 2.3 | 2.3 | 1.8 | 1.8 |
| 25 | 2.9 | 2.8 | 2.7 | 2.9 | 23 | 2.6 | 2.2 | 1.8 | 2.2 | 2.1 | 1.9 | 1.8 |
| 26 | 3.0 | 2.8 | 2.6 | 3.0 | 10.6 | 2.6 | 2.0 | 1.9 | 2.2 | 2.0 | 1.8 | 1.8 |
| 27 | 2.8 | 3.6 | 2.7 | 2.8 | 3.0 | 2.4 | 2.2 | 1.9 | 2.1 | 2.0 | 1.9 | 1.8 |
| 28 | 3.0 | 4.0 | 2.6 | 2.9 | 2.6 | 2.6 | 2.1 | 1.9 | 2.1 | 2.1 | 1.8 | 1.9 |
| 28 | 2.9 | 5.8 | 5.3 | 2.8 | 3.5 | 2.4 | 2.0 | ..... | 2.3 | 2.1 | 1.9 | 2.4 |
| 30 | 3.0 | 3.0 | 3.0 | 7.7 | 2.7 | 2.7 | 1.9 | ..... | 2.3 | 2.0 | 1.9 | 2.0 |
| 31 | 2.8 | 2.8 | ..... | 3.7 | ..... | 2.4 | 1.9 | ..... | 2.2 | ..... | 8.2 | ..... |

NOTE.—Gage not working properly and discharge estimated in million gallons per day as follows: Oct. 15 and 16 as shown; Apr. 16–20, 5.0; June 2–5, 2.4; June 6–10, 2.0; June 11–13, 3.0.

*Monthly discharge of Haiku Stream near Heeia, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 4.1 | 2.8 | 3.06 | 4.73 | 94.9 | 291 |
| August | 9.7 | 2.6 | 3.30 | 5.11 | 102 | 314 |
| September | 5.3 | 2.4 | 2.68 | 4.15 | 80.4 | 247 |
| October | 7.7 | 2.7 | 3.10 | 4.80 | 96.0 | 295 |
| November | 23 | 2.4 | 3.66 | 5.66 | 110 | 337 |
| December | 22 | 2.4 | 3.76 | 5.82 | 117 | 358 |
| January | 3.4 | 1.9 | 2.28 | 3.53 | 70.6 | 217 |
| February | 2.2 | 1.8 | 1.94 | 3.00 | 54.3 | 167 |
| March | 9.4 | 1.9 | 2.38 | 3.68 | 73.9 | 226 |
| April | ..... | 1.9 | 2.65 | 4.10 | 79.5 | 244 |
| May | 8.2 | 1.8 | 2.37 | 3.67 | 73.5 | 225 |
| June | ..... | 1.7 | 2.08 | 3.22 | 62.4 | 191 |
| The year | 23 | 1.7 | 2.78 | 4.30 | 1,010 | 3,110 |

**RIGHT BRANCH OF NORTH FORK OF KAUKONAHUA STREAM NEAR WAHIAWA, OAHU.**

LOCATION.—200 feet upstream from intake of Wahiawa Water Co.'s tunnel, which is at confluence of Right and Left branches (two main branches) of North Fork, 8 miles northeast of Wahiawa.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 20 feet upstream from gage.

CHANNEL AND CONTROL.—Channel is a straight stretch 200 feet long that has been cleared of boulders. Banks steep and flow well distributed and confined. Natural control of large boulders has been improved somewhat for lower water stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.08 feet at 6.15 a. m. November 25 (discharge, 321 million gallons per day, or 497 second-feet); minimum stage recorded, 1.16 feet at 4 p. m. February 8 (discharge, 0.22 million gallons per day, or 0.34 second-feet).

1913–1919: Maximum stage recorded 6.9 feet at 10 p. m. November 8, 1914 (discharge, estimated by extension of rating curve, 560 million gallons per day, or 866 second-feet); minimum daily discharge, March, 1914 (0.2 million gallons per day, or 0.3 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Wahiawa Water Co.'s ditch diverts entire low-water flow of both Right and Left branches of North Fork for domestic water supply and irrigation in vicinity of Wahiawa. All water, except the low flow, from North Fork is impounded in Wahiawa reservoir for irrigation of sugar cane on Waialua plantation.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to September 24 fairly well defined above 7 million gallons per day. Curves used September 25 to November 25 and November 26 to June 30 well defined between 7 and 200 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records good when water-stage recorder was operating; poor at other times.

*Discharge measurements of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 2 | R. D. Klise | 1.84 | 4.3 | 2.8 |
| Oct. 25 | A. H. Wong | 1.53 | 2.3 | 1.45 |
| Jan. 17 | J. E. Stewart | 1.255 | .8 | .5 |
| Feb. 21 | A. H. Wong | 1.52 | 4.2 | 2.7 |
| Apr. 3 | .....do | 1.30 | 1.25 | .8 |
| May 2 | .....do | 1.47 | 3.6 | 2.3 |
| June 4 | J. E. Stewart | 1.49 | 5.2 | 3.4 |
| 30 | .....do | 1.63 | 7.6 | 4.9 |

*Daily discharge, in million gallons, of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.5 | 3.9 | ..... | 1.0 | 3.4 | 4.6 | 1.3 | ..... | 5.0 | 0.8 | 3.4 | 2.9 |
| 2 | 2.3 | 2.9 | ..... | .8 | 3.6 | 3.5 | 1.4 | ..... | ..... | .8 | 2.7 | 8.0 |
| 3 | 2.1 | 2.8 | ..... | .7 | 2.3 | 23 | 1.2 | ..... | ..... | .8 | 2.5 | 26 |
| 4 | 3.9 | 2.9 | ..... | .7 | 10.5 | 3.8 | 1.2 | ..... | ..... | .7 | 2.8 | 2.9 |
| 5 | 20 | 6.1 | ..... | 1.1 | 17.9 | 3.6 | 1.1 | ..... | ..... | 1.1 | 4.3 | 2.3 |
| 6 | 4.1 | 4.3 | ..... | ..... | 4.0 | 45 | 1.0 | ..... | ..... | 1.8 | 2.3 | 1.9 |
| 7 | 3.9 | 4.8 | ..... | ..... | 6.8 | 24 | .8 | ..... | ..... | 1.2 | 4.3 | 5.3 |
| 8 | 3.6 | 3.3 | ..... | ..... | 22 | 17.0 | .8 | ..... | ..... | .8 | 9.7 | 29 |
| 9 | 4.4 | 2.8 | ..... | ..... | 9.0 | 7.0 | .6 | ..... | ..... | .8 | 18.4 | 5.9 |
| 10 | 58 | 4.6 | ..... | ..... | 4.4 | 15.0 | .6 | ..... | ..... | .8 | 37 | 3.5 |
| 11 | 36 | 3.1 | ..... | ..... | 4.8 | 8.0 | .6 | 12.7 | ..... | .8 | 13.7 | 31 |
| 12 | 8.3 | 4.6 | ..... | ..... | 6.3 | 5.4 | .8 | 6.6 | ..... | 10.8 | 5.5 | 5.9 |
| 13 | ..... | 28 | ..... | ..... | 3.1 | 4.6 | 1.1 | 1.6 | ..... | 1.5 | 5.7 | 6.4 |
| 14 | ..... | 18.0 | ..... | ..... | 3.4 | 4.1 | .8 | 1.2 | ..... | .8 | 3.8 | 4.2 |
| 15 | ..... | 6.6 | ..... | ..... | 2.9 | 3.5 | .7 | 1.1 | ..... | .6 | 3.2 | 12.5 |
| 16 | ..... | 16.0 | ..... | 4.6 | 2.3 | 3.4 | .6 | .9 | 2.5 | 2.1 | 2.9 | 3.7 |
| 17 | ..... | 33 | 2.2 | 6.1 | 2.2 | 3.2 | .6 | .8 | 2.2 | 50 | 5.4 | 14.2 |
| 18 | ..... | 8.5 | 2.1 | 2.6 | 2.0 | 3.5 | .6 | .8 | 2.1 | 21 | 2.9 | 9.1 |
| 19 | ..... | 7.8 | 2.5 | 9.7 | 1.8 | 2.8 | .6 | .8 | 1.7 | 56 | 3.5 | 4.0 |
| 20 | ..... | 6.3 | 1.7 | 4.7 | 1.5 | 7.8 | .6 | 17.8 | 3.0 | 19.4 | 2.7 | 3.6 |
| 21 | ..... | 12.0 | 1.9 | 6.5 | 1.3 | 4.3 | .6 | 3.8 | 2.9 | 8.7 | 2.3 | 3.0 |
| 22 | ..... | 32 | 1.5 | 3.6 | 1.0 | 2.7 | 18.0 | 15.6 | 10.7 | 6.7 | 2.4 | 2.7 |
| 23 | ..... | 7.8 | 1.5 | 2.2 | 1.0 | ..... | 26 | 5.2 | 2.3 | 21 | 2.9 | 2.4 |
| 24 | ..... | 7.1 | 1.2 | 1.7 | 2.3 | ..... | 2.1 | 7.2 | 1.6 | 19.1 | 2.1 | 2.3 |
| 25 | 4.1 | 7.8 | 1.4 | 1.5 | 49 | ..... | 1.5 | 3.4 | 1.4 | 4.0 | 1.8 | 10.0 |
| 26 | 3.7 | 5.7 | 1.4 | 1.8 | 15.0 | ..... | ..... | 2.7 | 1.2 | 3.6 | 1.8 | 34 |
| 27 | 3.4 | 5.7 | 1.0 | 1.5 | 5.0 | ..... | ..... | 3.0 | 1.2 | 5.9 | 2.2 | 10.9 |
| 28 | 4.1 | 6.1 | .9 | 1.3 | 4.0 | ..... | ..... | 3.2 | 1.1 | 4.0 | 1.7 | 5.0 |
| 29 | 14 | 5.0 | .9 | 1.1 | 5.1 | ..... | ..... | ..... | 1.2 | 3.9 | 1.6 | 29 |
| 30 | 3.7 | 8.0 | 1.3 | 51 | 3.8 | ..... | ..... | ..... | 1.0 | 5.1 | 1.5 | 5.0 |
| 31 | 6.3 | 4.4 | ..... | 7.4 | ..... | ..... | ..... | ..... | .8 | ..... | 5.2 | ..... |

NOTE.—Clock stopped and discharge estimated in million gallons per day as follows: July 13–15, 10; July 16–20, 4; July 21–24, 8; Sept. 1–5, 5; Sept. 6–10, 10; Sept. 11–16, 3; Oct. 6–10, 6; Oct. 11–15, 3; Dec. 23–31, 2; Jan. 26 to Feb. 10, 1.5; Mar. 2–5, 4; Mar. 6–10, 7; Mar. 11–15, 9; June 30 as shown.

All the above estimates except those for Sept. 11–16 and Dec. 23–31, have been made by comparison with the record at the Left Branch station.

*Monthly discharge of Right Branch of North Fork of Kaukonahua Stream near Wahiawa Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 58 | 2.1 | 8.72 | 13.5 | 270 | 830 |
| August | 33 | 2.8 | 8.77 | 13.6 | 272 | 834 |
| September | ..... | .9 | 3.82 | 5.91 | 114 | 352 |
| October | 51 | .7 | 5.05 | 7.81 | 157 | 480 |
| November | 49 | 1.0 | 6.72 | 10.4 | 202 | 619 |
| December | 45 | ..... | 7.03 | 10.9 | 218 | 669 |
| January | 26 | ..... | 2.39 | 3.70 | 74.2 | 227 |
| February | 17.8 | ..... | 3.69 | 5.71 | 103 | 317 |
| March | ..... | .8 | 4.45 | 6.89 | 138 | 423 |
| April | 56 | .6 | 8.48 | 13.1 | 254 | 781 |
| May | 37 | 1.5 | 5.23 | 8.09 | 162 | 498 |
| June | 34 | 1.9 | 9.55 | 14.8 | 287 | 879 |
| The year | 58 | ..... | 6.17 | 9.55 | 2,250 | 6,910 |

**LEFT BRANCH OF NORTH FORK OF KAUKONAHUA STREAM NEAR WAHIAWA, OAHU.**

LOCATION.—100 feet above intake of Wahiawa Water Co.'s tunnel, whichis at confluence of Right and Left branches (two main branches) of North Fork, 8 miles northeast of Wahiawa.

RECORDS AVAILABLE.—May 25, 1913, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable at gage.

CHANNEL AND CONTROL.—Channel straight for 100 feet above and below gage; fairly uniform in cross section with high, wooded banks; only one channel at all stages. Stream bed composed of boulders and gravel. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.83 feet at 7.15 a. m. November 25 (discharge, 586 million gallons per day, or 907 second-feet). Minimum stage recorded during year 1.08 feet at noon January 17 (discharge, 0.62 million gallons per day, or 0.96 second-feet).

1913–1919: Maximum stage recorded, 8.48 feet at 2.45 p. m. April 12, 1918 (discharge, 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded, 0.85 foot February 9 and 19, 1915 (discharge, 0.25 million gallons per day, or 0.37 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Wahiawa Water Co.'s tunnel diverts entire low-water flow of both Right and Left branches of North Fork, for domestic water supply and irrigation in vicinity of Wahiawa. All water, except the low flow from North Fork, is impounded in Wahiawa reservoir for irrigation of sugar cane on Waialua plantation.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 40 million gallons per day. Operation of water-stage recorder unsatisfatory at times. Records good when water-stage recorder was operating and poor at other times.

*Discharge measurements of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Aug. 2 | R. D. Klise | 1.45 | 8.8 | 5.7 |
| Oct. 25 | A. H. Wong | 1.22 | 3.0 | 1.9 |
| Jan. 17 | J. E. Stewart | 1.075 | 1.2 | .75 |
| Feb. 21 | A. H. Wong | 1.42 | 7.7 | 5.0 |
| Apr. 3 | .....do | 1.12 | 1.65 | 1.05 |
| May 2 | .....do | 1.35 | 6.0 | 3.9 |
| June 4 | J. E. Stewart | 1.47 | 9.3 | 6.0 |
| 30 | .....do | 1.50 | 11.1 | 7.2 |

*Daily discharge, in million gallons, of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.4 | 6.1 | 10.9 | 3.1 | 6.5 | 7.0 | ..... | 1.8 | 8.2 | 1.3 | 4.0 | 6.3 |
| 2 | 5.6 | 6.1 | 6.3 | 2.7 | 9.0 | 6.8 | ..... | 1.5 | 8.6 | 1.2 | 4.0 | 13.2 |
| 3 | 4.5 | 5.8 | 5.6 | 2.7 | 3.8 | 36 | ..... | 1.5 | 7.4 | 1.1 | 4.1 | 57 |
| 4 | 6.8 | 8.1 | 5.4 | 2.7 | 22 | 4.8 | ..... | 2.3 | 2.8 | 1.1 | 4.6 | 6.1 |
| 5 | 44 | 8.2 | 5.4 | 20 | 22 | 4.5 | ..... | 1.5 | 2.6 | 1.3 | 7.4 | 4.6 |
| 6 | 7.2 | 8.1 | 4.8 | 11.5 | 4.1 | 64 | ..... | 1.6 | 13.6 | 1.4 | 4.5 | 3.8 |
| 7 | 5.8 | 7.4 | 5.4 | 5.3 | 8.3 | 34 | ..... | 1.5 | 15.4 | 1.5 | 9.2 | ..... |
| 8 | 4.6 | 5.0 | 20 | 4.6 | 10.0 | 26 | ..... | 1.5 | 4.8 | 1.7 | 13.4 | ..... |
| 9 | 6.2 | 4.8 | 5.6 | 2.7 | 4.5 | 9.3 | ..... | 6.2 | 3.4 | 1.8 | 18.9 | ..... |
| 10 | 125 | 8.8 | 23 | 2.7 | 2.8 | 31 | ..... | 2.1 | 7.2 | 1.9 | 24 | ..... |
| 11 | 38 | 7.4 | ..... | 2.4 | 3.8 | 12.2 | ..... | 9.3 | 5.9 | 2.2 | 13.0 | ..... |
| 12 | 11.0 | 8.4 | ..... | 2.3 | 6.7 | 6.9 | ..... | 9.6 | 31 | 13.0 | 6.9 | ..... |
| 13 | 32 | 24 | ..... | 2.3 | 3.0 | 5.8 | ..... | 3.0 | 6.1 | 3.3 | 6.9 | ..... |
| 14 | 11.6 | 18.5 | ..... | 7.7 | 3.8 | 5.4 | ..... | 2.4 | 4.5 | 3.4 | 5.4 | ..... |
| 15 | 8.0 | 7.4 | ..... | 3.0 | 3.8 | ..... | ..... | 2.1 | 3.3 | 3.8 | 5.0 | ..... |
| 16 | 6.5 | 34 | ..... | 7.6 | 3.8 | ..... | ..... | 1.8 | 3.1 | 5.1 | 4.8 | ..... |
| 17 | 5.4 | 54 | 3.4 | 16.6 | 4.1 | ..... | .8 | 2.1 | 2.8 | ..... | 16.6 | ..... |
| 18 | 5.4 | 11.0 | 5.2 | 4.7 | 5.2 | 6.8 | .9 | 1.8 | 2.7 | ..... | 6.1 | ..... |
| 19 | 6.3 | 10.3 | 4.3 | 6.6 | 5.8 | 4.3 | 1.0 | 1.7 | 2.6 | ..... | 6.1 | ..... |
| 20 | 6.3 | 11.7 | 3.0 | 3.3 | 6.5 | 8.6 | 1.0 | 24 | 2.3 | ..... | 4.8 | ..... |
| 21 | 27 | 20 | 2.8 | 5.2 | 6.5 | 4.6 | 1.0 | 5.8 | 8.2 | ..... | 4.6 | ..... |
| 22 | 13.3 | 35 | ..... | 3 3 | 6.7 | ..... | 32 | 17.0 | 22 | ..... | 5.0 | ..... |
| 23 | 6.3 | 9.1 | ..... | 2.4 | 6.3 | ..... | 36 | 6.6 | 3.4 | ..... | 5.8 | ..... |
| 24 | 19.1 | 9.9 | ..... | 2.4 | 7.4 | ..... | 2.8 | 9.0 | 2.6 | ..... | 4.6 | ..... |
| 25 | 6.1 | 13.3 | 3.1 | 2.2 | 120 | ..... | 2.3 | 4.0 | 2.2 | ..... | 4.1 | ..... |
| 26 | 6.3 | 7.2 | 3.0 | 5.1 | 28 | ..... | 2.2 | 3.3 | 1.9 | ..... | 3.8 | ..... |
| 27 | 4.8 | 6.1 | 2.8 | 3.1 | 7.7 | ..... | 2.1 | 3.3 | 1.7 | ..... | 4.6 | ..... |
| 28 | 9.0 | 8.0 | 2.6 | 3.0 | 5.8 | ..... | 1.8 | 2.4 | 1.5 | ..... | 4.0 | ..... |
| 29 | 39 | 17.0 | 2.6 | 3.0 | 11.4 | ..... | 1.7 | ..... | 1.4 | ..... | 3.8 | ..... |
| 30 | 6.5 | 13.3 | 3.1 | 92 | 6.1 | ..... | 1.5 | ..... | 1.3 | ..... | 3.6 | ..... |
| 31 | 14.6 | 6.1 | ..... | 15.2 | ..... | ..... | 3.3 | ..... | 1.4 | ..... | 10.0 | ..... |

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: Sept. 11–16, 4.6; Sept. 22–24, 2.4; Dec. 15–17, 5.2; Dec. 19 as shown; Dec. 22–31, 3.1; Jan. 1–6, 1.9; Jan. 7–11, 1.1; Jan. 12–16, 1.2; Apr. 17–20, 50; Apr. 21–25, 14.0; Apr. 26–30, 7.0; June 7–10, 12.0; June 11–15, 10.0; June 16–20, 7.0; June 21–25, 6.0; and June 26–30, 22.

All the above estimates, except those for Sept. 11–16 and Dec. 23–31, have been made by comparison with the record for the Right Branch station.

*Monthly discharge of Left Branch of North Fork of Kaukonahua Stream, near Wahiawa, Oahu, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 125 | 4.5 | 16.1 | 24.9 | 498 | 1,530 |
| August | 54 | 4.8 | 12.9 | 20.0 | 400 | 1,230 |
| September | 23 | ..... | 5.44 | 8.42 | 163 | 501 |
| October | 92 | 2.2 | 8.11 | 12.5 | 251 | 772 |
| November | 120 | 2.8 | 11.5 | 17.8 | 345 | 1,060 |
| December | 64 | ..... | 10.5 | 16.2 | 325 | 999 |
| January | 36 | ..... | 3.65 | 5.65 | 113 | 347 |
| February | 24 | 1.5 | 4.67 | 7.23 | 131 | 401 |
| March | 31 | 1.3 | 6.00 | 9.28 | 186 | 571 |
| April | ..... | 1.1 | 11.7 | 18.1 | 350 | 1,080 |
| May | 24 | 3.6 | 7.21 | 11.2 | 224 | 686 |
| June | ..... | ..... | 12.1 | 18.7 | 364 | 1,110 |
| The year | 125 | ..... | 9.18 | 14.2 | 3,350 | 10,300 |

MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Oahu at points other than regular gaging stations are listed below.

*Miscellaneous measurements on Oahu during the year ending June 30, 1919.*

| Date. | Stream. | Locality. | Gage height (feet). | Discharge. | |
|---|---|---|---|---|---|
| | | | | Second-feet. | Million gallons per day. |
| July 15 | Waiahole | 50 feet below old ditch intake near Cullin's place. | | 17.4 | 11.2 |
| 15 | do | Left Branch near power station | | 2.2 | 1.4 |
| 15 | Waiahole ditch | Right Branch at 140 feet elevation | | 1.55 | 1.0 |
| 15 | Waiahole | Right and Middle branches 7 feet above weir grating at power station. | | 5.7 | 3.7 |
| 17 | Pond outlet | At Kumalae's place, Waikiki | | 3.1 | 2.0 |

## ISLAND OF MAUI.

### HONOKAHAU STREAM NEAR HONOKAHAU, MAUI.

LOCATION.—1,000 feet above intake of Honokahau ditch, 6 miles southeast of Honokahau.

RECORDS AVAILABLE.—March 6, 1913, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 400 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet below gage but makes sharp bend 50 feet above gage; right bank slopes gently; left bank is vertical wall of rock. Control composed of large boulders; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.55 feet at 11.30 a. m. November 26 (discharge, approximately 648 million gallons per day, or 1,000 second-feet); minimum stage recorded, 1.47 feet at 1 a. m. November 26 (discharge, 9.6 million gallons per day, or 14.9 second-feet).

1913–1919: Maximum stage recorded, 8.25 feet at 7.30 a. m. January 18, 1916 (discharge, computed from extension of rating curve, about 1,900 million gallons per day, or 2,940 second-feet); minimum stage recorded, 1.40 feet December 11–13, 17–18, 1917 (discharge, 6.0 million gallons per day, or 9.3 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Low flow of stream all diverted by Honokohau ditch for irrigation of sugar cane and for development of power.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 10 and 100 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records good when water-stage recorder was operating; poor at other times.

*Discharge measurements of Honokahau Stream near Honokahau, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 9 | C. T. Bailey | 1.88 | 35.5 | 23.1 |
| Sept. 20 | A. H. Wong | 1.76 | 29.5 | 19.1 |
| Nov. 13 | do | 1.88 | 34.5 | 22.4 |
| Jan. 9 | do | 1.57 | 17.8 | 11.5 |
| Mar. 17 | H. A. R. Austin | 2.10 | 54 | 35 |
| Apr. 29 | do | 1.54 | 16.6 | 10.7 |
| May 29 | A. H. Wong | 1.53 | 17.6 | 11.3 |

*Daily discharge, in million gallons, of Honokahau Stream near Honokahau, Maui, fo the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 35 | ..... | 24 | 15.8 | 36 | 12.7 | 13.6 | 20 | ..... | 11.0 | 23 | 12.2 |
| 2 | 31 | ..... | 16.9 | 15.8 | 22 | 59 | 14.2 | 22 | ..... | 10.7 | 12.0 | 11.7 |
| 3 | 30 | 27 | 15.5 | 15.8 | 15.5 | 92 | 20 | 25 | ..... | 11.2 | 11.4 | 11.2 |
| 4 | 29 | 19.1 | 14.2 | 17.3 | 66 | 15.8 | 23 | 12.7 | ..... | 10.7 | 12.2 | 11.2 |
| 5 | 40 | 28 | 13.6 | 15.8 | 25 | 54 | 13.3 | 11.7 | ..... | 10.4 | 40 | 11.0 |
| 6 | 19.4 | 21 | 13.3 | 31 | 21 | 149 | 18.0 | 11.2 | ..... | 10.4 | 15.4 | 10.7 |
| 7 | 21 | 16.9 | 13.6 | 16.2 | 12.4 | 85 | 13.0 | 11.2 | ..... | 10.4 | 17.6 | 22 |
| 8 | 28 | 20 | 19.1 | 15.2 | 10.7 | 53 | 12.2 | 10.7 | 15.8 | 10.7 | 47 | 35 |
| 9 | 41 | 20 | 15.5 | 14.2 | 12.7 | 18.8 | 12.0 | 54 | ..... | 10.2 | 30 | 12.0 |
| 10 | 195 | 17.6 | 15.2 | 15.2 | 12.4 | 44 | 12.0 | 15.5 | ..... | 10.2 | 76 | 20 |
| 11 | 33 | 19.5 | 14.9 | 14.6 | 48 | 36 | 12.0 | 14.9 | ..... | 14.6 | 15.5 | 12.7 |
| 12 | 24 | 37 | 15.8 | 15.5 | 75 | 15.5 | 12.2 | 25 | ..... | 20 | 14.8 | 11.7 |
| 13 | 47 | 141 | 16.5 | 15.5 | 22 | 14.9 | 13.0 | ..... | ..... | 12.0 | 12.4 | 11.7 |
| 14 | 31 | 41 | 16.9 | 14.2 | 12.2 | 32 | 12.7 | ..... | 12.7 | 11.4 | 11.4 | 11.7 |
| 15 | 24 | 26 | 16.2 | 12.7 | 11.0 | 56 | 12.4 | ..... | 12.4 | 11.7 | 11.2 | 28 |
| 16 | 24 | 220 | 17.3 | 12.7 | 10.4 | 31 | 12.2 | ..... | 15.8 | 35 | 11.2 | 18.0 |
| 17 | 19.1 | 83 | 20 | 11.4 | 10.7 | 32 | 11.7 | 11.2 | ..... | 40 | 43 | 40 |
| 18 | 17.3 | 43 | 25 | 12.2 | 11.7 | 26 | 11.7 | 11.2 | ..... | 21 | 53 | 28 |
| 19 | 30 | 27 | 36 | 12.3 | 10.4 | 16.5 | 12.0 | 10.7 | ..... | 37 | 14.6 | 14.6 |
| 20 | 46 | 68 | 18.4 | 31 | 10.7 | 21 | 12.0 | 80 | ..... | 34 | 12.0 | 14.6 |
| 21 | 51 | 42 | 18.4 | 15.3 | 11.0 | 46 | 11.7 | ..... | ..... | 14.2 | 27 | 12.2 |
| 22 | 27 | 24 | 18.0 | 21 | 11.0 | 14.9 | 17.0 | ..... | 60 | 62 | 11.7 | 11.2 |
| 23 | 62 | 22 | 27 | 13.0 | 10.2 | 15.2 | 32 | ..... | 36 | 34 | 17.2 | 11.4 |
| 24 | 43 | 24 | 19.5 | 11.7 | 10.4 | 24 | 28 | ..... | 14.6 | 27 | 12.2 | 11.4 |
| 25 | 64 | 20 | 22 | 12.2 | 10.2 | 16.5 | 32 | ..... | 12.2 | 40 | 12.0 | 23 |
| 26 | 21 | 19.5 | 18.0 | 18.6 | 72 | 13.9 | 13.3 | ..... | 12.4 | 25 | 11.2 | 23 |
| 27 | 38 | 18.0 | 16.9 | 12.7 | 29 | 14.9 | 34 | ..... | 12.0 | 16.9 | 13.3 | 22 |
| 28 | 133 | 70 | 15.8 | 11.7 | 19.0 | 13.6 | 33 | ..... | 11.7 | 12.7 | 11.0 | 17.2 |
| 29 | ..... | 29 | 17.6 | 55 | 28 | 12.7 | 15.5 | ..... | 11.0 | 11.4 | 11.0 | 26 |
| 30 | ..... | 18.4 | 16.2 | 53 | 13.3 | 28 | 12.7 | ..... | 12.0 | 12.6 | 14.4 | 12.0 |
| 31 | ..... | 67 | ..... | 18.2 | ..... | 20 | 32 | ..... | 11.2 | ..... | 14.9 | ..... |

NOTE.—Clock stopped and discharge estimated in million gallons per day by comparison with records of Lahainaluna Stream and Honokawai ditch as follows: July 29–31, 30; Aug. 1–2, 20; Feb. 13–16, 12; Feb. 21–28, 20; Mar. 1–7, 30; Mar. 9–13, 40; Mar. 17–21, 15.4.

*Monthly discharge of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 195 | 17.3 | 41.7 | 64.5 | 1,290 | 3,970 |
| August | 220 | 16.9 | 40.9 | 63.3 | 1,270 | 3,890 |
| September | 36 | 13.3 | 18.2 | 28.2 | 547 | 1,680 |
| October | 55 | 11.4 | 18.3 | 28.3 | 567 | 1,740 |
| November | 75 | 10.2 | 22.3 | 34.5 | 670 | 2,050 |
| December | 149 | 12.7 | 35.0 | 54.2 | 1,080 | 3,330 |
| January | 34 | 11.7 | 17.2 | 26.6 | 534 | 1,640 |
| February | 80 | 10.7 | 19.8 | 30.6 | 555 | 1,700 |
| March | ..... | 11.0 | 23.8 | 36.8 | 737 | 2,260 |
| April | 62 | 10.2 | 19.9 | 30.8 | 598 | 1,830 |
| May | 76 | 11.0 | 20.6 | 31.9 | 640 | 1,960 |
| June | 40 | 10.7 | 17.2 | 26.6 | 517 | 1,580 |
| The year | 220 | 10.2 | 24.7 | 38.2 | 9,010 | 27,600 |

### HONOKAWAI DITCH NEAR LAHAINA, MAUI.

LOCATION.—At downstream portal of long tunnel on Honokawai ditch, 1½ miles below intake and 1½ miles northeast of Puukolii.

RECORDS AVAILABLE.—November 14, 1918, to June 30, 1919, at this location; and from July 1, 1912, to December 31, 1917, at old location about a mile upstream.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank across rectangular concrete-lined section 20 feet below gage.

CHANNEL AND CONTROL.—Channel is concrete lined, straight for 100 feet above and below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 5.66 feet at 3 p. m. May 8 (discharge, 27 million gallons per day, or 42 second-feet); minimum stage recorded, 0.22 foot at 9 p. m. November 14 (discharge, 0.32 million gallons per day, or 0.5 second-foot).

DIVERSIONS.—Diversion ditch about 50 feet below intake to well diverts part of flood water above gage height of 3.95 feet when flood gates are open.

REGULATION.—Flow controlled by headgates at intake of ditch and by flood gates just below intake of recorder well.

UTILIZATION.—Development of power and irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves applicable as follows: November 14 to March 9 and March 10–17, poorly defined; March 18 to May 21, fairly well defined between 3 and 20 million gallons per day.

*Discharge measurements of Honokawai ditch near Lahaina, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Nov. 14 | A. H. Wong | 0.24 | 0.6 | 0.4 |
| Jan. 13 | ....do | .66 | 6.3 | 4.0 |
| Mar. 18 | H. A. R. Austin | 4.10 | 5.9 | 3.8 |
| 18 | J. E. Stewart | 4.10 | 5.8 | 3.8 |
| 18 | H. A. R. Austin | 4.10 | 6.8 | 4.4 |
| Apr. 15 | .....do | 4.03 | 5.9 | 3.8 |
| 30 | .....do | 4.07 | 6.5 | 4.2 |
| May 18 | A. H. Wong | 4.96 | 25.5 | 16.6 |
| 18 | H. A. R. Austin | 4.85 | 22.9 | 14.8 |
| June 12 | J. E. Stewart | 3.925 | 6.2 | 4.0 |

*Daily discharge, in million gallons, of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1919.*

| Day. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|
| 1 | ..... | 3.8 | 4.3 | 6.3 | 7.0 | 2.4 | 6.5 | 3.9 |
| 2 | ..... | 4.4 | 4.1 | 5.9 | 7.3 | 2.5 | 4.0 | 3.8 |
| 3 | ..... | 5.1 | 4.2 | 6.2 | 13.0 | 2.5 | 3.7 | 3.6 |
| 4 | ..... | 6.5 | 6.5 | 3.2 | 5.7 | 2.5 | 3.7 | 3.6 |
| 5 | ..... | 5.4 | 4.2 | 3.1 | 7.3 | 2.5 | 9.3 | 3.6 |
| 6 | ..... | 6.2 | 5.7 | 3.0 | 15.4 | 2.5 | 6.4 | 3.6 |
| 7 | ..... | 6.5 | 4.2 | 3.0 | 13.2 | 2.5 | 6.6 | ..... |
| 8 | ..... | 5.9 | 3.6 | 3.3 | 11.3 | 2.5 | 15.6 | ..... |
| 9 | ..... | 5.7 | 3.6 | ..... | 13.2 | 2.7 | 8.7 | ..... |
| 10 | ..... | 6.3 | 3.5 | ..... | 19.5 | 2.7 | 9.3 | ..... |
| 11 | ..... | 5.9 | 3.3 | ..... | 8.5 | 3.1 | 4.1 | ..... |
| 12 | ..... | 5.3 | 3.3 | ..... | 12.1 | 5.5 | 4.0 | 3.9 |
| 13 | ..... | 5.0 | 3.7 | ..... | 6.1 | 3.6 | 3.5 | 3.9 |
| 14 | ..... | 6.0 | 3.7 | ..... | 4.0 | 3.3 | 3.0 | 3.9 |
| 15 | .8 | 7.8 | 3.5 | ..... | 2.5 | 3.6 | 3.0 | 7.7 |
| 16 | 1.4 | 7.1 | 3.5 | ..... | 2.4 | 6.5 | 3.0 | 5.5 |
| 17 | 1.7 | 6.7 | 3.5 | ..... | 4.6 | 9.4 | 7.2 | 10.5 |
| 18 | 2.0 | 6.7 | 3.3 | 3.1 | 4.0 | 6.8 | 12.1 | 7.6 |
| 19 | 1.9 | 6.3 | 2.9 | 3.2 | 4.2 | 7.9 | 4.0 | 5.0 |
| 20 | 1.9 | 6.7 | 2.8 | 13.2 | 4.9 | 12.1 | 3.2 | 4.3 |
| 21 | 2.3 | 5.9 | 2.9 | 6.0 | 3.3 | 6.4 | 6.8 | 4.2 |
| 22 | 3.6 | 4.6 | 3.6 | 8.9 | 8.7 | 15.6 | 4.8 | 4.1 |
| 23 | 3.6 | 4.9 | 11.1 | 6.7 | 8.6 | 12.1 | 6.3 | 3.9 |
| 24 | 3.8 | 7.7 | 13.2 | 6.5 | 4.2 | 13.5 | 4.9 | 3.9 |
| 25 | 3.9 | 5.3 | 9.5 | 6.0 | 3.2 | 11.4 | 4.5 | 5.5 |
| 26 | 4.4 | 5.1 | 3.6 | 4.7 | 3.2 | 12.8 | 4.1 | 7.7 |
| 27 | 9.7 | 5.0 | 9.7 | 6.2 | 3.0 | 7.2 | 4.2 | 8.4 |
| 28 | 6.0 | 4.3 | 10.1 | 4.1 | 2.7 | 4.9 | 3.9 | 7.4 |
| 29 | 5.3 | 4.3 | 5.1 | ..... | 2.6 | 4.4 | 3.6 | 8.7 |
| 30 | 5.1 | 5.4 | 3.8 | ..... | 2.5 | 4.1 | 3.8 | 4.6 |
| 31 | ..... | 6.3 | 8.2 | ..... | 2.5 | ..... | 4.8 | ..... |

NOTE.—Feb. 9–17 and June 7–11 pencil attachment not working and discharge estimated as follows: Feb. 9–12, 5.7 million gallons per day; Feb. 13–17, 3.1 million gallons per day; June 7–11, 3.8 million gallons per day.

*Monthly discharge of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| December | 7.8 | 3.8 | 5.75 | 8.90 | 178 | 547 |
| January | 13.2 | 2.8 | 5.10 | 7.89 | 158 | 485 |
| February | 13.2 | 3.0 | 5.03 | 7.78 | 141 | 432 |
| March | 19.5 | 2.4 | 6.80 | 10.5 | 211 | 647 |
| April | 15.6 | 2.4 | 5.98 | 9.25 | 180 | 551 |
| May | 15.6 | 3.0 | 5.57 | 8.62 | 173 | 530 |
| June | 10.5 | 3.6 | 5.06 | 7.83 | 152 | 466 |
| The period | | | | | 1,190 | 3,660 |

### LAHAINALUNA STREAM ABOVE PIPE-LINE INTAKE, NEAR LAHAINA, MAUI.

LOCATION.—200 feet above intake of pipe line supplying Lahaina and Lahainaluna School, 2½ miles northeast of Lahaina.

RECORDS AVAILABLE.—February 29, 1916, to June 30, 1919.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; fairly straight in vicinity of gage; filled with large boulders; banks steep and high. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.79 feet at 10.30 a. m. November 26 (discharge, approximately 314 million gallons per day, or 486 second-feet); minimum stage recorded, 1.04 feet June 14–20 and 24 (discharge, 2.8 million gallons per day, or 4.3 second-feet).

1916–1919: Maximum stage recorded, November 26, 1918; minimum stage recorded, 1.0 foot February 4–8 and June 6–11, 1918 (discharge, 2.5 million gallons per day, or 3.8 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Domestic supply, development of power, and irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed November 26. Rating curve applicable as follows: July 1 to November 25, fairly well defined below 15 million gallons per day; November 26 to June 30, well defined between 2 and 10 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records good.

*Discharge measurements of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 21 | A. H. Wong | 1.08 | 4.3 | 2.8 |
| Nov. 15 | .....do | 1.09 | 4.7 | 3.0 |
| Jan. 14 | .....do | 1.08 | 5.2 | 3.4 |
| Mar. 15 | J. E. Stewart | 1.10 | 5.7 | 3.7 |
| Apr. 15 | H. A. R. Austin | 1.075 | 4.4 | 2.8 |
| May 28 | A. H. Wong | 1.06 | 4.9 | 3.2 |

*Daily discharge, in million gallons, of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ..... | 3.5 | 4.0 | 3.0 | 24 | 7.3 | 3.9 | 5.6 | 4.8 | 3.3 | 3.1 | 3.0 |
| 2 | ..... | 3.4 | 3.2 | 3.0 | 4.7 | 10.4 | 3.7 | 6.1 | 4.0 | 3.3 | 3.1 | 2.9 |
| 3 | ..... | 4.4 | 3.2 | 3.7 | 3.4 | 66 | 3.7 | 5.6 | 6.7 | 3.3 | 3.1 | 2.9 |
| 4 | ..... | 3.1 | 3.1 | 3.9 | 17.0 | 8.5 | 3.7 | 3.7 | 3.4 | 3.3 | 3.0 | 2.9 |
| 5 | ..... | 4.8 | 3.1 | 3.1 | 4.8 | 41 | 3.7 | 3.7 | 9.6 | 3.3 | 3.0 | 2.9 |
| 6 | ..... | 3.9 | 3.1 | 7.2 | 3.6 | 102 | 3.7 | 3.7 | 26 | 3.3 | 3.3 | 2.9 |
| 7 | 3.0 | 3.2 | 3.1 | 3.1 | 3.1 | 26 | 3.7 | 3.5 | 12.4 | 3.3 | 4.4 | 2.9 |
| 8 | 3.8 | 5.5 | 3.7 | 3.0 | 3.0 | 16.4 | 3.7 | 3.5 | 11.9 | 3.3 | 10.0 | 3.1 |
| 9 | 4.7 | 3.2 | 3.1 | 2.9 | 3.0 | 5.6 | 3.7 | 5.1 | 30 | 3.3 | 9.6 | 3.0 |
| 10 | 59 | 8.1 | 3.1 | 2.9 | 3.1 | 15.0 | 3.7 | 4.4 | 23 | 3.3 | 5.6 | 3.1 |
| 11 | 4.0 | 3.3 | 3.1 | 3.1 | 73 | 12.4 | 3.7 | 7.8 | 7.0 | 3.3 | 3.5 | 3.4 |
| 12 | 4.8 | 3.9 | 3.1 | 3.2 | 47 | 4.8 | 3.7 | 11.9 | 7.8 | 3.5 | 3.4 | 2.9 |
| 13 | 8.6 | 9.0 | 3.1 | 3.6 | 5.8 | 4.4 | 3.9 | 4.2 | 4.6 | 3.3 | 3.3 | 2.9 |
| 14 | 8.3 | 4.7 | 3.1 | 3.0 | 3.2 | 4.2 | 3.4 | 4.0 | 4.0 | 3.3 | 3.1 | 2.8 |
| 15 | 5.2 | 0.5 | 3.0 | 3.0 | 3.1 | 10.0 | 3.4 | 4.9 | 3.7 | 3.3 | 3.1 | 4.2 |
| 16 | 3.8 | 77 | 3.0 | 2.9 | 3.0 | 9.6 | 3.4 | 3.5 | 3.5 | 3.5 | 3.0 | 3.0 |
| 17 | 3.1 | 62 | 3.1 | 2.9 | 2.9 | 8.5 | 3.4 | 3.3 | 4.0 | 4.0 | 7.5 | 2.9 |
| 18 | 2.9 | 14.6 | 4.7 | 2.9 | 3.1 | 5.9 | 3.4 | 3.3 | 3.7 | 3.7 | 7.5 | 3.5 |
| 19 | 4.0 | 5.3 | 7.5 | 4.0 | 2.9 | 6.1 | 3.4 | 3.3 | 4.2 | 3.5 | 3.3 | 2.9 |
| 20 | 7.8 | 43 | 3.1 | 11.7 | 2.9 | 4.8 | 3.4 | 20 | 4.0 | 8.5 | 3.1 | 2.8 |
| 21 | 16.2 | 5.6 | 3.1 | 3.1 | 2.9 | 5.6 | 3.3 | 5.6 | 3.5 | 5.1 | 4.9 | 2.8 |
| 22 | 5.5 | 3.7 | 3.1 | 3.0 | 2.8 | 5.6 | 4.6 | 7.3 | 4.2 | 8.9 | 3.4 | 2.8 |
| 23 | 9.0 | 3.4 | 6.4 | 2.9 | 2.8 | 5.9 | 15.5 | 5.3 | 3.5 | 13.7 | 8.9 | 2.8 |
| 24 | 10.4 | 4.8 | 3.3 | 2.9 | 2.8 | 9.6 | 14.6 | 8.1 | 3.4 | 10.4 | 3.4 | 2.8 |
| 25 | 59 | 3.7 | 3.1 | 2.9 | 2.9 | 4.6 | 9.2 | 4.2 | 3.4 | 6.4 | 3.3 | 2.9 |
| 26 | 4.1 | 3.3 | 3.1 | 4.1 | 25 | 4.0 | 5.1 | 3.5 | 3.4 | 11.9 | 3.1 | 3.3 |
| 27 | 4.8 | 3.3 | 3.1 | 3.0 | 13.7 | 4.4 | 18.7 | 5.3 | 3.4 | 4.0 | 3.1 | 5.9 |
| 28 | 19.4 | 3.6 | 4.7 | 2.9 | 4.2 | 4.0 | 19.2 | 3.3 | 3.4 | 3.3 | 3.1 | 7.0 |
| 29 | 7.8 | 3.9 | 3.1 | 4.8 | 3.7 | 3.9 | 8.9 | ..... | 3.4 | 3.3 | 3.0 | 5.1 |
| 30 | 3.3 | 3.4 | 3.0 | 17.0 | 3.4 | 4.0 | 4.0 | ..... | 3.3 | 3.1 | 3.0 | 3.0 |
| 31 | 3.2 | 5.2 | ..... | 4.2 | ..... | 4.2 | 16.9 | ..... | 3.3 | ..... | 3.0 | ..... |

NOTE.—July 1–6 no record; discharge estimated at 5.0 million gallons per day.

*Monthly discharge of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 59 | 2.9 | 9.54 | 14.8 | 296. | 908 |
| August | 77 | 3.1 | 10.0 | 15.5 | 311 | 951 |
| September | 7.5 | 3.0 | 3.52 | 5.45 | 106 | 324 |
| October | 17.0 | 2.9 | 4.09 | 6.33 | 127 | 389 |
| November | 73 | 2.8 | 9.36 | 14.5 | 281 | 862 |
| December | 102 | 3.9 | 13.7 | 21.2 | 425 | 1,300 |
| January | 19.2 | 3.3 | 6.20 | 9.59 | 192 | 590 |
| February | 20 | 3.3 | 5.49 | 8.49 | 154 | 472 |
| March | 30 | 3.3 | 6.98 | 10.8 | 216 | 664 |
| April | 13.7 | 3.1 | 4.77 | 7.38 | 143 | 439 |
| May | 10.0 | 3.0 | 4.23 | 6.54 | 131 | 402 |
| June | 7.0 | 2.8 | 3.31 | 5.12 | 99.3 | 305 |
| The year | 102 | 2.8 | 6.80 | 10.5 | 2,480 | 7,600 |

### OLOWALU DITCH NEAR OLOWALU, MAUI.

LOCATION.—425 feet above intake to penstock of hydroelectric power station, 1 mile above Olowalu, and 7 miles east of Lahaina.

RECORDS AVAILABLE.—July 28, 1916, to June 30, 1919. Replaces old station in tailrace from power house, for which records are available August 12, 1911, to June 30, 1916.

GAGE.—Stevens continuous water-stage recorder installed June 9, 1919, to replace staff gage installed July 28, 1916. Vertical staff read by power-house tender.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel about 3.5 feet wide cut in earth and rock; straight for 50 feet above and below gage. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 0.96 foot November 12, 27, and 28, and December 3 (discharge, 7.4 million gallons per day, or 11.4 second-feet); minimum stage recorded, 0.11 foot at 5.30 a. m. December 5 (discharge, 0.9 million gallons per day, or 1.4 second-feet).

1916–1919: Maximum stage recorded, 1.20 feet at 5.30 a. m. December 26, 1917 (discharge, 9 million gallons per day, or 14 second-feet); minimum stage recorded December 5, 1918.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—After passing through power house water is used for irrigation of sugar cane. A small amount is sometimes diverted for irrigation at higher levels and does not pass through power house.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to September 21 and March 15 to June 30 fairly well defined between 3 and 6 million gallons per day. Discharge September 22 to March 14 obtained by shifting-channel methods. Readings by observer considered unreliable at times. Operation of water-stage recorder unsatisfactory. Records fair.

*Discharge measurements of Olowalu ditch near Olowalu, Maui, during the year ending June, 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 21 | A. H. Wong | 0.58 | 4.9 | 3.2 |
| Nov. 15 | do | .60 | 6.5 | 4.2 |
| Jan. 11 | do | .60 | 5.8 | 3.8 |
| Mar. 15 | H. A. R. Austin | .85 | 8.6 | 5.6 |
| Apr. 28 | do | .79 | 7.8 | 5.0 |
| June 12 | J. E. Stewart | .51 | 4.6 | 2.9 |
| 16 | A. H. Wong | .515 | 3.6 | 2.4 |
| 16 | do | .52 | 4.3 | 2.8 |

*Daily discharge, in million gallons, of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.9 | 6.4 | 6.4 | 2.7 | 6.0 | 6.0 | 5.4 | 6.4 | 5.2 | 2.1 | 4.6 | 3.6 |
| 2 | 6.9 | 6.0 | 5.8 | 2.6 | 6.0 | 6.4 | 4.9 | 6.0 | 4.9 | 2.0 | 4.3 | 3.5 |
| 3 | 6.4 | 6.0 | 5.1 | 2.8 | 6.0 | 7.4 | 4.8 | 5.3 | 6.0 | 2.0 | 3.7 | 3.5 |
| 4 | 6.0 | 6.0 | 4.9 | 3.4 | 6.4 | 1.2 | 4.5 | 4.8 | 6.0 | 1.7 | 3.4 | 3.4 |
| 5 | 5.6 | 6.0 | 4.8 | 3.1 | 6.9 | 2.9 | 4.1 | 4.4 | 6.4 | 1.6 | 2.9 | 3.3 |
| 6 | 5.1 | 5.7 | 4.5 | 3.0 | 6.4 | 5.3 | 3.8 | 4.1 | 6.4 | 1.6 | 2.9 | 3.6 |
| 7 | 4.9 | 5.6 | 4.0 | 2.9 | 5.7 | 5.0 | 3.7 | 3.7 | 6.4 | 1.5 | 3.4 | 3.2 |
| 8 | 4.7 | 5.7 | 3.5 | 2.9 | 5.5 | 4.9 | 3.7 | 3.6 | 6.4 | 1.4 | 4.1 | 3.8 |
| 9 | 4.8 | 5.5 | 3.2 | 2.9 | 5.2 | 4.3 | 3.7 | 4.1 | 6.4 | 1.4 | 4.6 | 3.8 |
| 10 | 6.9 | 5.0 | 3.0 | 3.0 | 4.9 | 3.6 | 3.5 | 4.0 | 6.4 | 1.4 | 4.0 | 3.0 |
| 11 | 6.4 | 5.2 | 2.9 | 2.9 | 6.9 | 3.4 | 3.5 | 3.7 | 6.4 | 1.6 | 4.0 | 3.0 |
| 12 | 6.4 | 5.0 | 2.8 | 2.9 | 7.4 | 3.1 | 3.4 | 3.8 | 6.4 | 1.6 | 4.0 | 2.9 |
| 13 | 6.4 | 4.9 | 2.7 | 2.9 | 7.4 | 2.9 | 3.3 | 3.7 | 6.4 | 1.6 | 3.8 | 2.9 |
| 14 | 6.4 | 6.4 | 2.7 | 2.8 | 6.4 | 4.6 | 3.2 | 3.5 | 6.0 | 1.5 | 3.7 | 2.9 |
| 15 | 6.0 | 6.4 | 2.7 | 2.8 | 6.4 | 6.9 | 3.2 | 3.4 | 5.6 | 1.4 | 3.5 | 3.4 |
| 16 | 5.6 | 6.4 | 2.6 | 2.8 | 6.0 | 6.9 | 3.1 | 3.2 | 5.3 | 2.0 | 3.4 | 3.2 |
| 17 | 5.6 | 6.4 | 2.6 | 2.8 | 5.7 | 6.9 | 3.1 | 3.1 | 4.9 | 2.9 | 3.7 | ..... |
| 18 | 5.5 | 6.0 | 2.4 | 3.0 | 5.6 | 6.9 | 2.9 | 2.9 | 4.6 | 2.7 | 6.4 | ..... |
| 19 | 5.5 | 5.6 | 6.4 | 3.2 | 5.1 | 6.9 | 2.9 | 3.5 | 4.5 | 2.6 | 5.1 | ..... |
| 20 | 6.0 | 6.4 | 6.0 | 3.4 | 4.8 | 6.4 | 2.8 | 6.9 | 4.1 | 2.8 | 4.5 | ..... |
| 21 | 6.4 | 6.4 | 4.5 | 3.3 | 4.1 | 6.9 | 2.7 | 6.9 | 3.9 | 2.8 | 5.9 | ..... |
| 22 | 6.0 | 6.4 | 4.3 | 3.2 | 3.7 | 6.9 | 2.9 | 6.9 | 4.1 | 2.9 | 5.5 | ..... |
| 23 | 6.4 | 6.4 | 4.0 | 2.9 | 3.5 | 6.4 | 6.4 | 6.4 | 4.0 | 6.4 | 5.8 | ..... |
| 24 | 6.4 | 6.0 | 3.7 | 3.0 | 3.2 | 6.4 | 5.9 | 6.4 | 3.5 | 6.4 | 4.3 | ..... |
| 25 | 6.4 | 6.0 | 3.4 | 3.0 | 3.1 | 6.0 | 6.4 | 6.9 | 3.1 | 6.4 | 3.6 | ..... |
| 26 | 6.4 | 5.8 | 3.2 | 6.0 | 5.1 | 5.7 | 6.0 | 6.4 | 2.8 | 6.4 | 3.5 | ..... |
| 27 | 6.4 | 5.8 | 3.0 | 5.8 | 7.4 | 5.4 | 6.9 | 5.6 | 2.6 | 6.0 | 4.1 | ..... |
| 28 | 6.9 | 5.5 | 2.9 | 5.5 | 7.4 | 4.9 | 6.9 | 5.6 | 2.5 | 5.9 | 3.4 | ..... |
| 29 | 6.9 | 5.4 | 2.9 | 5.3 | 6.9 | 4.7 | 6.0 | ..... | 2.4 | 5.3 | 3.4 | ..... |
| 30 | 6.4 | 4.9 | 2.7 | 6.9 | 6.4 | 5.5 | 5.2 | ..... | 2.2 | 4.9 | 3.2 | ..... |
| 31 | 6.4 | 5.6 | ..... | 6.4 | ..... | 5.9 | 5.7 | ..... | 2.2 | ..... | 3.7 | ..... |

NOTE.—June 17–30 clock stopped, gage height steady and discharge estimated from mean gage height at 2.9 million gallons per day.

*Monthly discharge of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 6.9 | 4.7 | 6.10 | 9.44 | 189 | 580 |
| August | 6.4 | 4.9 | 5.83 | 9.02 | 181 | 555 |
| September | 6.4 | 2.4 | 3.79 | 5.86 | 114 | 349 |
| October | 6.9 | 2.6 | 3.55 | 5.49 | 110 | 338 |
| November | 7.4 | 3.1 | 5.72 | 8.85 | 172 | 527 |
| December | 7.4 | 1.2 | 5.37 | 8.31 | 167 | 511 |
| January | 6.9 | 2.7 | 4.34 | 6.71 | 134 | 413 |
| February | 6.9 | 2.9 | 4.83 | 7.47 | 135 | 415 |
| March | 6.4 | 2.2 | 4.77 | 7.38 | 148 | 454 |
| April | 6.4 | 1.4 | 3.03 | 4.69 | 90.8 | 279 |
| May | 6.4 | 2.9 | 4.08 | 6.31 | 126 | 388 |
| June | 3.8 | ..... | 3.12 | 4.83 | 93.6 | 287 |
| The year | 7.4 | 1.2 | 4.55 | 7.04 | 1,660 | 5,100 |

### UKUMEHAME STREAM NEAR OLOWALU, MAUI.

LOCATION.—Half a mile above intake of upper ditch, 2 miles above government road at 14-mile post, and 4 miles by road and trail east of Olowalu.

RECORDS AVAILABLE.—August 14, 1911, to June 30, 1919.

GAGE.—Gurley printing water-stage recorder installed February 20, 1916; replaced vertical staff installed April 23, 1913, 200 feet below present gage and washed out January 18, 1916.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 900 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below gage; right bank is steep and high; left bank slopes gradually; very rough stream bed composed of boulders and gravel; control somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.13 feet at 3.30 p. m. December 6 (discharge, 118 million gallons per day, or 183 second feet); minimum stage recorded, 0.91 foot, at 1.30 p. m. to 10 p. m. June 13, 1919 (discharge, 3.0 million gallons per day, or 4.6 second-feet.)

1911–1919: Maximum stage recorded, 9.0 feet estimated gage height of flood of January 18, 1916 (discharge not estimated); minimum stage recorded, 0.60 foot October 4 and 5, 1913 (discharge, 2.3 million gallons per day, or 3.6 second-feet).

DIVERSIONS.—None.

REGULATIONS.—None.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves as follows: March 12 to April 2, 1918, poorly defined; April 3, 1918, to May 13, 1919, fairly well defined below and poorly defined above 25 million gallons per day; May 23 to June 30, 1919, well defined below and fairly well defined above 25 million gallons per day. Operation of water-stage recorder satisfactory.

*Discharge measurements of Ukumehame Stream near Olowalu, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 10 | C. T. Bailey | 0.87 | 38 | 24.4 |
| Sept. 19 | A. H. Wong | .40 | 7.4 | 4.8 |
| Nov. 12 | do | .81 | 29 | 18.8 |
| Jan. 13 | do | .39 | 6.0 | 3.8 |
| Mar. 18 | H. A. R. Austin | .40 | 6.9 | 4.5 |
| Apr. 28 | do | .385 | 6.1 | 4.0 |
| June 10 | A. H. Wong | .975 | 5.4 | 3.5 |
| 10 | do | .985 | 5.5 | 3.6 |
| 12 | J. E. Stewart | .95 | 4.5 | 2.9 |

*Daily discharge, in million gallons, of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.3 | 8.7 | 5.4 | 3.8 | 4.2 | 5.0 | 3.6 | 7.0 | 4.2 | 4.0 | 3.8 | 3.4 |
| 2 | 7.0 | 8.0 | 5.0 | 3.8 | 4.0 | 8.3 | 3.6 | 6.3 | 4.4 | 4.0 | 3.8 | 3.4 |
| 3 | 6.6 | 7.6 | 4.7 | 3.8 | 3.8 | 38 | 3.6 | 6.3 | 4.4 | 4.0 | 3.6 | 3.4 |
| 4 | 6.0 | 6.6 | 4.7 | 3.8 | 8.0 | 19.0 | 3.6 | 5.7 | 4.2 | 4.0 | 3.4 | 3.3 |
| 5 | 5.7 | 6.3 | 4.4 | 3.8 | 6.6 | 35 | 3.6 | 5.0 | 5.0 | 4.0 | 3.4 | 3.2 |
| 6 | 5.0 | 6.0 | 4.4 | 4.2 | 4.4 | 67 | 3.6 | 4.7 | 4.7 | 4.0 | 3.4 | 3.2 |
| 7 | 5.0 | 5.7 | 4.2 | 3.8 | 4.0 | 39 | 3.8 | 4.7 | 6.3 | 4.0 | 3.6 | 3.2 |
| 8 | 5.4 | 5.7 | 4.4 | 3.8 | 3.8 | 28 | 3.8 | 4.7 | 5.0 | 4.0 | 3.6 | 3.4 |
| 9 | 5.7 | 5.4 | 4.2 | 3.8 | 3.8 | 15.7 | 3.8 | 5.0 | 8.0 | 4.0 | 3.6 | 3.3 |
| 10 | 22 | 5.0 | 4.2 | 3.8 | 3.8 | 12.4 | 4.0 | 4.7 | 11.6 | 3.8 | 3.6 | 3.3 |
| 11 | 10.1 | 5.4 | 4.2 | 3.8 | 7.3 | 10.1 | 4.0 | 4.4 | 7.6 | 4.0 | 3.6 | 3.3 |
| 12 | 7.6 | 5.4 | 4.0 | 3.8 | 15.2 | 8.0 | 4.0 | 4.4 | 6.3 | 4.0 | 3.4 | 3.2 |
| 13 | 8.3 | 7.3 | 4.4 | 3.6 | 7.6 | 7.0 | 4.2 | 4.4 | 5.7 | 3.8 | ..... | 3.1 |
| 14 | 7.3 | 7.0 | 4.2 | 3.6 | 5.4 | 7.6 | 4.2 | 4.2 | 6.0 | 3.8 | ..... | 3.1 |
| 15 | 6.6 | 6.6 | 4.0 | 3.6 | 4.4 | 12.0 | 4.2 | 4.4 | 5.0 | 3.8 | ..... | 3.6 |
| 16 | 6.3 | 37 | 4.0 | 3.6 | 4.0 | 8.3 | 4.2 | 4.0 | 4.7 | 4.7 | ..... | 3.3 |
| 17 | 5.7 | 26 | 4.0 | 3.6 | 4.0 | 7.6 | 4.2 | 4.0 | 5.7 | 4.7 | ..... | 3.4 |
| 18 | 5.7 | 13.6 | 4.2 | 3.6 | 4.0 | 6.6 | 4.2 | 3.8 | 4.4 | 4.2 | ..... | 3.4 |
| 19 | 5.7 | 9.8 | 4.4 | 3.6 | 3.8 | 5.7 | 4.2 | 3.8 | 4.4 | 4.0 | ..... | 3.3 |
| 20 | 5.7 | 12.0 | 4.2 | 3.6 | 3.8 | 5.4 | 4.2 | 9.8 | 4.4 | 4.0 | ..... | 3.4 |
| 21 | 8.3 | 12.0 | 4.0 | 3.6 | 3.8 | 7.3 | 4.2 | 6.6 | 4.4 | 4.0 | ..... | 3.2 |
| 22 | 6.3 | 9.0 | 4.0 | 3.6 | 3.8 | 5.7 | 5.0 | 7.3 | 5.7 | 5.4 | ..... | 3.2 |
| 23 | 9.0 | 7.6 | 4.0 | 3.6 | 3.8 | 6.0 | 6.0 | 6.0 | 4.4 | 6.6 | ..... | 3.1 |
| 24 | 10.5 | 7.0 | 4.0 | 3.6 | 3.8 | 4.7 | 5.4 | 6.3 | 4.2 | 4.7 | ..... | 3.1 |
| 25 | 18.6 | 6.3 | 4.0 | 3.6 | 3.8 | 4.2 | 6.0 | 6.3 | 4.2 | 7.0 | 3.8 | 3.2 |
| 26 | 12.4 | 6.0 | 4.0 | 4.2 | 19.0 | 4.0 | 4.7 | 5.4 | 4.2 | 5.4 | 3.6 | 3.4 |
| 27 | 9.4 | 5.7 | 4.0 | 3.6 | 14.8 | 3.8 | 8.3 | 4.7 | 4.2 | 4.4 | 4.0 | 3.4 |
| 28 | 32 | 6.3 | 4.0 | 3.6 | 10.1 | 3.8 | 7.0 | 4.4 | 4.2 | 4.2 | 3.5 | 3.4 |
| 29 | 28 | 6.3 | 4.0 | 4.4 | 7.6 | 3.6 | 5.4 | ..... | 4.0 | 3.8 | 3.4 | 3.7 |
| 30 | 13.6 | 5.4 | 4.0 | 8.3 | 6.0 | 4.0 | 5.0 | ..... | 4.0 | 3.8 | 3.4 | 3.4 |
| 31 | 10.1 | 5.7 | ..... | 4.0 | ..... | 4.0 | 7.6 | ..... | 4.0 | ..... | 3.4 | ..... |

NOTE.—May 13–24, no record. Concrete control being constructed; discharge estimated at 3.5 million gallons per day.

*Monthly discharge of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 32 | 5.0 | 9.77 | 15.1 | 303 | 929 |
| August | 37 | 5.0 | 8.79 | 13.6 | 272 | 836 |
| September | 5.4 | 4.0 | 4.24 | 6.56 | 127 | 390 |
| October | 8.3 | 3.6 | 3.90 | 6.03 | 121 | 311 |
| November | 19.0 | 3.8 | 6.08 | 9.41 | 182 | 560 |
| December | 67 | 3.6 | 12.8 | 19.8 | 397 | 1,220 |
| January | 8.3 | 3.6 | 4.62 | 7.15 | 143 | 440 |
| February | 9.8 | 3.8 | 5.30 | 8.20 | 148 | 455 |
| March | 11.6 | 4.0 | 5.14 | 7.95 | 160 | 489 |
| April | 7.0 | 3.8 | 4.34 | 6.71 | 130 | 400 |
| May | 4.0 | 3.4 | 3.55 | 5.49 | 110 | 338 |
| June | 3.7 | 3.1 | 3.31 | 5.12 | 99.3 | 305 |
| The year | 67 | 3.1 | 6.01 | 9.30 | 2,190 | 6,670 |

### KOOLAU DITCH NEAR KEANAE, MAUI.

LOCATION.—25 feet above portal of tunnel in west side of Keanae Valley, a quarter of a mile above ditchman's house, and 3 miles southwest of Keanae post office.

RECORDS AVAILABLE.—November 2, 1917, to June 30, 1919. Discharge January 1, 1910, to December 31, 1912, computed from gage heights obtained by East Maui Irrigation Co.

GAGE.—Friez water-stage recorder installed November 2, 1917. Record not used July 1, 1918, to June 30, 1919. East Maui Irrigation Co. has obtained staff gage readings at this location since about 1904.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Concrete-lined ditch; straight for 100 feet above gage; control not well defined but probably permanent as ditch enters long tunnel 25 feet below gage.

EXTREMES OF DISCHARGE.—1910–1912 and 1917–1919: Maximum stage recorded, 6.06 feet at 6 a. m. November 30, 1917 (discharge, 163 million gallons per day,[1] or 252 second-feet); minimum stage recorded, water occasionally shut off.

Maximum stage recorded during year, 5.56 feet at 4.30 p. m. July 28 (discharge, 145 million gallons per day, or 224 second-feet); minimum stage recorded, water occasionally shut off.

DIVERSIONS.—Ditch diverts water from all streams from Makapipi to Keanae, inclusive, but all available water was not taken part of the time on account of lining operations.

REGULATION.—By gates at intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation affected for short periods by trash gathering on rack below gage; also affected at times by opening of waste gates above gage. Rating curve well defined between 5 and 125 million gallons per day. Operation of water-stage recorder satisfactory, but water surface in well not the same as in ditch for most of year. Staff gage heights have been used throughout the year. Records fair.

*Discharge measurements of Koolau ditch near Keanae, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 24 | A. H. Wong | 1.99 | 51 | 33 |
| Jan. 17 | ....do | 1.54 | 33.5 | 21.7 |
| Mar. 12 | J. E. Stewart | 4.77 | 182 | 118 |
| Apr. 20 | H. A. R. Austin | 2.28 | 60 | 38.5 |
| June 29 | A. H. Wong | 1.50 | 29.5 | 19.1 |

[1] Supersedes figures published in Water-Supply Paper 485.

*Daily discharge, in million gallons, of Koolau ditch near Keanae, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32 | 102 | 33 | 22 | 86 | 42 | 54 | 76 | 39 | 51 | 112 | 26 |
| 2 | 51 | 79 | 29 | 22 | 99 | 72 | 48 | 79 | 39 | 48 | 63 | .25 |
| 3 | 57 | 79 | 27 | 21 | 79 | 96 | 42 | 57 | 42 | 45 | 51 | 24 |
| 4 | 32 | 60 | 25 | 21 | 93 | 102 | 48 | 45 | 32 | 42 | 51 | 24 |
| 5 | 42 | 69 | 29 | 19 | 86 | 119 | 39 | 39 | 76 | 39 | 86 | 23 |
| 6 | 21 | 63 | 36 | 21 | 89 | 119 | 39 | 32 | 126 | 36 | 112 | 22 |
| 7 | 24 | 66 | 34 | 19 | 54 | 93 | 32 | 29 | 116 | 36 | 69 | 21 |
| 8 | 66 | 76 | 42 | 18 | 39 | 99 | 29 | 27 | 119 | 33 | 69 | 21 |
| 9 | 42 | 48 | 33 | 17 | 36 | 93 | 28 | 72 | 112 | 33 | 116 | 20 |
| 10 | 105 | 45 | 32 | 21 | 33 | 89 | 27 | 72 | 126 | 30 | 72 | 22 |
| 11 | 48 | 45 | 29 | 19 | 122 | 99 | 27 | 54 | 119 | 30 | 57 | 21 |
| 12 | 33 | 60 | 27 | 30 | 119 | 93 | 24 | 99 | 122 | 32 | 51 | 18 |
| 13 | 30 | 72 | 24 | 32 | 109 | 66 | 24 | 54 | 105 | 27 | 48 | 18 |
| 14 | 25 | 76 | 21 | 21 | 83 | 60 | 22 | 45 | 93 | 27 | 45 | 17 |
| 15 | 45 | 57 | 20 | 19 | 57 | 96 | 21 | 34 | 76 | 26 | 42 | 23 |
| 16 | 48 | 119 | 22 | 17 | 45 | 86 | 21 | 29 | 105 | 66 | 36 | 18 |
| 17 | 39 | 105 | 21 | 17 | 36 | 105 | 20 | 26 | 119 | 89 | 42 | 19 |
| 18 | 42 | 109 | 29 | 17 | 30 | 93 | 19 | 24 | 72 | 32 | 109 | 21 |
| 19 | 39 | 89 | 60 | 21 | 28 | 99 | 19 | 22 | 66 | 36 | 54 | 19 |
| 20 | 60 | 119 | 17 | 57 | 28 | 99 | 18 | 112 | 63 | 48 | 45 | 19 |
| 21 | 96 | 105 | 12.6 | 23 | 29 | 102 | 17 | 42 | 51 | 76 | 54 | 18 |
| 22 | 76 | 86 | 11.0 | 21 | 26 | 93 | 19 | 48 | 86 | 126 | 42 | 16 |
| 23 | 99 | 72 | 42 | 18 | 25 | 89 | 69 | 51 | 122 | 126 | 60 | 15 |
| 24 | 93 | [a] 58 | 30 | 17 | 23 | 93 | 86 | 33 | 105 | 112 | 45 | 16 |
| 25 | 102 | 45 | 36 | 18 | 22 | 79 | 72 | 45 | 83 | 109 | 39 | 16 |
| 26 | 86 | 48 | 25 | 93 | 21 | 54 | 34 | 30 | 69 | 99 | 33 | 15 |
| 27 | 99 | 57 | 24 | 86 | 32 | 63 | 112 | 34 | 60 | 89 | 34 | 20 |
| 28 | 116 | 93 | 23 | 32 | 42 | 51 | 102 | 39 | 48 | 66 | 32 | 26 |
| 29 | 96 | 93 | 19 | 48 | 109 | 45 | 112 | ..... | 45 | 54 | 30 | 19 |
| 30 | 72 | 63 | 28 | 109 | 45 | 54 | 63 | ..... | 48 | 48 | 28 | 17 |
| 31 | 93 | 39 | ..... | 68 | ..... | 93 | 79 | ..... | 54 | ..... | 27 | ..... |

[a] Interpolated.

*Monthly discharge of Koolau ditch near Keanae, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 116 | 21.0 | 61.6 | 95.3 | 1,910 | 5,860 |
| August | 119 | 39.0 | 74.1 | 115 | 2,300 | 7,050 |
| September | 60 | 11.0 | 28.0 | 43.3 | 841 | 2,580 |
| October | 109 | 17.0 | 31.5 | 48.7 | 976 | 3,000 |
| November | 122 | 21.0 | 57.5 | 89.0 | 1,720 | 5,290 |
| December | 119 | 42.0 | 85.0 | 132 | 2,640 | 8,090 |
| January | 112 | 17.0 | 44.1 | 68.2 | 1,370 | 4,200 |
| February | 112 | 22.0 | 48.2 | 74.6 | 1,350 | 4,140 |
| March | 126 | 32.0 | 81.9 | 127 | 2,540 | 7,790 |
| April | 126 | 26.0 | 57.0 | 88.2 | 1,710 | 5,250 |
| May | 116 | 27.0 | 56.6 | 87.6 | 1,750 | 5,380 |
| June | 26 | 15.0 | 20.0 | 30.9 | 599 | 1,840 |
| The year | 126 | 11 | 54.0 | 83.6 | 19,700 | 60,500 |

22031—23—WSP 515——6

### HONOMANU STREAM NEAR KEANAE, MAUI.

LOCATION.—500 feet above intake of Spreckels ditch and trail bridge, 6 miles south of Keanae post office.

RECORDS AVAILABLE.—November 15, 1913, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and below gage; stream bed filled with large boulders and very rough; right bank vertical wall of rock; left bank steep and high. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.62 feet at 4 p. m. December 6 (discharge, 1,420 million gallons per day, or 2,200 second-feet); minimum stage recorded, 1.78 feet at 7 p. m. June 25 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

1913–1919: Maximum stage recorded, 9.9 feet at 9 p. m. May 1, 1916 (discharge, 1,500 million gallons per day, or 2,320 second-feet [1]); minimum stage recorded, June 25, 1919.

DIVERSIONS.—None.

REGULATION.—None

UTILIZATION.—Ordinary flow is diverted by Spreckels ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 5 and 200 million gallons per day; poorly defined below 5 and above 200 million gallons per day. Operation of water-stage recorder unsatisfactory. Records fair except for October and June for which they are poor.

*Discharge measurements of Honomanu Stream near Keanae, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 23 | A. H. Wong | 2.88 | 20.4 | 13.2 |
| Nov. 17 | do | 2.38 | 3.9 | 2.5 |
| Jan. 17 | do | 2.14 | 2.6 | 1.7 |
| Mar. 18 | J. E. Stewart | 3.34 | 41 | 26.5 |
| Apr. 19 | H. A. R. Austin | 2.24 | 4.6 | 2.9 |
| May 27 | A. H. Wong | 2.14 | 2.7 | 1.75 |
| June 29 | do | 2.08 | 2.2 | 1.4 |

[1] Revised data.

*Daily discharge, in million gallons, of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 37 | ..... | 18.2 | ..... | 3.7 | 6.0 | 8.3 | ..... | 3.0 | 27 | 2.0 |
| 2 | 47 | ..... | 9.2 | ..... | 98 | 4.0 | 4.4 | ..... | 2.8 | 4.0 | 1.0 |
| 3 | 77 | ..... | 5.5 | 10.1 | 499 | 5.0 | 2.9 | ..... | 2.6 | 2.8 | .8 |
| 4 | 21 | 5.8 | 5.0 | 33 | 62 | 10.6 | 2.2 | ..... | 2.4 | 2.7 | .7 |
| 5 | 26 | 7.8 | 4.3 | 11.7 | 198 | 4.2 | 1.6 | ..... | 1.9 | 39 | .7 |
| 6 | 8.0 | 8.0 | 3.8 | 6.6 | 580 | 3.5 | 1.5 | ..... | 1.8 | 19.5 | .7 |
| 7 | 15.5 | 6.5 | 3.8 | 4.1 | 146 | 2.6 | 1.4 | ..... | 1.5 | 4.0 | .5 |
| 8 | 22 | 10.7 | 4.9 | 3.5 | 100 | 2.2 | 1.3 | ..... | 1.5 | 3.6 | .5 |
| 9 | 38 | 5.4 | 4.1 | 3.1 | 22 | 1.9 | 50 | ..... | 1.4 | 10.5 | .5 |
| 10 | 273 | 4.6 | 4.1 | 3.1 | 29 | 1.9 | 6.9 | ..... | 1.2 | 4.0 | .5 |
| 11 | 21 | 5.2 | 4.0 | 127 | 36 | 1.8 | 3.1 | ..... | 1.2 | 4.1 | .5 |
| 12 | 11.5 | ..... | 4.0 | 249 | 12.9 | 1.8 | 5.9 | 23 | 1.2 | 2.6 | .4 |
| 13 | 16.7 | ..... | 4.2 | 60 | 8.6 | 1.7 | 5.8 | 7.6 | 1.3 | 2.4 | .4 |
| 14 | 16.4 | ..... | 4.2 | 10.2 | 34 | 1.7 | 5.6 | 5.4 | 1.2 | 2.5 | .4 |
| 15 | 16.9 | ..... | 4.2 | 5.3 | 36 | 1.7 | 6.0 | 4.8 | 1.1 | 2.2 | .5 |
| 16 | 7.8 | ..... | 4.1 | 4.0 | 21 | 1.6 | 6.3 | 8.7 | 9.2 | 1.8 | .4 |
| 17 | 6.2 | ..... | 4.4 | 3.6 | 28 | 1.6 | 6.6 | 14.2 | 12.5 | 30 | 1.6 |
| 18 | 5.4 | ..... | 4.9 | 3.4 | 20 | 1.8 | 3.7 | 5.0 | 5.5 | 44 | 4.0 |
| 19 | 4.7 | ..... | 35 | 3.0 | 22 | 1.7 | 9.3 | 4.1 | 3.4 | 3.8 | 1.4 |
| 20 | 12.5 | ..... | 4.0 | 2.7 | 14.5 | 1.5 | 26 | 3.9 | 6.5 | 2.6 | .6 |
| 21 | ..... | ..... | 2.6 | 2.6 | 38 | 1.3 | 3.5 | 3.8 | 9.5 | 3.5 | .4 |
| 22 | ..... | ..... | 2.3 | 2.8 | 11.3 | 1.4 | ..... | 102 | 36 | 2.6 | .4 |
| 23 | ..... | ..... | ..... | 2.2 | 11.2 | 15.3 | ..... | 41 | 23 | 3.7 | .3 |
| 24 | ..... | ..... | ..... | 2.0 | 11.8 | 22 | ..... | 16.1 | 12.0 | 2.8 | .3 |
| 25 | ..... | 5.5 | ..... | 1.9 | 8.6 | 8.5 | ..... | 6.2 | 8.9 | 2.4 | .2 |
| 26 | ..... | 5.4 | ..... | 2.2 | 5.8 | 2.6 | ..... | 5.0 | 8.0 | 2.1 | .2 |
| 27 | ..... | 5.5 | ..... | 2.7 | 5.0 | 17.1 | ..... | 4.1 | 5.6 | 1.7 | 1.0 |
| 28 | ..... | 27 | ..... | 10.7 | 3.7 | 24 | ..... | 3.6 | 3.5 | 1.8 | 2.2 |
| 29 | ..... | 15.9 | ..... | 21 | 3.1 | 18.0 | ..... | 3.5 | 2.8 | 1.8 | 1.9 |
| 30 | ..... | 7.8 | ..... | 4.5 | 23 | 5.9 | ..... | 3.2 | 18.4 | 1.2 | 1.2 |
| 31 | ..... | 16.3 | ..... | ..... | 13.5 | 30 | ..... | 3.2 | ..... | 2.6 | ..... |

NOTE.—No record July 21 to Aug. 3, Aug. 12-24, Sept. 23 to Nov. 2, Jan. 11-16, Feb. 21 to Mar. 3, and Mar. 3-11. Discharge has been estimated in million gallons per day as follows: July 21-25, 100; July 26-31, 50; Aug. 1-3, 15; Aug. 12-15, 40; Aug. 16-20, 150; Aug. 21-24, 10; Sept. 23 to Oct. 31, 3; Nov. 1-2, 30; Feb. 22-25, 5; Feb. 26-28, 3; Mar. 1-4, 3; and Mar. 5-11, 60. Discharge interpolated Jan. 11-15.

*Monthly discharge of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 273 | 4.7 | 47.9 | 74.1 | 1,480 | 4,560 |
| August | ..... | 4.6 | 36.5 | 56.5 | 1,130 | 3,470 |
| September | 35 | 2.3 | 5.49 | 8.49 | 165 | 505 |
| October | ..... | ..... | 3.00 | 4.64 | 93 | 285 |
| November | 249 | 1.9 | 21.8 | 33.7 | 656 | 2,010 |
| December | 580 | 3.1 | 67.9 | 105 | 2,110 | 6,460 |
| January | 30 | 1.3 | 6.61 | 10.2 | 205 | 629 |
| February | 50 | 1.3 | 6.83 | 10.6 | 191 | 587 |
| March | 102 | ..... | 22.6 | 35.0 | 700 | 2,150 |
| April | 36 | 1.1 | 6.36 | 9.84 | 191 | 586 |
| May | 44 | 1.2 | 7.72 | 11.9 | 239 | 734 |
| June | 4.0 | .2 | .87 | 1.35 | 26.2 | 80 |
| The year | 580 | .2 | 19.7 | 30.5 | 7,190 | 22,100 |

### HAIPUAENA STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above inflow of Spreckels ditch, 7 miles by trail east of Huelo.

RECORDS AVAILABLE.—October 19, 1913, to June 30, 1919; also records of combined flow of stream and Spreckels ditch at staff-gage station 600 feet below present site December 18, 1910, to September 30, 1913.

GAGE.—Stevens continuous water-stage recorder installed June 16, 1914, to replace original Friez recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and below gage; right bank high with steep slope; left bank nearly vertical. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.94 feet at noon December 3, 1918 (discharge, 428 million gallons per day, or 662 second-feet); minimum stage recorded, 0.33 foot at midnight June 25 (discharge, 1.0 million gallons per day, or 1.6 second-feet).

1913–1919: Maximum stage recorded, 5.92 feet at 3.15 a. m. April 3, 1918 (discharge, computed from extension of rating curve, 430 million gallons per day, or 666 second-feet); minimum stage recorded, 0.1 foot October 26, 1917 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 2 and 200 million gallons per day. Operation of water-stage recorder satisfactory, except gage-height record as given in footnote to table of daily discharge. Records fair when water-stage recorder was operating; poor at other times.

*Discharge measurements of Haipuaena Stream near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 24 | A. H. Wong | 0.64 | 5.4 | 3.5 |
| Nov. 18 | do | .68 | 5.2 | 3.4 |
| Jan. 17 | do | .50 | 2.4 | 1.6 |
| Mar. 11 | J. E. Stewart | 1.36 | 27.5 | 17.8 |
| Apr. 19 | H. A. R. Austin | .62 | 3.3 | 2.1 |
| May 27 | A. H. Wong | .59 | 3.4 | 2.2 |
| June 27 | do | .64 | 4.6 | 3.0 |

*Daily discharge, in million gallons, of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 21 | 16.3 | 7.8 | 2.4 | 13.9 | 3.1 | 5.0 | 7.5 | 3.1 | 2.8 | 14.6 | 3.0 |
| 2 | 26 | 8.0 | 4.1 | 2.2 | 18,2 | 35 | 3.7 | 5.8 | 3.4 | 2.7 | 3.9 | 2.1 |
| 3 | 39 | 8.0 | 3.3 | 2.0 | 6.7 | 145 | 3.7 | 4.7 | 3.5 | 2.6 | 3.2 | 1.8 |
| 4 | 13.6 | 5.6 | 2.9 | 2.0 | 19.0 | 18.2 | 9.5 | 3.9 | 2.7 | 2.6 | 3.1 | 1.7 |
| 5 | 15.0 | 6.2 | 2.7 | 1.9 | 13.9 | 56 | 4.1 | 3.2 | 13.5 | 2.5 | 24 | 1.6 |
| 6 | 7.1 | 7.3 | ..... | 2.0 | 7.5 | 161 | 3.5 | 2.8 | 30. | 2.4 | 10.4 | 1.6 |
| 7 | 9.2 | 5.9 | ..... | 1.8 | 4.7 | 48 | 3.1 | 2.6 | 19.4 | 2.3 | 4.2 | 1.6 |
| 8 | 11.7 | 7.3 | ..... | 1.6 | 3.9 | 44 | 2.7 | 2.5 | 9.0 | 2.2 | 4.0 | 1.7 |
| 9 | 21 | 5.0 | ..... | 1.6 | 3.5 | 10.8 | 2.6 | 33 | 37 | 2.2 | 9.2 | 1.9 |
| 10 | 104 | 4.3 | ..... | 1.8 | 3.3 | 15.7 | 2.5 | 6.2 | 58 | 2.5 | 4.5 | 2.2 |
| 11 | 10.5 | 4.8 | ..... | 1.6 | 37 | 22 | 2.4 | 4.1 | 18.2 | 2.8 | 3.9 | 1.4 |
| 12 | 7.5 | 9.0 | ..... | 2.7 | 98 | 8.2 | 2.3 | 6.1 | 15.7 | 2.4 | 3.0 | 1.3 |
| 13 | 11.5 | 30 | ..... | 4.1 | 33 | 6.2 | 2.2 | 5.2 | 7.3 | 2.4 | 2.7 | 1.3 |
| 14 | 11.3 | 13.0 | ..... | 2.2 | ..... | 21 | 2.1 | 4.0 | 5.6 | 2.4 | 2.4 | 1.3 |
| 15 | 11.3 | 6.0 | ..... | 1.9 | ..... | 25 | 2.0 | 3.4 | 4.8 | 1.7 | 2.2 | 1.6 |
| 16 | 6.9 | 104 | ..... | 1.6 | ..... | 11.0 | 1.9 | 2.9 | 7.5 | 6.5 | 2.0 | 1.6 |
| 17 | 5.3 | 45 | ..... | 1.5 | ..... | 17.5 | 1.8 | 2.6 | 12.7 | 9.4 | 11.8 | 1.8 |
| 18 | 4.2 | 28 | 2.9 | 1.4 | 3.3 | 10.2 | 1.8 | 2.4 | 5.8 | 3.3 | 24 | 3.0 |
| 19 | 3.7 | 12.0 | 14.2 | 1.6 | 3.2 | 13.2 | 1.8 | 2.2 | 5.0 | 3.3 | 3.7 | 2.4 |
| 20 | 5.3 | 38 | 2.6 | 4.7 | 3.0 | 9.0 | 1.8 | 12.9 | 5.0 | 4.2 | 3.1 | 1.6 |
| 21 | 13.9 | 12.7 | 1.9 | 2.1 | 2.7 | 21 | 1.8 | 4.6 | 4.3 | 6.5 | 4.3 | 1.4 |
| 22 | 9.0 | 7.1 | 1.9 | 1.9 | 2.5 | 8.6 | 1.9 | 5.6 | 62 | 24 | 3.2 | 1.3 |
| 23 | 55 | 5.4 | 4.6 | 1.7 | 2.4 | 7.3 | 10.5 | 4.6 | 26 | 18.6 | 3.7 | 1.4 |
| 24 | 24 | 4.7 | 3.1 | 1.6 | 2.2 | 7.5 | 14.2 | 5.0 | 10.4 | 13.6 | 3.3 | 1.1 |
| 25 | 61 | 4.0 | 3.1 | 1.5 | 2.2 | 6.6 | 7.8 | 5.8 | 5.2 | 11.5 | 2.8 | 1.1 |
| 26 | 11.4 | 3.6 | 2.5 | 14.8 | 2.2 | 5.0 | 3.3 | 3.6 | 4.1 | 10.4 | 2.4 | 1.1 |
| 27 | 13.7 | 3.2 | 2.3 | 5.5 | 2.5 | 4.7 | 12.5 | 3.0 | 3.3 | 10.3 | 2.5 | 2.6 |
| 28 | 44 | 18.8 | 2.1 | 3.0 | 7.3 | 4.0 | 15.6 | 2.5 | 3.0 | 4.1 | 2.3 | 3.3 |
| 29 | 20 | 7.3 | 6.1 | 2.8 | 13.7 | 3.5 | 13.3 | ..... | 3.0 | 3.2 | 2.0 | 2.4 |
| 30 | 8.2 | 4.5 | 4.0 | 19.2 | 4.0 | 6.4 | 6.1 | ..... | 2.9 | 8.1 | 1.8 | 1.6 |
| 31 | 16.2 | 7.1 | ..... | 4.4 | ..... | 15.1 | 20 | ..... | 2.9 | ..... | 2.8 | ..... |

NOTE.—Discharge estimated by comparison with the record on Puohakamoa Stream as follows: Sept 6–17, 2.5 million gallons per day; Nov. 14–17, 7.5 million gallons per day. Discharge interpolated Jan. 9–16 and Mar. 28 to Apr. 8.

*Monthly discharge of Haipuaena Stream near Huelo, Maui; for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 104 | 3.7 | 20.0 | 30.9 | 622 | 1,900 |
| August | 104 | 3.2 | 14.3 | 22.1 | 442 | 1,360 |
| September | 14.2 | ..... | 3.40 | 5.26 | 102 | 313 |
| October | 19.2 | 1.4 | 3.26 | 5.04 | 101 | 310 |
| November | 98 | 2.2 | 11.5 | 17.8 | 344 | 1,060 |
| December | 161 | 3.1 | 24.8 | 38.4 | 770 | 2,360 |
| January | 20 | 1.8 | 5.40 | 8.36 | 168 | 514 |
| February | 33 | 2.2 | 5.45 | 8.43 | 153 | 468 |
| March | 62 | 2.7 | 12.7 | 19.6 | 394 | 1,210 |
| April | 24 | 1.7 | 5.78 | 8.94 | 174 | 532 |
| May | 24 | 1.8 | 5.52 | 8.54 | 171 | 525 |
| June | 3.3 | 1.1 | 1.79 | 2.77 | 53.8 | 165 |
| The year | 161 | 1.1 | 9.57 | 14.8 | 3,500 | 10,700 |

### PUOHAKAMOA STREAM NEAR HUELO, MAUI.

LOCATION.—150 feet above inflow of Spreckels ditch and trail crossing, 7 miles east of Huelo.

RECORDS AVAILABLE.—June 13, 1913, to June 30, 1919 (new station); December 18, 1910, to June 18, 1913 (old station).

GAGE.—Stevens continuous water-stage recorder installed November 23, 1917, replacing Barrett & Lawrence water-stage recorder installed June 13, 1913. Old staff-gage station was 150 feet downstream at trail bridge below inflow from Spreckels ditch.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 200 feet below gage. Inflow of Spreckels ditch must be deducted from measurements made at footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; banks steep and high; stream bed is very rough and steep. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.79 feet at 11.15 a. m. December 3 (discharge, 822 million gallons per day, or 1,270 second-feet); minimum stage recorded, 0.67 foot at 6 p. m. June 25 (discharge, 1.1 million gallons per day, or 1.7 second-feet).

1910–1919: Maximum stage recorded, 7.63 feet at 7 p. m. April 2, 1918 (discharge, computed from extension of rating curve, 900 million gallons per day, or 1,400 second-feet); minimum stage recorded, 0.25 foot October 26, 1917 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

DIVERSIONS.—Kula pipe line diverts small amount of water above station at elevation 4,300 feet.

REGULATION.—None.

UTILIZATION.—Ordinary flow of stream is diverted by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 1 and 50 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

*Discharge measurements of Puohakamoa Stream near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 24 | A. H. Wong | 1.48 | 9.7 | 6.3 |
| Nov. 18 | do | 1.58 | 10.6 | 6.8 |
| Jan. 17 | do | 1.15 | 5.0 | 3.2 |
| Mar. 11 | J. E. Stewart | 2.91 | 74 | 48 |
| Apr. 18 | H. A. R. Austin | 1.26 | 7.2 | 4.7 |
| 19 | do | 1.40 | 8.2 | 5.3 |
| June 26 | A. H. Wong | .73 | 2.5 | 1.6 |

*Daily discharge, in million gallons, of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 46 | 35 | 18.5 | 4.1 | 31 | 6.2 | 9.3 | 17.1 | 6.8 | 5.1 | 32 | 7.1 |
| 2 | 73 | 21 | 11.8 | 3.5 | 35 | 74 | 8.2 | 13.0 | 6.4 | 4.4 | 8.2 | 3.6 |
| 3 | 93 | 20 | 8.8 | 3.1 | 13.8 | 269 | 15.3 | 11.0 | 6.2 | 4.0 | 6.2 | 2.9 |
| 4 | 32 | 14.4 | 7.7 | 3.4 | 56 | 31 | 14.6 | 7.7 | 5.3 | 3.7 | 6.2 | 2.7 |
| 5 | 34 | 15.0 | 6.7 | 3.0 | 26 | 83 | 8.2 | 6.7 | 28 | 3.4 | 48 | 2.5 |
| 6 | 15.4 | 18.4 | 6.2 | 3.4 | 15.0 | 306 | ..... | 5.8 | 76 | 3.1 | 20 | 2.3 |
| 7 | 18.7 | 14.4 | 5.8 | 3.5 | 8.8 | 100 | ..... | 5.1 | 52 | 3.1 | 6.2 | 2.0 |
| 8 | 26 | 17.4 | 7.4 | 2.6 | 7.2 | 91 | ..... | 4.9 | 21 | 2.8 | 8.5 | 1.9 |
| 9 | 51 | 11.0 | 5.2 | 2.3 | 6.7 | 24 | ..... | 73 | 80 | 2.9 | 22 | 1.8 |
| 10 | 247 | 9.8 | 5.2 | 2.8 | 6.2 | 44 | ..... | 11.8 | 139 | 2.6 | 8.2 | 2.2 |
| 11 | 28 | 11.0 | 4.6 | 2.6 | 103 | 46 | ..... | 8.9 | 41 | 2.6 | 7.8 | 2.2 |
| 12 | 19.5 | 21 | 4.4 | 5.2 | 195 | 19.5 | ..... | 13.3 | 34 | 3.3 | 6.2 | 1.8 |
| 13 | 29 | 70 | 4.4 | 6.9 | 58 | 14.4 | ..... | 11.0 | 15.4 | 2.6 | 5.2 | 1.6 |
| 14 | 28 | 34 | 4.2 | 3.6 | 16.7 | 55 | ..... | 8.2 | 11.6 | 2.2 | 5.0 | 1.7 |
| 15 | 28 | 15.4 | 3.7 | 2.8 | 11.6 | 53 | ..... | 6.7 | 10.4 | 2.3 | 4.3 | 2.4 |
| 16 | 16.7 | 251 | 3.9 | 2.3 | 9.3 | 30 | ..... | 6.2 | 15.1 | 11.6 | 3.7 | 1.9 |
| 17 | 12.4 | 111 | 3.9 | 2.0 | 8.2 | 33 | ..... | 5.1 | 25 | 16.6 | 18.8 | 3.4 |
| 18 | 11.0 | 66 | 6.4 | 2.0 | 7.2 | 26 | 3.2 | 4.7 | 10.4 | 5.0 | 47 | 5.2 |
| 19 | 10.4 | 26 | 31 | 2.4 | 6.2 | 31 | 3.1 | 4.0 | 9.3 | 5.6 | 8.2 | 4.8 |
| 20 | 15.5 | 94 | 6.4 | 8.7 | 5.8 | 22 | 3.1 | 28 | 8.8 | 7.6 | 6.1 | 2.4 |
| 21 | 36 | 35 | 4.2 | 3.0 | 5.2 | 42 | 3.6 | 10.8 | 7.7 | 12.0 | 8.4 | 1.7 |
| 22 | 23 | 19.5 | 3.7 | 2.9 | 4.7 | 19.3 | 4.2 | 12.8 | 153 | 50 | 5.8 | 1.4 |
| 23 | 141 | 15.4 | 9.5 | 2.5 | 4.4 | 17.3 | 20 | 10.0 | 57 | 37 | 6.7 | 1.2 |
| 24 | 59 | 13.3 | 6.2 | 2.0 | 3.9 | 18.2 | 29 | 10.0 | 21 | 27 | 5.8 | 1.3 |
| 25 | 140 | 11.0 | 6.7 | 2.2 | 3.6 | 13.3 | 16.5 | 13.3 | 12.4 | 22 | 4.8 | 1.2 |
| 26 | 31 | 9.8 | 4.6 | 29 | 4.5 | 11.0 | 8.2 | 7.2 | 10.4 | 16.7 | 4.2 | 1.3 |
| 27 | 38 | 8.8 | 3.9 | 10.5 | 4.8 | 10.4 | 27 | 6.2 | 8.8 | 11.0 | 4.4 | 3.9 |
| 28 | 112 | 46 | 3.5 | 5.7 | 13.8 | 8.8 | 32 | 5.8 | 7.2 | 8.2 | 4.0 | 5.5 |
| 29 | 54 | 18.6 | 8.4 | 6.0 | 26 | 7.7 | 31 | ..... | 6.7 | 6.7 | 3.6 | 3.9 |
| 30 | 22 | 11.0 | 7.3 | 35 | 7.6 | 30 | 14.2 | ..... | 5.8 | 9.2 | 3.2 | 2.4 |
| 31 | 38 | 22 | ..... | 9.2 | ..... | 17.6 | 40 | ..... | 5.3 | ..... | 6.2 | ..... |

NOTE.—Jan. 6–17 no record, clock run down, discharge estimated at 4.9 million gallons per day.

*Monthly discharge of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 247 | 10.4 | 49.3 | 76.3 | 1,530 | 4,690 |
| August | 251 | 8.8 | 35.0 | 54.2 | 1,090 | 3,330 |
| September | 31 | 3.5 | 7.14 | 11.0 | 214 | 657 |
| October | 35 | 2.0 | 5.75 | 8.90 | 178 | 547 |
| November | 195 | 3.6 | 23.5 | 36.4 | 705 | 2,160 |
| December | 306 | 6.2 | 50.1 | 77.5 | 1,550 | 4,770 |
| January | 40 | 3.1 | 11.3 | 17.5 | 350 | 1,080 |
| February | 73 | 4.0 | 11.7 | 18.1 | 328 | 1,010 |
| March | 153 | 5.3 | 28.9 | 44.7 | 897 | 2,750 |
| April | 50 | 2.2 | 9.81 | 15.2 | 294 | 903 |
| May | 48 | 3.2 | 10.8 | 16.7 | 335 | 1,030 |
| June | 7.1 | 1.2 | 2.67 | 4.13 | 80.2 | 246 |
| The year | 306 | 1.2 | 20.7 | 32.0 | 7,550 | 23,200 |

### ALO STREAM NEAR HUELO, MAUI.

LOCATION.—300 feet above inflow of Spreckels ditch and trail crossing, 5 miles east of Huelo.

RECORDS AVAILABLE.—December 18, 1910, to June 30, 1919.

GAGE.—Friez water-stage recorder installed June 18, 1914. Prior to June 18, 1914, vertical staff at trail bridge 300 feet downstream from present site.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage is a fairly large pool at foot of rapids; banks steep and high. Control at outlet of pool composed of rock ledge and large boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.45 feet at 1.30 p. m. August 28 (discharge, approximately 350 million gallons per day, or 542 second-feet); minimum stage recorded, 0.41 foot at 5 p. m. June 14 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1910–1919: Maximum stage recorded, 4.35 feet at 7 p. m. December 9, 1916 (discharge, computed from extension of rating curve, approximately 550 million gallons per day, or 850 second-feet); minimum stage recorded, 1.34 feet (old datum) November 4, 1911 (discharge, 0.06 million gallons per day, or 0.1 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 60 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records good between 2 and 60 million gallons per day: fair above and below these limits.

*Discharge measurements of Alo Stream near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 24 | A. H. Wong | 0.52 | 1.2 | 0.8 |
| Nov. 18 | do | .62 | 1.9 | 1.2 |
| Jan. 19 | do | .47 | .7 | .45 |
| Mar. 10 | H. A. R. Austin | 1.04 | 10.4 | 6.7 |
| Apr. 18 | do | .53 | 1.55 | 1.0 |
| June 25 | A. H. Wong | .41 | .5 | .35 |

*Daily discharge, in million gallons, of Alo Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.6 | 8.6 | 3.7 | 1.2 | 5.0 | 2.0 | 1.8 | 2.8 | 2.6 | 1.0 | 4.6 | 0.8 |
| 2 | 16.0 | 4.2 | 3.1 | .9 | 3.2 | 18.5 | 1.4 | 4.5 | 2.6 | .9 | 1.8 | .8 |
| 3 | 6.5 | 4.0 | 3.1 | .9 | 2.5 | 94 | 1.8 | 3.1 | 3.4 | .9 | 1.6 | .8 |
| 4 | 4.5 | 3.2 | 3.0 | .9 | 16.1 | 4.4 | 2.5 | 2.0 | 2.0 | .8 | 1.7 | .8 |
| 5 | 5.0 | 2.8 | 2.6 | .9 | 5.3 | 6.7 | 1.3 | 1.7 | 3.2 | .8 | 14.4 | .7 |
| 6 | 3.1 | 3.8 | 2.4 | 1.1 | 4.9 | 43 | 1.3 | 1.5 | 18.8 | .8 | 3.4 | .7 |
| 7 | 3.3 | 3.3 | 2.4 | .6 | 2.3 | 18.3 | 1.0 | 1.4 | 9.0 | .8 | 2.3 | .6 |
| 8 | 5.0 | 2.6 | 3.1 | .6 | 2.2 | 10.0 | .9 | 1.1 | 6.8 | .8 | 2.7 | .6 |
| 9 | 26 | 2.2 | 2.3 | .6 | 1.8 | 4.3 | .8 | 22 | 8.6 | .8 | 6.5 | .6 |
| 10 | 72 | 2.1 | 2.1 | .8 | 1.8 | 19.0 | .8 | 2.4 | 15.6 | .7 | 2.3 | .8 |
| 11 | 6.8 | 2.6 | 2.1 | .6 | 22 | 10.1 | .8 | 2.3 | 7.5 | .8 | 2.0 | .8 |
| 12 | 5.1 | 5.5 | 1.8 | .9 | 8.8 | 4.1 | .8 | 3.7 | 6.8 | .9 | 2.0 | .6 |
| 13 | 9.8 | 9.8 | 1.7 | .9 | 5.8 | 3.2 | .8 | 2.1 | 4.3 | .8 | 1.8 | .6 |
| 14 | 8.1 | 4.4 | 1.8 | .6 | 3.5 | 15.8 | .8 | 2.1 | 3.6 | .7 | 1.6 | .5 |
| 15 | 7.9 | 3.3 | 1.8 | .6 | 2.4 | 7.8 | .8 | 1.8 | 2.6 | .8 | 1.4 | .9 |
| 16 | 5.6 | 57 | 2.0 | .5 | 2.0 | 4.5 | .8 | 1.5 | 5.1 | 6.2 | 1.1 | .5 |
| 17 | 3.9 | 22 | 1.7 | .5 | 1.7 | 4.3 | .7 | 1.3 | 8.8 | 4.4 | 2.5 | .6 |
| 18 | 3.5 | 10.0 | 2.5 | .4 | 1.6 | 3.4 | .8 | 1.2 | 3.2 | 1.0 | 10.8 | 1.0 |
| 19 | 3.1 | 8.8 | 4.3 | .6 | 1.5 | 4.6 | .8 | 1.1 | 2.8 | .9 | 2.0 | .7 |
| 20 | 5.8 | 16.1 | 1.8 | 4.2 | 1.3 | 6.9 | .8 | 15.3 | 2.5 | 1.5 | 2.1 | .6 |
| 21 | 7.8 | 7.7 | 1.8 | 1.0 | 1.2 | 10.4 | .8 | 3.7 | 2.1 | 1.7 | 3.0 | .6 |
| 22 | 4.4 | 5.2 | 1.8 | 1.0 | 1.0 | 5.3 | .9 | 6.4 | 44 | 9.0 | 1.8 | .4 |
| 23 | 27 | 4.1 | 2.0 | .6 | 1.1 | 4.3 | 1.6 | 3.8 | 10.6 | 7.8 | 1.8 | .5 |
| 24 | 7.6 | 3.9 | .9 | .6 | 1.1 | 4.3 | 3.4 | 5.0 | 3.7 | 10.0 | 1.3 | .7 |
| 25 | 16.0 | 3.6 | 2.2 | .7 | 1.0 | 3.7 | 2.6 | 3.4 | 2.8 | 5.6 | 1.1 | .7 |
| 26 | 7.6 | 3.4 | 1.0 | 2.0 | 1.5 | 3.3 | 1.9 | 2.3 | 2.4 | 4.7 | 1.1 | .7 |
| 27 | 12.0 | 2.9 | .8 | 23 | 1.4 | 2.8 | 3.0 | 2.3 | 1.9 | 3.0 | .9 | 2.2 |
| 28 | 21 | 25 | .6 | 1.0 | 4.6 | 2.0 | 5.1 | 2.2 | 1.7 | 2.7 | .9 | 2.3 |
| 29 | 19.2 | 5.7 | 2.3 | 1.2 | 12.1 | 1.9 | 3.3 | ..... | 1.3 | 2.0 | .8 | 1.4 |
| 30 | 5.0 | 3.6 | 2.5 | 8.2 | 1.7 | 2.6 | 1.7 | ..... | 1.1 | 1.9 | .8 | .8 |
| 31 | 7.0 | 4.6 | ..... | 2.3 | ..... | 2.6 | 3.9 | ..... | 1.0 | ..... | 1.0 | ..... |

NOTE.—Water-stage recorder not working properly and discharge partly estimated on the following dates: July 10, 24, 26; Aug. 20; Oct. 12; Nov. 11, 12; Dec. 3, 5, 7, 15; Jan. 3; June 24 and 27.

*Monthly discharge of Alo Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 72 | 3.1 | 10.8 | 16.7 | 336 | 1,030 |
| August | 57 | 2.1 | 7.94 | 12.3 | 246 | 755 |
| September | 4.3 | .6 | 2.17 | 3.36 | 65.2 | 200 |
| October | 23 | .4 | 1.93 | 2.99 | 59.9 | 184 |
| November | 22 | 1.0 | 4.08 | 6.31 | 122 | 376 |
| December | 94 | 1.9 | 10.6 | 16.4 | 328 | 1,010 |
| January | 5.1 | .7 | 1.60 | 2.48 | 49.7 | 152 |
| February | 22 | 1.1 | 3.71 | 5.74 | 104 | 319 |
| March | 44 | 1.0 | 6.21 | 9.61 | 192 | 591 |
| April | 10.0 | .7 | 2.49 | 3.85 | 74.7 | 229 |
| May | 14.4 | .8 | 2.68 | 4.15 | 83.1 | 255 |
| June | 2.3 | .4 | .81 | 1.25 | 24.3 | 75 |
| The year | 94 | .4 | 4.62 | 7.15 | 1,680 | 5,180 |

**EAST BRANCH OF WAIKAMOI STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.**

LOCATION.—200 feet above Haiku-uka boundary-line trail at elevation 3,020 feet, 5½ miles by trail east of Kailiili.

RECORDS AVAILABLE.—May 29, 1918, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from suspension footbridge or by wading.

CHANNEL AND CONTROL.—One channel at all stages, straight for 30 feet above and 50 feet below station, composed of gravel and boulders, and with steep clean banks. Control, large boulders and gravel; subject to shift during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 6.51 feet at 11.20 a. m. December 3 (discharge, 117 million gallons per day, or 181 second-feet); minimum stage recorded, 3.77 feet at 2.30 p. m. April 15 (discharge, 0.07 million gallons per day, or 0.11 second-foot).

DIVERSIONS.—A little water is diverted above by Kula pipe line.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined between 1 and 10 million gallons per day applicable June 1 to December 2, 1918. Rating curve fairly well defined between 1 and 5 million gallons per day applicable December 3, 1918, to June 30, 1919. Operation of water-stage recorder satisfactory. Records fair.

*Discharge measurements of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the period May 29, 1918, to June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| 1918. | | | | |
| May 29 | H. A. R. Austin | 4.25 | 2.9 | 1.9 |
| Sept. 26 | A. H. Wong | 3.98 | .9 | .6 |
| Nov. 21 | do | 3.98 | .95 | .6 |
| 1919. | | | | |
| Jan. 21 | do | 3.87 | .45 | .3 |
| Mar. 14 | H. A. R. Austin | 4.05 | 2.3 | 1.5 |
| Apr. 25 | do | 4.18 | 3.0 | 1.95 |
| May 25 | do | 3.92 | .9 | .6 |

*Daily discharge, in million gallons, of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the period June 1, 1918, to June 30, 1919.*

| Day. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.4 | ..... | 3.0 | 2.2 | 0.6 | 5.2 | 0.8 | 1.4 | 2.3 | 0.8 | 0.7 | 3.9 | 1.0 |
| 2 | 2.3 | ..... | 1.8 | 1.2 | .6 | 5.2 | 12.1 | 1.2 | 1.5 | .8 | .6 | 1.1 | .6 |
| 3 | 1.9 | ..... | 1.8 | .9 | .6 | 1.9 | 37 | 2.1 | 1.3 | .8 | .6 | .9 | .5 |
| 4 | 1.7 | ..... | 1.3 | .8 | .6 | 5.2 | 4.5 | 3.8 | 1.1 | .7 | .6 | 1.0 | .5 |
| 5 | 1.5 | ..... | 1.4 | .8 | .5 | 2.2 | 14.7 | 1.4 | 1.0 | 5.7 | .6 | 9.0 | .5 |
| 6 | 1.4 | ..... | 1.7 | .7 | .6 | 1.2 | 44 | 1.4 | .9 | 10.4 | .6 | 2.3 | .4 |
| 7 | 1.4 | ..... | 1.4 | .7 | .5 | 1.0 | 13.4 | 1.0 | .8 | 6.2 | .6 | 1.1 | .4 |
| 8 | 1.4 | ..... | 1.9 | .7 | .5 | 1.1 | 11.5 | .9 | .8 | 1.9 | .6 | 1.1 | .4 |
| 9 | 1.5 | ..... | 1.2 | .6 | .5 | ..... | 2.6 | .9 | 9.5 | 12.7 | .6 | 3.3 | .4 |
| 10 | 3.1 | ..... | 1.1 | .6 | 5 | ..... | 4.8 | .9 | 1.6 | 17.7 | .5 | 1.1 | .4 |
| 11 | 4.7 | ..... | 1.2 | .6 | .5 | ..... | 4.9 | .8 | 1.2 | 6.0 | .6 | 1.1 | .4 |
| 12 | 7.3 | 1.5 | 1.9 | .6 | 1.0 | ..... | 2.0 | .8 | 2.0 | 3.9 | .6 | .9 | .4 |
| 13 | 2.2 | 2.0 | 9.8 | .6 | 1.3 | ..... | 1.6 | .7 | 1.5 | 1.7 | .6 | .8 | .4 |
| 14 | 1.8 | 1.9 | 3.1 | .5 | .6 | ..... | 6.0 | .7 | 1.1 | 1.4 | .5 | .8 | .4 |
| 15 | 14.1 | 2.3 | 1.4 | .5 | .5 | ..... | 6.1 | .8 | 1.0 | 1.2 | .5 | .6 | .4 |
| 16 | 6.6 | 1.4 | 34 | .5 | .4 | 1.1 | 4.5 | .7 | .9 | 2.0 | 2.5 | .6 | .4 |
| 17 | 5.6 | 1.2 | 11.2 | .6 | .4 | 1.1 | 4.5 | .6 | .8 | 2.0 | 2.8 | 5.7 | 1.2 |
| 18 | 2.2 | 1.2 | 7.1 | 1.4 | .4 | .9 | 4.6 | .6 | .8 | 1.1 | 1.1 | 6.8 | 1.5 |
| 19 | 1.8 | 1.1 | 2.7 | 5.4 | .4 | .8 | 4.3 | .6 | .7 | 1.0 | 1.0 | 1.0 | .9 |
| 20 | 1.5 | 1.7 | 11.6 | .8 | .6 | .8 | 2.3 | .5 | 3.5 | 1.2 | 1.7 | .8 | .6 |
| 21 | 2.1 | 4.5 | 2.7 | .6 | .4 | .7 | 5.2 | .5 | 1.3 | 1.0 | 2.8 | 1.0 | .5 |
| 22 | 2.7 | 2.7 | 1.6 | .6 | .5 | .6 | 2.0 | 1.0 | 1.7 | 15.5 | 8.6 | .8 | .4 |
| 23 | 2.2 | 17.3 | 1.4 | 1.8 | .5 | .6 | 2.4 | 4.5 | 1.4 | 7.4 | 3.2 | 1.2 | .4 |
| 24 | 1.9 | 5.3 | 1.2 | .9 | .4 | .6 | 2.5 | 5.6 | 1.4 | 2.0 | 2.8 | .8 | .4 |
| 25 | 1.9 | 19.4 | 1.2 | .8 | 1.1 | .6 | 1.9 | 2.6 | 1.7 | 1.8 | 2.0 | .7 | .4 |
| 26 | 2.0 | 2.4 | 1.0 | .7 | 5.8 | .7 | 1.5 | 1.4 | .9 | 1.1 | 1.9 | .6 | .4 |
| 27 | 1.7 | 1.9 | .9 | .6 | 1.3 | .9 | 1.5 | 4.9 | .9 | .9 | 1.5 | .7 | .7 |
| 28 | 1.9 | 11.7 | 3.0 | .6 | .8 | 2.1 | 1.2 | 5.5 | .8 | .8 | 1.0 | .6 | 1.1 |
| 29 | ..... | 3.4 | 1.6 | 1.1 | 1.6 | 2.2 | 1.1 | 5.4 | ..... | .7 | .8 | .6 | .6 |
| 30 | ..... | 1.6 | 1.1 | .9 | 4.8 | .9 | 4.6 | 2.1 | ..... | .6 | 3.6 | .5 | .5 |
| 31 | ..... | 4.5 | 1.5 | ..... | 1.5 | ..... | 3.2 | 6.2 | ..... | .7 | ..... | 1.9 | ..... |

NOTE.—Discharge estimated from adjacent streams in million gallons per day, as follows: June 29–30, 1918, 2.0; July 1–11, 5.0; Nov. 9–15, 2.0.

*Monthly discharge of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the period June 1, 1918, to June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| 1918. | | | | | | |
| June | 14.1 | 1.4 | 2.89 | 4.47 | 86.8 | 266 |
| 1918-19. | | | | | | |
| July | 19.4 | 1.1 | 4.65 | 7.19 | 144 | 442 |
| August | 34 | .9 | 3.80 | 5.88 | 118 | 362 |
| September | 5.4 | .5 | .98 | 1.52 | 29.3 | 90 |
| October | 5.8 | .4 | .98 | 1.52 | 30.3 | 93 |
| November | 5.2 | .6 | 1.72 | 2.66 | 51.6 | 158 |
| December | 44 | .8 | 6.88 | 10.6 | 213 | 655 |
| January | 6.2 | .5 | 1.98 | 3.06 | 61.5 | 188 |
| February | 9.5 | .7 | 1.59 | 2.46 | 44.4 | 137 |
| March | 17.7 | .6 | 3.60 | 5.57 | 112 | 342 |
| April | 8.6 | .5 | 1.54 | 2.38 | 46.1 | 142 |
| May | 9.0 | .5 | 1.72 | 2.66 | 53.3 | 164 |
| June | 1.5 | .4 | .57 | .88 | 17.1 | 52 |
| The year | 44 | .4 | 2.52 | 3.90 | 921 | 2,820 |

**WEST BRANCH OF WAIKAMOI STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.**

LOCATION.—At Haiku-uka boundary-line trail crossing at elevation 3,000 feet, 5 miles by trail southeast of Kailiili.

RECORDS AVAILABLE.—May 29, 1918, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from suspension footbridge or by wading.

CHANNEL AND CONTROL.—One channel at all stages, straight for 60 feet above and 100 feet below gage; right bank steep, high, and composed of rock and hardpan; left bank low, sloping, and of solid rock. Control solid rock ledge, permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record 9.85 feet about noon December 6 (discharge, 2,020 million gallons per day, or 3,130 second-feet); minimum stage recorded, 3.52 feet at 8 p. m. October 2 (discharge, 0.45 million gallons per day, or 0.7 second-foot).

DIVERSIONS.—A little water diverted above by Kula pipe line.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 10 million gallons per day. Operation of water-stage recorder unsatisfactory. Records good when water-stage recorder was operating.

*Discharge measurements of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the period May 29, 1918, to June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| 1918. | | | | |
| May 29 | H. A. R. Austin | 3.98 | 15.0 | 9.5 |
| Sept. 26 | A. H. Wong | 3.60 | 1.45 | .95 |
| Nov. 21 | .....do | 3.57 | 1.05 | .65 |
| 1919 | | | | |
| Mar. 14 | J. E. Stewart | .645 | 4.7 | 3.0 |
| Apr. 25 | H. A. R. Austin | .80 | 9.2 | 5.9 |
| May 25 | .....do | .53 | 1.75 | 1.15 |

*Daily discharge, in million gallons, of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the period June 1, 1918, to June 30, 1919.*

| Day. | June. | July. | Aug. | Sept. | Oct. | Nov. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.3 | 15.8 | 10.0 | ..... | 1.0 | ..... | ..... | ..... | 13.3 | 2.3 |
| 2 | 5.0 | 21 | 5.1 | ..... | .3 | ..... | ..... | ..... | 6.6 | 1.7 |
| 3 | 3.0 | 40 | 5.1 | ..... | ..... | ..... | ..... | ..... | 2.3 | 1.4 |
| 4 | 2.0 | 9.2 | 2.9 | ..... | ..... | ..... | ..... | ..... | 1.4 | ..... |
| 5 | 1.6 | 12.3 | 2.6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 6 | 1.4 | 3.3 | 3.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 7 | 1.1 | 3.5 | 2.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 8 | 1.3 | 6.7 | 4.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 9 | 1.4 | 21 | 2.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 10 | 4.7 | 145 | 1.9 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 11 | 11.6 | 7.5 | 1.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 12 | 23 | 4.6 | 3.1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 13 | 6.2 | 4.6 | 43 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 14 | 3.5 | 4.1 | 13.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 15 | 57 | 4.4 | 4.1 | ..... | ..... | ..... | 2.4 | ..... | ..... | ..... |
| 16 | 25 | 2.7 | 157 | 0.6 | ..... | ..... | ..... | ..... | ..... | ..... |
| 17 | 16.8 | 2.0 | 58 | .6 | ..... | ..... | ..... | ..... | ..... | ..... |
| 18 | 2.6 | 1.6 | 42 | 4.3 | ..... | ..... | ..... | ..... | ..... | ..... |
| 19 | 3.0 | 1.7 | 9.4 | 6.8 | ..... | ..... | ..... | ..... | ..... | ..... |
| 20 | 2.4 | 2.0 | 45 | 1.8 | ..... | ..... | ..... | ..... | ..... | ..... |
| 21 | 3.9 | 12.6 | 11.0 | .6 | ..... | ..... | ..... | ..... | ..... | ..... |
| 22 | 4.1 | 9.3 | ..... | .5 | ..... | 1.0 | ..... | ..... | ..... | ..... |
| 23 | 2.6 | 66 | ..... | 4.8 | ..... | 1.2 | ..... | ..... | ..... | ..... |
| 24 | 2.6 | 27 | ..... | 1.8 | ..... | ..... | ..... | ..... | ..... | ..... |
| 25 | 3.7 | 120 | ..... | 1.2 | ..... | ..... | ..... | 5.2 | ..... | ..... |
| 26 | 2.6 | 11.9 | ..... | .7 | ..... | ..... | ..... | 4.2 | 1.4 | ..... |
| 27 | 1.8 | 5.1 | ..... | .6 | ..... | ..... | ..... | 3.9 | 1.4 | ..... |
| 28 | 1.7 | 32 | ..... | .5 | ..... | ..... | ..... | 2.8 | 1.4 | ..... |
| 29 | 3.2 | 10.9 | ..... | 1.1 | ..... | ..... | ..... | 2.0 | 1.3 | ..... |
| 30 | 3.9 | 4.4 | ..... | 2.4 | ..... | ..... | ..... | 1.6 | 1.3 | ..... |
| 31 | ..... | 14.2 | ..... | ..... | ..... | ..... | ..... | ..... | 1.2 | ..... |

NOTE.—Clock stopped on all days for which discharge is not given.

*Monthly discharge of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the period June 1, 1918, to June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| 1918 | | | | | | |
| June | 57 | 1.1 | 6.90 | 10.7 | 207 | 635 |
| 1918–19. | | | | | | |
| July | 145 | 1.6 | 20.2 | 31.3 | 626 | 1,920 |
| August 1–21 | 157 | 1.5 | 20.4 | 31.6 | 428 | 1,310 |
| September 16–30 | 6.8 | .5 | 1.89 | 2.92 | 28.3 | 87 |
| April 25–30 | 5.2 | 1.6 | 3.28 | 5.07 | 19.7 | 60 |

### SPRECKELS DITCH BELOW KAAIEA GULCH, NEAR HUELO, MAUI.

LOCATION.—1,000 feet below intake in Kaaiea Stream and 2½ miles by trail southeast of ditch superintendent's house at Huelo.

RECORDS AVAILABLE.—December 15, 1917, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Ditch section below gage. During heavy rains stage-discharge relation is affected by two small streams which enter ditch a short distance below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.51 feet at 7.20 a. m. July 10 (discharge, 84 million gallons per day, or 130 second-feet); minimum stage recorded, 0.45 foot between November 23 and January 17 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

1917–1919: Maximum stage recorded 4.63 feet at 3 p. m. April 2, 1918 (discharge, 87 million gallons per day,[1] or 135 second-feet); minimum stage recorded, water occasionally shut off.

DIVERSIONS.—Ditch diverts water from a dozen or more streams east of Nailiilihaele.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 3 and 50 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records excellent when water-stage recorder was operating; fair at other times.

*Discharge measurements of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 3. | C. T. Bailey | 2.95 | 70 | 45.5 |
| Sept. 23. | A. H. Wong | 2.01 | 38.5 | 24.9 |
| Nov. 17. | do | 1.97 | 36.5 | 23.5 |
| Jan. 16. | do | 1.14 | 12.8 | 8.3 |
| 19. | do | 1.06 | 10.4 | 6.7 |
| Mar. 9. | J. E. Stewart | 1.96 | 35 | 22.5 |
| Apr. 18. | H. A. R. Austin | 1.42 | 20.6 | 13.3 |

*Daily discharge, in million gallons, of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 39 | 29 | 32 | 15.0 | 37 | ..... | 25 | 17.0 | 16.0 | 21 | 15.0 |
| 2 | 47 | 29 | 29 | 13.0 | 29 | ..... | 25 | 18.0 | 14.0 | 20 | 10.6 |
| 3 | 47 | 29 | 22 | 12.2 | 29 | ..... | 23 | 19.0 | 13.0 | 19 | 8.8 |
| 4 | 45 | 29 | 19.0 | 12.8 | 31 | ..... | 18.0 | 14.0 | 12.0 | 18.9 | 8.0 |
| 5 | 40 | 29 | 20 | 11.7 | 29 | ..... | 15.0 | 20 | 11.3 | 23 | 7.7 |
| 6 | 27 | 29 | 20 | 13.0 | ..... | ..... | 13.0 | 25 | 10.6 | 22 | 7.3 |
| 7 | 29 | 29 | 19.0 | 11.1 | ..... | ..... | 12.0 | 25 | 10.0 | 21 | 6.6 |
| 8 | 38 | 29 | 25 | 10.4 | ..... | ..... | 10.7 | 25 | 9.3 | 21 | 6.5 |
| 9 | 43 | 29 | 19.0 | 9.8 | ..... | ..... | 21 | 25 | 9.5 | 22 | 6.3 |
| 10 | 51 | 29 | 18.0 | 11.5 | ..... | ..... | 25 | 25 | 8.6 | 22 | 7.7 |
| 11 | 33 | 29 | 16.0 | 10.7 | ..... | ..... | 23 | 25 | 8.6 | 21 | 7.3 |
| 12 | 36 | 29 | 15.0 | 18.0 | ..... | ..... | 25 | 25 | 9.7 | 20 | 6.0 |
| 13 | 39 | 29 | 15.0 | 23 | ..... | ..... | 24 | 24 | 8.2 | 18.0 | 5.6 |
| 14 | 38 | 29 | 13.0 | 14.0 | ..... | ..... | 20 | 24 | 7.5 | 16.0 | 5.5 |
| 15 | 40 | 29 | 12.2 | 11.7 | ..... | ..... | 16.0 | 24 | 7.0 | 14.0 | 8.8 |
| 16 | 38 | 39 | 13.0 | 10.0 | ..... | ..... | 15.0 | 24 | 17.4 | 12.8 | 6.1 |
| 17 | 31 | 34 | 12.4 | 9.3 | 24 | 7.5 | 11.9 | 24 | 25 | 15.0 | 7.5 |
| 18 | 29 | 29 | 19.0 | 8.8 | 21 | 7.2 | 10.9 | 24 | 13.0 | 21 | 12.0 |
| 19 | 25 | 29 | 31 | 10.7 | 18.0 | 6.8 | 9.8 | 23 | 14.0 | 20 | 11.3 |
| 20 | 29 | 30 | 19.0 | 32 | 18.0 | 6.3 | 25 | 23 | 16.0 | 17.0 | 7.0 |
| 21 | 40 | 29 | 11.7 | 14.0 | 17.0 | 6.1 | 23 | 20 | 20 | 20 | 5.5 |
| 22 | 40 | 29 | 9.8 | 12.6 | 15.0 | 7.3 | 24 | 40 | 24 | 18.0 | 4.5 |
| 23 | 35 | 29 | 27 | 10.4 | 14.0 | 22 | 23 | 27 | 24 | 19.0 | 4.4 |
| 24 | 31 | 17.8 | 22 | 9.3 | ..... | 25 | 22 | 25 | 23 | 17.0 | 4.0 |
| 25 | 31 | 16.8 | 26 | 9.7 | ..... | 25 | 23 | 25 | 23 | 15.0 | 4.0 |
| 26 | 29 | 23 | 17.0 | 35 | ..... | 18.0 | 17.0 | 25 | 23 | 12.2 | 4.0 |
| 27 | 29 | 26 | 14.0 | 35 | ..... | 25 | 16.0 | 24 | 23 | 12.2 | 10.1 |
| 28 | 29 | 36 | 13.0 | 23 | ..... | 25 | 16.0 | 20 | 22 | 11.5 | 16.4 |
| 29 | 29 | 38 | 22 | 22 | ..... | 25 | ..... | 17.0 | 20 | 10.2 | 11.1 |
| 30 | 29 | 31 | 26 | 42 | ..... | 25 | ..... | 16.0 | 18.0 | 9.1 | 6.5 |
| 31 | 29 | 31 | ..... | 33 | ..... | 24 | ..... | 17.0 | ..... | 11.6 | ..... |

NOTE.—No record Nov. 6-16 and Nov. 24 to Jan. 16; discharge estimated in million gallons per day as follows: Nov. 6-10, 23; Nov. 11-16, 30; Nov. 24-30, 15; Dec. 1-31, 25; Jan. 1-5, 20; Jan. 6-10, 15; Jan 11-16, 10.

[1] Supersedes figure published in Water-Supply Paper 485. Revision on the basis of latest rating curve

*Monthly discharge of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 51 | 25 | 35.3 | 54.6 | 1,100 | 3,360 |
| August | 39 | 16.8 | 29.1 | 45.0 | 903 | 2,770 |
| September | 32 | 9.8 | 19.2 | 29.7 | 577 | 1,770 |
| October | 42 | 8.8 | 16.6 | 25.7 | 515 | 1,580 |
| November | ..... | ..... | 22.7 | 35.1 | 682 | 2,090 |
| December | ..... | ..... | 25.0 | 38.7 | 775 | 2,380 |
| January | 25 | ..... | 15.8 | 24.4 | 490 | 1,500 |
| February | 25 | 9.8 | 19.0 | 29.4 | 532 | 1,630 |
| March | 40 | 14.0 | 22.9 | 35.4 | 709 | 2,180 |
| April | 25 | 7.0 | 15.4 | 23.8 | 461 | 1,420 |
| May | 23 | 9.1 | 17.4 | 26.9 | 540 | 1,660 |
| June | 16.4 | 4.0 | 7.74 | 12.0 | 232 | 713 |
| The year | 51 | ..... | 20.6 | 31.9 | 7,510 | 23,100 |

### MANUEL LUIS DITCH AT PUOHAKAMOA GULCH, NEAR HUELO, MAUI.

LOCATION.—In Puohakamoa Gulch at lower portal of tunnel between Haipuaena and Puohakamoa streams, 6 miles east of Huelo.

RECORDS AVAILABLE.—December 15, 1917, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by rectangular sharp-crested weir 4.5 feet long set in concrete with full contractions.

CHANNEL AND CONTROL.—Weir basin 25 feet long, 8.3 feet wide, and 1.9 feet deep below crest of weir; made by enlarging tunnel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.43 feet 1 p. m. March 22 (discharge, 61 million gallons per day, or 94 second-feet); minimum stage recorded, 0.07 foot September 21 and June 25 (discharge, 0.3 million gallons per day, or 0.45 second-foot).

1917–1919: Maximum stage recorded, 3.96 feet April 2, 3, and 9, 1918 (discharge 77 million gallons per day, or 119 second-feet); minimum stage recorded, September 21, 1918, and June 25, 1919.

DIVERSIONS.—Ditch is an extension of Center ditch and picks up water not diverted by Spreckels ditch, which is at higher elevation.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Rating curve well defined between 1 and 70 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records excellent above and fair below 1 million gallons per day.

*Daily discharge, in million gallons, of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.6 | 18.4 | 6.0 | 0.6 | 6.2 | 1.2 | 0.6 | 1.3 | 0.9 | 0.7 | 9.4 | 0.6 |
| 2 | 7.6 | 5.6 | 2.6 | .5 | 7.8 | 13.0 | .7 | 1.5 | 1.1 | .7 | 1.1 | .5 |
| 3 | 9.6 | 7.4 | .8 | .5 | 2.2 | 31 | .7 | 1.2 | 1.3 | .7 | .9 | .5 |
| 4 | 2.6 | 1.9 | .7 | .5 | 12.0 | 6.9 | 1.6 | .7 | .9 | .6 | 1.3 | .5 |
| 5 | 3.8 | 3.1 | .6 | .4 | 6.2 | 20 | ..... | .5 | 2.7 | .5 | 13.0 | .5 |
| 6 | 1.3 | 5.7 | .6 | .6 | 3.7 | 29 | ..... | .5 | 13.2 | .5 | 5.9 | .4 |
| 7 | 3.5 | 3.5 | .5 | .4 | 1.1 | 20 | ..... | .5 | 13.6 | .5 | 1.7 | .4 |
| 8 | 3.7 | 4.2 | .5 | .4 | .9 | 16.8 | ..... | .5 | 9.4 | .5 | 1.6 | .3 |
| 9 | 7.9 | 1.2 | .5 | .3 | .9 | 4.5 | ..... | 11.7 | 16.5 | .5 | 6.9 | .3 |
| 10 | 36 | 1.2 | .5 | .3 | .8 | 10.1 | ..... | 1.6 | 28 | .5 | 1.4 | .4 |
| 11 | 5.6 | 1.6 | .4 | .3 | 17.7 | 8.7 | ..... | .9 | 10.8 | .5 | 1.1 | .4 |
| 12 | 2.3 | 9.7 | .4 | .3 | 30 | 2.2 | ..... | 4.6 | 10.8 | .4 | 1.1 | .3 |
| 13 | 4.0 | 15.7 | .4 | .3 | 15.0 | 1.5 | ..... | .9 | 8.1 | .5 | 1.0 | .3 |
| 14 | 4.0 | 15.8 | .4 | .3 | 5.2 | 11.5 | ..... | .9 | 3.2 | .4 | .9 | .3 |
| 15 | 5.2 | 3.1 | .3 | .3 | 1.3 | 8.9 | ..... | .7 | 2.2 | .4 | .9 | .4 |
| 16 | 2.0 | 38 | .3 | .3 | 1.2 | 3.7 | ..... | .7 | 5.5 | 3.6 | .8 | .4 |
| 17 | 1.1 | 33 | .3 | .3 | 1.0 | 5.7 | .4 | .6 | 8.7 | 4.3 | 3.1 | .3 |
| 18 | .9 | 27 | .4 | .3 | .9 | 1.7 | .4 | .6 | 2.0 | ..... | 12.6 | .6 |
| 19 | .9 | 15.8 | 4.6 | .2 | .9 | 4.4 | .4 | .6 | 1.6 | ..... | .9 | .4 |
| 20 | 2.8 | 31 | .4 | 1.7 | .9 | 5.2 | .3 | 8.1 | 1.5 | ..... | .9 | .3 |
| 21 | 12.3 | 22 | .3 | .3 | .8 | 8.7 | .3 | 1.6 | 1.3 | 2.1 | 1.6 | .3 |
| 22 | 4.6 | 12.2 | .3 | .4 | .7 | 2.5 | .3 | 2.7 | 28 | 12.3 | .9 | .3 |
| 23 | 22 | 5.6 | .5 | .3 | .7 | 1.9 | .4 | 1.7 | 14.0 | 11.4 | .9 | .3 |
| 24 | 25 | 3.1 | .6 | .3 | .6 | 2.8 | 2.8 | 1.7 | 6.8 | 8.1 | .9 | .3 |
| 25 | 30 | 1.6 | 1.6 | .2 | .6 | 1.3 | 2.1 | 2.3 | 2.9 | 5.6 | .7 | .3 |
| 26 | 15.5 | 1.2 | .6 | 4.2 | .6 | 1.0 | .5 | 1.1 | 2.0 | 5.6 | .6 | .3 |
| 27 | 18.6 | 1 | .5 | 2.8 | .6 | .8 | 4.0 | 1.0 | 1.6 | 3.0 | .7 | .5 |
| 28 | 32 | 13.6 | .5 | .4 | 1.9 | .7 | 5.7 | .9 | 1.4 | 1.5 | .6 | .7 |
| 29 | 25 | 12.6 | 1.3 | .4 | 8.8 | .6 | 6.4 | ..... | 1.2 | 1.1 | .6 | .6 |
| 30 | 8.3 | 3.5 | 1.6 | 9.8 | 1.5 | 4.7 | .8 | ..... | 1.0 | 1.3 | .6 | .5 |
| 31 | 16.9 | 5.0 | ..... | .9 | ..... | 1.8 | 5.9 | ..... | .9 | ..... | .6 | ..... |

NOTE.—Discharge estimated Jan. 5-16 at 0.5 million gallons per day and Apr. 18-20 at 1.4 million gallons per day.

*Monthly discharge of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 36 | 0.9 | 10.3 | 15.9 | 319 | 980 |
| August | 38 | 1.1 | 10.5 | 16.2 | 324 | 999 |
| September | 6.0 | .3 | .97 | 1.50 | 29.0 | 89 |
| October | 9.8 | .2 | .93 | 1.44 | 28.8 | 88 |
| November | 30 | .6 | 4.42 | 6.84 | 133 | 407 |
| December | 31 | .6 | 7.51 | 11.6 | 233 | 714 |
| January | 6.4 | .3 | 1.30 | 2.01 | 40.3 | 124 |
| February | 11.7 | .5 | 1.84 | 2.85 | 51.6 | 158 |
| March | 28 | .9 | 6.55 | 10.1 | 203 | 623 |
| April | 12.3 | .4 | 2.40 | 3.71 | 72.0 | 221 |
| May | 13.0 | .6 | 2.43 | 3.76 | 75.2 | 231 |
| June | .7 | .3 | .41 | .63 | 12.2 | 38 |
| The year | 38 | .2 | 4.17 | 6.45 | 1,520 | 4,670 |

### CENTER DITCH AT WAIKAMOI, NEAR HUELO, MAUI.

LOCATION.—250 feet below intake in Waikamoi Stream, 4 miles by trail east of Huelo.
RECORDS AVAILABLE.—March 6, 1918, to June 30, 1919.
GAGE.—Stevens continuous water-stage recorder.
DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sections of ditch trapezoidal; sides and bottom of hardpan and rock; straight for 30 feet above and 10 feet below gage. Control is plank set on edge in bottom of ditch 5 feet below gage.

EXTREMES OF DISCHARGE.—1918–1919: Maximum stage recorded, 3.25 feet at 11.20 p. m. April 22, 1919 (discharge, 74 million gallons per day, or 114 second-feet); minimum stage recorded, ditch dry December 4, 1918, and January, 16, 1919.

DIVERSIONS.—Ditch diverts water that arises below or passes Spreckels ditch.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder unsatisfactory. No record for blank periods in table of daily discharge. Records excellent when water-stage recorder was operating, except for December, for which they are fair.

*Discharge measurements of Center ditch at Waikamoi, near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 23 | A. H. Wong | 0.24 | 1.3 | 0.85 |
| Nov. 17 | do | .19 | .85 | .55 |
| Mar. 9 | J. E. Stewart | 1.64 | 39.5 | 26 |
| Apr. 17 | H. A. R. Austin | 2.135 | 62 | 40 |

*Daily discharge, in million gallons, of Center ditch at Waikamoi, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18.0 | 38 | 2.1 | 0.8 | 2.0 | 0.3 | ..... | 4.2 | 48 | 1.8 |
| 2 | 33 | 17.5 | 2.0 | .8 | 1.5 | .2 | ..... | 3.9 | 4.4 | 1.6 |
| 3 | 46 | 19.9 | 1.9 | .7 | 1.3 | .8 | ..... | 3.2 | 3.2 | 1.6 |
| 4 | ..... | 5.2 | 1.7 | 1.0 | 2.2 | .7 | ..... | 3.1 | 4.5 | 1.5 |
| 5 | ..... | 7.0 | 1.6 | .8 | 1.6 | .01 | ..... | 2.9 | 2.1 | 1.4 |
| 6 | ..... | 3.9 | 1.5 | .8 | 1.4 | .01 | ..... | 2.8 | 2.0 | 1.3 |
| 7 | ..... | 2.2 | 1.5 | .9 | 1.4 | .03 | ..... | 2.5 | 5.8 | 1.3 |
| 8 | ..... | 7.0 | 1.6 | .9 | 1.5 | .02 | ..... | 2.2 | 5.3 | 1.3 |
| 9 | ..... | 2.9 | 1.5 | 1.0 | 1.6 | .02 | ..... | 2.3 | 35 | 1.2 |
| 10 | ..... | 2.9 | 1.3 | 1.0 | 1.6 | .02 | 25 | 2.3 | 6.2 | 1.3 |
| 11 | ..... | 2.8 | 1.3 | 1.5 | 2.6 | .03 | 24 | 2.1 | 4.3 | 1.6 |
| 12 | ..... | 15.1 | 1.3 | 1.7 | 2.0 | .04 | 14.7 | 2.0 | 3.8 | 1.2 |
| 13 | ..... | 18.0 | 1.3 | 1.7 | 1.5 | .02 | 9.6 | 1.8 | 3.4 | 1.1 |
| 14 | ..... | 19.9 | 1.2 | 1.7 | .8 | .02 | 17.5 | 1.5 | 3.1 | ..... |
| 15 | ..... | 2.9 | 1.0 | 1.8 | .6 | .03 | 9.9 | 1.6 | 2.9 | ..... |
| 16 | ..... | 14.9 | 1.2 | 1.8 | .6 | .08 | 26 | 23 | 2.6 | ..... |
| 17 | ..... | 8.5 | 1.0 | 1.8 | .6 | .04 | 29 | 34 | 15.3 | ..... |
| 18 | ..... | 7.4 | 1.0 | 1.7 | .6 | .06 | 9.1 | 2.3 | 52 | 1.6 |
| 19 | ..... | 6.6 | 2.0 | 3.3 | .5 | .04 | 5.8 | 2.5 | 3.9 | 1.2 |
| 20 | ..... | 7.4 | 1.2 | 1.8 | .5 | .06 | 5.7 | 5.1 | 2.9 | 1.2 |
| 21 | ..... | 12.2 | 1.0 | 1.6 | .5 | .08 | 5.3 | 16.0 | 5.1 | 1.0 |
| 22 | ..... | 6.3 | 1.0 | 1.3 | .4 | .1 | 38 | 60 | 3.0 | .9 |
| 23 | ..... | 3.1 | 1.0 | 1.0 | .4 | .09 | 36 | 59 | 2.9 | .9 |
| 24 | ..... | 1.6 | 1.1 | .8 | .4 | .09 | 36 | 48 | 2.9 | .9 |
| 25 | ..... | 1.5 | .8 | 2.3 | .4 | .09 | 34 | 37 | 2.5 | .9 |
| 26 | ..... | 1.3 | .8 | 2.1 | .5 | .1 | 34 | 31 | 2.3 | .9 |
| 27 | ..... | 1.1 | 1.6 | 1.8 | .6 | .1 | 19.9 | 19.4 | 2.3 | 1.4 |
| 28 | ..... | 1.6 | 1.6 | .8 | .5 | .1 | 7.6 | 5.0 | 2.0 | 2.0 |
| 29 | 48 | 1.8 | 1.6 | 1.8 | .7 | .1 | 5.4 | 3.9 | 2.0 | 1.8 |
| 30 | 17.5 | 2.1 | .7 | 1.5 | .7 | .09 | 5.0 | 3.7 | 1.9 | 1.3 |
| 31 | 36.1 | 2.0 | ..... | 1.6 | ..... | .09 | 4.3 | ..... | 1.3 | ..... |

NOTE.—No record, July 4–23 and Dec. 31 to Mar. 9, discharge not estimated. Mar. 25 and 26 paper not feeding and graph estimated. No record June 14–17; discharge estimated at 1.2 million gallons per day.

*Monthly discharge of Center ditch at Waikamoi near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| August | 38 | 1.1 | 7.89 | 12.2 | 245 | 751 |
| September | 2.1 | .7 | 1.35 | 2.09 | 40.4 | 124 |
| October | 3.3 | .7 | 1.41 | 2.18 | 43.6 | 134 |
| November | 2.6 | .4 | 1.05 | 1.62 | 31.5 | 97 |
| April | 60 | 1.5 | 12.9 | 20.0 | 388 | 1,190 |
| May | 5.2 | 1.8 | 7.72 | 11.9 | 239 | 734 |
| June | 2.0 | .9 | 1.30 | 2.01 | 39.0 | 120 |

### KAILUA STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—100 feet above trail crossing at Haiku-uka boundary line and 1½ miles by horse trail southeast of Kailiili.

RECORDS AVAILABLE.—July 11, 1918, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—By wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 25 feet above and 50 feet below gage. Right bank low; left bank steep. Control is concrete slab 1.5 feet thick across stream 15 feet below gage. Permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 7.21 feet at 3.15 p. m. August 16 (discharge, 211 million gallons per day, or 326 second-feet); minimum stage recorded, 4.17 feet at 12:20 p. m. September 15 (discharge, 0.007 million gallons per day, or 0.01 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Water picked up by East Maui Irrigation Co.'s ditches for the irrigation of cane lands.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 1 million gallons per day. Operation of water-stage recorder unsatisfactory. Records good while water-stage recorder was operating; poor at other times.

*Discharge measurements of Kailua Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 26 | C. T. Bailey | 4.26 | 0.3 | 0.2 |
| Nov. 21 | A. H. Wong | 4.26 | .25 | .15 |
| Jan. 21 | do | 4.25 | .25 | .15 |
| Mar. 14 | J. E. Stewart | 4.33 | 1.85 | 1.2 |
| Apr. 25 | H. A. R. Austin | 4.34 | 2.3 | 1.5 |
| May 25 | do | 4.26 | .4 | .25 |

*Daily discharge, in million gallons, of Kailua Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ..... | 4.6 | 5.2 | 0.5 | ..... | ..... | 0.8 | 6.8 | 0.8 |
| 2 | ..... | 2.8 | 2.0 | .3 | ..... | ..... | .8 | 1.1 | .2 |
| 3 | ..... | 2.6 | .8 | .3 | ..... | ..... | .8 | .8 | .15 |
| 4 | ..... | 1.6 | .5 | .3 | ..... | ..... | .2 | .6 | .15 |
| 5 | ..... | 1.6 | .4 | .2 | ..... | ..... | .2 | 22 | .09 |
| 6 | ..... | 1.9 | .3 | .2 | ..... | ..... | .2 | 7.7 | .09 |
| 7 | ..... | 1.2 | .2 | .2 | ..... | ..... | .2 | 1.4 | .07 |
| 8 | ..... | 1.6 | .3 | .2 | ..... | ..... | .2 | .9 | .07 |
| 9 | ..... | 1.1 | .2 | .2 | ..... | ..... | .2 | 2.5 | .07 |
| 10 | ..... | .9 | .15 | .2 | ..... | ..... | .2 | 1.1 | .07 |
| 11 | ..... | .9 | .02 | .3 | ..... | ..... | .2 | 1.1 | .09 |
| 12 | 3.1 | 1.2 | .02 | .5 | ..... | ..... | .2 | .6 | .09 |
| 13 | 3.1 | 23 | .02 | .6 | ..... | 2.8 | .2 | .5 | .07 |
| 14 | 2.6 | 11.6 | .15 | ..... | ..... | 1.1 | .07 | .3 | .07 |
| 15 | 2.8 | 2.1 | .01 | ..... | ..... | .8 | .03 | .2 | .07 |
| 16 | 2.1 | 84 | .07 | ..... | ..... | .8 | .2 | .15 | .07 |
| 17 | 1.4 | 40 | .09 | ..... | ..... | .8 | 1.1 | 7.2 | .05 |
| 18 | 1.2 | 31 | .2 | ..... | ..... | .8 | .5 | 16.9 | .15 |
| 19 | 1.2 | 4.6 | 6.8 | ..... | ..... | .8 | .5 | 1.2 | .3 |
| 20 | 1.5 | 33 | .6 | ..... | ..... | .8 | .8 | .5 | .15 |
| 21 | 6.6 | 9.8 | .3 | ..... | ..... | .2 | 1.6 | .4 | .07 |
| 22 | 3.7 | 3.4 | .15 | ..... | 12.2 | 24 | 4.3 | .2 | .03 |
| 23 | 42 | 2.3 | .9 | ..... | ..... | 20 | 6.6 | .05 | .03 |
| 24 | 21 | 1.6 | .5 | ..... | ..... | 5.2 | 3.4 | .15 | .02 |
| 25 | 70 | 1.2 | .3 | ..... | ..... | 1.6 | 1.6 | .3 | .02 |
| 26 | 8.9 | .9 | .2 | ..... | ..... | 1.1 | 1.2 | .2 | .02 |
| 27 | 3.1 | .6 | .3 | ..... | ..... | .8 | .9 | .2 | .03 |
| 28 | 15.6 | 1.1 | .2 | ..... | ..... | .8 | .6 | .2 | .09 |
| 29 | 7.1 | .9 | 1.5 | ..... | ..... | .8 | .4 | .15 | .07 |
| 30 | 2.6 | .8 | .9 | ..... | ..... | .8 | 2.0 | .09 | .07 |
| 31 | 6.1 | .8 | ..... | ..... | ..... | .8 | ..... | .5 | ..... |

NOTE.—Oct. 14 to Nov. 21, Nov. 22 to Apr. 24, and June 17–30; clock stopped. March 13 to Apr. 24 and June 17–30, discharge obtained from staff gage readings made twice daily.

*Monthly discharge of Kailua Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July 12–31 | 70 | 1.2 | 10.3 | 15.9 | 206 | 631 |
| August | 84 | .6 | 8.86 | 13.7 | 275 | 843 |
| September | 6.8 | .01 | .776 | 1.20 | 23.3 | 71 |
| October 1–13 | .6 | .2 | .31 | .48 | 4.0 | 12 |
| March 13–31 | 24 | .2 | 3.41 | 5.28 | 64.8 | 199 |
| April | 6.6 | .03 | 1.01 | 1.56 | 30.2 | 93 |
| May | 22 | .05 | 2.45 | 3.79 | 76.0 | 233 |
| June | .8 | .02 | .111 | .172 | 3.32 | 10 |

### HOOLAWALIILII STREAM NEAR HUELO, MAUI.

LOCATION.—400 feet above New Hamakua ditch crossing, 4 miles by trail west of Huelo.

RECORDS AVAILABLE.—April 5, 1911, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder installed June 19, 1914, at same location and datum as original staff gage.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage is a pool about 100 feet long and 10 feet wide formed by concrete control 12 feet long over which water makes a drop of about 50 feet; banks slope gently and are covered with dense growth of vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.48 feet at 10.40 a. m., December 3 (discharge, 198 million gallons per day, or 306 second-feet); minimum stage recorded, 0.08 foot October 25 and June 23 (discharge, 0.9 million gallons per day, or 1.4 second-feet).

1911–1919: Maximum stage recorded, 3.4 feet at 8.15 a. m. April 3, 1918 (discharge, computed from extension of rating curve, 306 million gallons per day,[1] of 473 second-feet); minimum stage recorded, 0.00 foot October 1 and 2, 1917 (discharge, 0.55 million gallons per day, or 0.85 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 20 million gallons per day. High-water extension based on study of slope determined from flood marks indicates considerably less water at high stages than given by earlier curves. Operation of water-stage recorder satisfactory except January 1–17. Records excellent below 20 million gallons per day when recorder was operating.

*Discharge measurements of Hoolawaliilii Stream near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 22 | A. H. Wong | 0.10 | 2.4 | 1.55 |
| Nov. 19 | .....do | .20 | 4.8 | 3.1 |
| Jan. 18 | .....do | .13 | 2.3 | 1.5 |
| Apr. 22 | H. A. R. Austin | .205 | 3.8 | 2.5 |
| May 25 | A. H. Wong | .16 | 3.2 | 2.0 |

*Daily discharge, in million gallons, of Hoolawaliilii Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.9 | 6.7 | 3.2 | 1.6 | 2.4 | 2.9 | ..... | 3.2 | 3.6 | 3.2 | 3.6 | 2.0 |
| 2 | 4.9 | 5.2 | 2.7 | 1.5 | 1.8 | 9.1 | ..... | 3.6 | 3.6 | 2.9 | 2.9 | 1.8 |
| 3 | 5.2 | 4.9 | 2.7 | 1.5 | 1.1 | 56 | ..... | 3.9 | 3.6 | 2.5 | 2.7 | 1.8 |
| 4 | 3.9 | 4.2 | 2.5 | 1.5 | 8.5 | 13.5 | ..... | 2.9 | 2.9 | 2.4 | 2.7. | 1.5 |
| 5 | 4.9 | 4.2 | 2.4 | 1.5 | 6.4 | 12.1 | ..... | 2.5 | 3.2 | 2.2 | 10.6 | 1.1 |
| 6 | 3.9 | 3.9 | 2.2 | 1.5 | 3.6 | 54 | ..... | 2.5 | 11.8 | 2.2 | 4.6 | 1.1 |
| 7 | 3.6 | 4.2 | 2.2 | 1.5 | 2.7 | 32 | ..... | 2.4 | 15.9 | 2.0 | 3.9 | 1.3 |
| 8 | 3.9 | 3.2 | 2.2 | 1.3 | 2.5 | 22.7 | ..... | 2.2 | 8.8 | 2.0 | 3.9 | 1.5 |
| 9 | 9.5 | 2.9 | 2.0 | 1.3 | 2.4 | 13.5 | ..... | 10.1 | 12.4 | 2.0 | 6.7 | 1.5 |
| 10 | 64 | 2.9 | 2.0 | 1.3 | 2.2 | 15.6 | ..... | 3.6 | 24 | 1.8 | 4.2 | 1.5 |
| 11 | 14.2 | 2.9 | 1.8 | 1.5 | 4.3 | 19.5 | ..... | 3.6 | 13.5 | 2.0 | 3.9 | 1.5 |
| 12 | 9.3 | 4.0 | 1.6 | 1.5 | 17.4 | 10.4 | ..... | 4.6 | 12.8 | 2.0 | 3.6 | 1.3 |
| 13 | 9.8 | 7.1 | 1.5 | 1.5 | 10.7 | 7.8 | ..... | 3.6 | 9.3 | 1.8 | 2.9 | 1.1 |
| 14 | 7.8 | 6.0 | 1.5 | 1.5 | 5.9 | 16.1 | ..... | 3.2 | 7.8 | 1.8 | 2.7 | 1.3 |
| 15 | 7.2 | 4.2 | 1.5 | 1.5 | 4.6 | 14.2 | ..... | 2.9 | 6.7 | 2.0 | 2.5 | 1.3 |
| 16 | 5.9 | 42 | 1.5 | 1.5 | 3.9 | 9.8 | ..... | 2.9 | 7.2 | 2.7 | 2.5 | 1.3 |
| 17 | 4.9 | 35 | 1.5 | 1.3 | 3.6 | 8.8 | ..... | 2.7 | 9.8 | 2.9 | 2.5 | 1.3 |
| 18 | 4.6 | 18.1 | 1.5 | 1.5 | 2.9 | 7.2 | 1.6 | 2.5 | 6.2 | 2.0 | 6.3 | 1.1 |
| 19 | 4.2 | 12.1 | 1.6 | 1.3 | 2.9 | 7.2 | 1.8 | 2.4 | 5.9 | 2.0 | 2.5 | 1.1 |
| 20 | 4.2 | 28 | 1.3 | 2.4 | 2.9 | 10.2 | 1.8 | 10.6 | 5.2 | 1.8 | 2.5 | 1.1 |
| 21 | 6.0 | 16.3 | 1.3 | 1.6 | 2.7 | 12.1 | 1.6 | 4.9 | 4.9 | 2.0 | 2.5 | 1.1 |
| 22 | 4.6 | 9.8 | 1.3 | 1.5 | 2.5 | 8.3 | 2.0 | 7.1 | 36 | 3.7 | 2.4 | 1.0 |
| 23 | 19.0 | 7.2 | 1.8 | 1.3 | 2.4 | 7.2 | 2.0 | 5.5 | 21 | 6.0 | 2.4 | 1.0 |
| 24 | 14.9 | 5.9 | 1.6 | 1.1 | 2.4 | 6.7 | 2.4 | 5.2 | 11.4 | 7.6 | 2.2 | 1.1 |
| 25 | 16.1 | 4.9 | 2.0 | 1.1 | 2.4 | 5.5 | 2.7 | 5.2 | 8.3 | 7.2 | 2.2 | 1.1 |
| 26 | 9.8 | 4.2 | 1.6 | 1.5 | 2.4 | 4.9 | 2.2 | 3.9 | 6.2 | 4.9 | 2.2 | 1.0 |
| 27 | 9.8 | 3.9 | 1.5 | 1.3 | 2.5 | 4.6 | 2.7 | 3.9 | 5.5 | 4.2 | 2.0 | 1.1 |
| 28 | 20 | 18.4 | 1.3 | 1.1 | 3.6 | 4.2 | 4.2 | 3.6 | 4.9 | 3.9 | 2.0 | 1.1 |
| 29 | 23 | 5.2 | 3.0 | 1.3 | 5.5 | 3.9 | 2.9 | ..... | 4.6 | 3.2 | 2.0 | 1.1 |
| 30 | 10.4 | 3.9 | 1.8 | 2.4 | 3.6 | 4.5 | 2.5 | ..... | 3.9 | 3.2 | 1.8 | 1.0 |
| 31 | 9.5 | 3.9 | ..... | 1.8 | ..... | 4.2 | 4.1 | ..... | 3.6 | ..... | 2.2 | ..... |

NOTE.—Jan. 1–17, discharge estimated by comparison with Hoolawanui Stream as follows: Jan. 1–10, 3.4 million gallons per day; Jan. 11–17, 2.2 million gallons per day.

[1] Supersedes figures published in Water-Supply Paper 485.

*Monthly discharge of Hoolawaliilii Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 64 | 2.9 | 10.4 | 16.1 | 322 | 989 |
| August | 42 | 2.9 | 9.20 | 14.2 | 285 | 875 |
| September | 3.2 | 1.3 | 1.89 | 2.92 | 56.6 | 174 |
| October | 2.4 | 1.1 | 1.48 | 2.29 | 46.0 | 141 |
| November | 17.4 | 1.1 | 4.09 | 6.33 | 123 | 377 |
| December | 56 | 2.9 | 13.2 | 20.4 | 409 | 1,260 |
| January | 4.2 | 1.6 | 2.71 | 4.19 | 83.9 | 258 |
| February | 10.6 | 2.2 | 4.11 | 6.36 | 115 | 353 |
| March | 36 | 2.9 | 9.18 | 14.2 | 284 | 873 |
| April | 7.6 | 1.8 | 3.00 | 4.64 | 90.1 | 276 |
| May | 10.6 | 1.8 | 3.28 | 5.07 | 102 | 312 |
| June | 2.0 | 1.0 | 1.27 | 1.96 | 38.1 | 117 |
| The year | 64 | 1.0 | 5.36 | 8.29 | 1,950 | 6,000 |

**HOOLAWANUI STREAM NEAR HUELO, MAUI.**

LOCATION.—500 feet above crossing of New Hamakua ditch, 5 miles by trail west of Huelo.

RECORDS AVAILABLE.—December 12, 1910, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder installed June 20, 1914, 200 feet upstream from original staff, which is replaced.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—Stream drops over a low waterfall into a large circular pool with gently sloping banks. Control at outlet of pool composed of boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.63 feet at 12.15 p. m. December 3 (discharge, approximately 338 million gallons per day, or 523 second-feet); minimum stage recorded, −0.09 foot at 7 p. m. October 25 (discharge, 0.65 million gallons per day, or 1.0 second-foot).

1910–1918: Maximum stage recorded, 5.4 feet at 11.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, approximately 440 million gallons per day, or 680 second-feet); minimum stage recorded, −0.19 foot at 7 p. m. October 25, 1917 (discharge, 0.15 million gallons per day, or 0.2 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined above 1 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records excellent above and good below 1 million gallons per day when water-stage recorder was operating. Records fair when water-stage recorder was not operating.

*Discharge measurements of Hoolawanui Stream near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Nov. 19 | A. H. Wong | 0.31 | 5.2 | 3.4 |
| Jan. 18 | do | .16 | 2.6 | 1.7 |
| Mar. 8 | H. A. R. Austin | .58 | 11.7 | 7.6 |
| Apr. 22 | do | .28 | 5.3 | 3.4 |

*Daily discharge, in million gallons, of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.4 | 11.6 | ..... | 1.9 | 3.8 | 2.7 | ..... | 4.5 | 5.3 | 3.8 | 6.8 | 2.6 |
| 2 | 17.7 | 9.4 | ..... | 1.6 | 7.1 | 10.6 | ..... | 4.8 | 5.0 | 3.6 | 3.5 | 2.2 |
| 3 | 15.6 | 8.6 | ..... | 1.5 | 4.5 | 76 | ..... | 4.4 | 4.6 | 3.4 | 3.2 | 1.9 |
| 4 | 10.2 | 6.8 | ..... | 1.6 | 15.7 | 20 | ..... | 4.0 | 4.0 | 3.1 | 3.2 | 1.8 |
| 5 | 11.6 | 6.8 | ..... | 1.4 | 14.2 | 18.5 | ..... | 3.5 | 4.5 | 3.0 | 15.6 | 1.8 |
| 6 | 7.2 | 6.8 | ..... | 1.6 | 7.4 | 94 | ..... | 3.4 | 14.0 | 2.8 | 7.0 | 1.7 |
| 7 | 6.8 | 6.0 | ..... | 1.4 | 5.9 | 44 | ..... | 3.4 | 16.1 | 2.6 | 4.5 | 1.6 |
| 8 | 7.8 | 5.3 | ..... | 1.3 | 5.0 | 32 | ..... | 3.3 | 8.9 | 2.5 | 4.8 | 1.6 |
| 9 | 14.5 | 4.5 | ..... | 1.3 | 4.5 | 17.1 | ..... | 21 | 16.3 | 2.5 | 10.3 | 1.6 |
| 10 | 90 | 4.2 | ..... | 1.3 | 4.1 | 16.5 | ..... | 6.2 | 34 | 2.3 | 5.3 | 1.6 |
| 11 | 21 | 4.1 | ..... | 1.2 | 10.2 | 19.2 | ..... | 5.7 | 17.4 | 2.3 | 4.2 | 1.5 |
| 12 | 13.9 | 6.8 | ..... | 1.4 | 40 | 11.9 | ..... | 7.4 | 15.2 | 2.3 | 4.1 | 1.4 |
| 13 | 15.8 | 15.8 | ..... | 1.2 | 27 | 9.4 | ..... | 6.2 | 10.3 | 2.2 | 3.8 | 1.4 |
| 14 | 13.3 | 10.3 | ..... | 1.1 | 11.9 | 17.6 | ..... | 5.9 | 8.0 | 1.9 | 3.6 | 1.4 |
| 15 | 12.8 | 6.0 | ..... | 1.0 | 7.6 | 16.3 | ..... | 5.5 | 6.8 | 2.0 | 3.2 | 1.5 |
| 16 | 10.1 | 60 | ..... | 1.0 | 5.7 | 11.9 | ..... | 5.9 | 7.0 | 2.8 | 3.0 | 1.3 |
| 17 | 8.2 | 42 | ..... | .9 | 4.4 | 12.5 | ..... | 5.7 | 10.1 | 3.3 | 3.9 | 1.4 |
| 18 | 7.2 | 26 | 1.5 | .9 | 4.0 | 10.6 | 2.1 | 5.5 | 6.2 | 2.1 | 12.0 | 1.4 |
| 19 | 6.6 | 16.8 | 2.3 | 1.0 | 3.5 | 11.1 | 2.0 | 5.5 | 5.7 | 2.1 | 3.9 | 1.3 |
| 20 | 7.0 | 38 | 1.6 | 1.8 | 3.3 | 10.8 | 2.0 | 15.1 | 5.1 | 1.9 | 3.4 | 1.2 |
| 21 | 9.8 | 22 | 1.6 | 1.0 | 3.0 | 12.2 | 2.0 | 8.6 | 4.6 | 1.9 | 3.8 | 1.2 |
| 22 | 7.2 | 14.2 | 1.6 | .9 | 2.8 | 9.6 | 2.0 | 10.7 | 40 | 5.4 | 3.2 | 1.1 |
| 23 | 35 | 10.6 | 2.2 | .8 | 2.6 | 8.0 | 2.6 | 9.4 | 23 | 10.4 | 3.1 | 1.0 |
| 24 | 22 | 8.9 | 1.8 | .8 | 2.5 | 7.8 | 3.5 | 8.6 | 12.8 | 10.0 | 2.9 | 1.0 |
| 25 | 33 | 7.2 | 2.1 | .7 | 2.2 | 6.8 | 3.6 | 8.9 | 9.4 | 8.7 | 2.7 | 1.0 |
| 26 | 19.0 | 6.4 | 1.6 | 1.3 | 2.4 | 5.9 | 2.5 | 7.0 | 7.6 | 5.9 | 2.6 | 1.0 |
| 27 | 17.1 | 5.5 | 1.4 | 1.5 | 2.7 | 5.3 | 4.6 | 6.6 | 6.4 | 4.5 | 2.5 | 1.2 |
| 28 | 32 | 26 | 1.4 | 1.2 | 5.0 | 4.6 | 6.4 | 5.9 | 5.5 | 3.9 | 2.4 | 1.4 |
| 29 | 27 | 9.6 | 7.1 | 1.4 | 4.4 | 4.2 | 6.1 | ..... | 4.8 | 3.5 | 2.2 | 1.2 |
| 30 | 15.8 | ..... | 2.3 | 4.5 | 3.0 | 5.3 | 3.6 | ..... | 4.4 | 3.4 | 2.1 | 1.0 |
| 31 | 14.2 | ..... | ..... | 2.4 | ..... | 4.2 | 6.8 | ..... | 4.0 | ..... | 2.7 | ..... |

NOTE.—Discharge estimated in million gallons per day by comparison with station on Hoolawaliilii Stream as follows: Aug. 30-31, 5.5; Sept. 1-5, 4.6; Sept. 6-10, 3.6; Sept. 11-17, 2.6; Jan. 1-10, 4.9; Jan. 11-17, 2.6.

*Monthly discharge of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 90 | 6.6 | 17.3 | 26.8 | 537 | 1,650 |
| August | 60 | 4.1 | 13.5 | 20.9 | 417 | 1,280 |
| September | 7.1 | 1.4 | 2.92 | 4.52 | 87.7 | 269 |
| October | 4.5 | .7 | 1.38 | 2.14 | 42.9 | 131 |
| November | 40 | 2.2 | 7.35 | 11.4 | 220 | 677 |
| December | 94 | 2.7 | 17.3 | 26.8 | 537 | 1,650 |
| January | 6.4 | 2.0 | 3.77 | 5.83 | 117 | 359 |
| February | 21 | 3.3 | 6.88 | 10.6 | 193 | 591 |
| March | 40 | 4.0 | 10.5 | 16.2 | 327 | 999 |
| April | 10.4 | 1.9 | 3.67 | 5.68 | 110 | 338 |
| May | 15.6 | 2.1 | 4.50 | 6.96 | 140 | 428 |
| June | 2.6 | 1.0 | 1.44 | 2.23 | 43.3 | 133 |
| The year | 94 | .7 | 7.59 | 11.7 | 2,770 | 8,500 |

### HONOPOU STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above New Hamakua ditch crossing, 6 miles west of Huelo.

RECORDS AVAILABLE.—December 10, 1910, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder, installed June 19, 1914, at same site as original staff.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below gage; right bank is overflowed during floods; left bank steep and high. Control an old iron weir set in concrete; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.00 feet at 10 a. m. December 3 (discharge, 135 million gallons per day, or 209 second-feet); minimum stage recorded, 0.09 foot June 22 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1910–1919: Maximum stage recorded, 3.7 feet at 10 p. m. May 1, 1916 (discharge, based on curve applicable from January 19, 1917, 247 million gallons per day,[1] or 382 second-feet); minimum stage recorded, 0.05 foot September, October, and November, 1917 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined above 1 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records excellent above and fair below 1 million gallons per day when water-stage recorder was operating; fair when water-stage recorder was not operating.

*Discharge measurements of Honopou Stream near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 22 | C. T. Bailey | 0.15 | 1.4 | 0.9 |
| Nov. 19 | A. H. Wong | .29 | 2.6 | 1.65 |
| Jan. 18 | do | .20 | 1.3 | .8 |
| Mar. 7 | J. E. Stewart | .48 | 6.1 | 4.0 |
| Apr. 22 | H. A. R. Austin | .26 | 2.4 | 1.6 |
| May 25 | A. H. Wong | .19 | 2.0 | 1.3 |

*Daily discharge, in million gallons, of Honopou Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.4 | 4.8 | 2.9 | 1.0 | 1.1 | 1.7 | ..... | 1.6 | 2.2 | 2.3 | 1.7 | 1.0 |
| 2 | 3.6 | 3.9 | 2.6 | .9 | 1.3 | 5.9 | ..... | 2.0 | 2.2 | 2.1 | 1.6 | .9 |
| 3 | 2.9 | 3.6 | 2.3 | .9 | 1.0 | 30 | ..... | 2.0 | 2.2 | 1.9 | 1.5 | .9 |
| 4 | 2.3 | 3.0 | 2.1 | .9 | 3.8 | 8.3 | ..... | 1.6 | 1.9 | 1.7 | 1.5 | .8 |
| 5 | 3.0 | 2.9 | 1.9 | .9 | 2.3 | 7.5 | ..... | 1.6 | 1.9 | 1.6 | 5.7 | .7 |
| 6 | 2.2 | 2.8 | 1.7 | .8 | 2.1 | 28 | ..... | 1.5 | 6.1 | 1.6 | 2.2 | .7 |
| 7 | 2.1 | 2.8 | 1.7 | .7 | 1.5 | 17.4 | ..... | 1.4 | 7.2 | 1.6 | 2.0 | .7 |
| 8 | 2.3 | 2.1 | 1.6 | .7 | 1.3 | 13 | ..... | 1.4 | 4.3 | 1.4 | 2.4 | .7 |
| 9 | 4.5 | 2.0 | 1.5 | .7 | 1.3 | 9.4 | ..... | 4.2 | 6.2 | 1.2 | 3.9 | .6 |
| 10 | 30 | 1.7 | 1.5 | .7 | 1.2 | 9.4 | ..... | 1.9 | 9.5 | 1.2 | 2.2 | .6 |
| 11 | 7.5 | 1.6 | 1.4 | .7 | 2.8 | 10.2 | ..... | 2.1 | 6.8 | 1.2 | 2.1 | .7 |
| 12 | 5.4 | 2.8 | 1.3 | .7 | 8.1 | 7.3 | ..... | 3.0 | 6.0 | 1.2 | 2.0 | .6 |
| 13 | 5.6 | 4.0 | 1.2 | .7 | 5.6 | 6.0 | ..... | 1.8 | 4.9 | 1.1 | 1.9 | .6 |
| 14 | 4.6 | 3.0 | 1.1 | .7 | 3.6 | 9.0 | ..... | 1.8 | 4.3 | 1.1 | 1.7 | .6 |
| 15 | 4.2 | 2.1 | 1.1 | .6 | 3.1 | 7.5 | ..... | 1.7 | 3.9 | 1.1 | 1.6 | .6 |
| 16 | 3.6 | 19.0 | 1.0 | .5 | 2.6 | 6.2 | ..... | 1.6 | 3.9 | 1.5 | 1.6 | .6 |
| 17 | 3.1 | 12.8 | 1.0 | .5 | 2.5 | 5.7 | ..... | 1.6 | 5.1 | 1.8 | 1.6 | .6 |
| 18 | 2.9 | 8.6 | 1.1 | .5 | 2.3 | 5.2 | 1.2 | 1.6 | 3.3 | 1.1 | 2.9 | .6 |
| 19 | 2.6 | 6.9 | 1.2 | .5 | 2.0 | 5.2 | 1.2 | 1.6 | 3.1 | 1.2 | 1.5 | .6 |
| 20 | 2.6 | 13.2 | .9 | 1.2 | 2.0 | 5.8 | 1.2 | 6.0 | 3.0 | 1.0 | 1.5 | .6 |
| 21 | 3.6 | 8.3 | .9 | .6 | 1.9 | 6.6 | 1.2 | 2.6 | 2.8 | 1.0 | 1.5 | .6 |
| 22 | 2.3 | 6.2 | .8 | .6 | 1.8 | 4.6 | 1.2 | 3.6 | 16.3 | 2.4 | 1.3 | .5 |
| 23 | 8.8 | 5.1 | 1.0 | .5 | 1.7 | 4.3 | 1.4 | 2.6 | 9.9 | 3.0 | 1.2 | .4 |
| 24 | 6.0 | 4.2 | .9 | .5 | 1.6 | 4.2 | 1.9 | 2.5 | 6.2 | 3.5 | 1.1 | .5 |
| 25 | 7.5 | 3.6 | 1.0 | .4 | 1.6 | 3.8 | 1.7 | 2.5 | 5.1 | 3.2 | 1.1 | .4 |
| 26 | 5.6 | 3.2 | .9 | .7 | 1.7 | 3.5 | 1.2 | 2.2 | 4.3 | 2.3 | 1.1 | .4 |
| 27 | 5.6 | 2.9 | .8 | .6 | 1.8 | 3.1 | 2.1 | 2.3 | 3.9 | 2.0 | 1.0 | .6 |
| 28 | 9.2 | 11.5 | .8 | .6 | 2.9 | 2.9 | 2.8 | 2.1 | 3.2 | 1.7 | 1.0 | .7 |
| 29 | 10.6 | 4.6 | 2.3 | .6 | 2.6 | 2.6 | 1.8 | ..... | 3.0 | 1.6 | 1.0 | .6 |
| 30 | 6.6 | 3.6 | 1.1 | 1.2 | 1.8 | 2.9 | 1.5 | ..... | 2.6 | 1.6 | 1.0 | .6 |
| 31 | 5.9 | 3.1 | ..... | .8 | ..... | 2.9 | 2.5 | ..... | 2.4 | ..... | 1.1 | ..... |

NOTE.—Jan. 1–17 discharge estimated from maximum and minimum gage heights, and comparison with Honomanu Stream near Keanae. Mean discharge estimated in million gallons per day as follows: Jan. 1–10, 2.6; Jan. 11–17, 1.7.

[1] Supersedes figure published in Water Supply Papers 445, 465, and 485.

*Monthly discharge of Honopou Stream near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 30 | 2.1 | 5.45 | 8.43 | 169 | 518 |
| August | 19.0 | 1.6 | 5.16 | 7.98 | 160 | 491 |
| September | 2.9 | .8 | 1.39 | 2.15 | 41.6 | 128 |
| October | 1.2 | .4 | .71 | 1.10 | 21.9 | 68 |
| November | 8.1 | 1.0 | 2.36 | 3.65 | 70.9 | 217 |
| December | 30 | 1.7 | 7.75 | 12.0 | 240 | 737 |
| January | 2.8 | 1.2 | 1.96 | 3.03 | 60.8 | 186 |
| February | 6.0 | 1.4 | 2.23 | 3.45 | 62.4 | 192 |
| March | 16.3 | 1.9 | 4.76 | 7.36 | 148 | 453 |
| April | 3.5 | 1.0 | 1.71 | 2.65 | 51.2 | 157 |
| May | 5.7 | 1.0 | 1.79 | 2.77 | 55.5 | 170 |
| June | 1.0 | .4 | .63 | .98 | 19.0 | 58 |
| The year | 30 | .4 | 3.01 | 4.66 | 1,100 | 3,370 |

### NEW HAMAKUA DITCH AT HONOPOU, NEAR HUELO, MAUI.

LOCATION.—300 feet below Honopou Stream crossing and 7 miles by road and trail west of Huelo.

RECORDS AVAILABLE.—January 25, 1918, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sides and bottom of ditch, hardpan and fairly smooth; banks steep; straight for 75 feet above and 25 feet below gage. No well defined control; stage-discharge may be affected by collection of mud and gravel on bottom of ditch.

EXTREMES OF DISCHARGE.—1918–1919: Maximum stage recorded, 4.26 feet at 3.30 p. m. August 28, 1918 (discharge, 88 million gallons per day, or 136 second-feet); minimum stage recorded, 0.62 foot at 12.40 p. m. August 25, 1918 (discharge, 7.7 million gallons per day, or 11.9 second-feet).

DIVERSION.—Ditch receives greater part of flow of Koolau ditch at Alo division weir and diverts water from streams west of that point.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed August 24 owing to slides being cleaned out of ditch. Rating applicable July 1 to August 24 fairly well defined below 30 million gallons per day. Rating curve applicable August 25 to June 30 well defined above 20 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records good when water-stage recorder was operating.

*Discharge measurements of New Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 5 | C. T. Bailey | 4.20 | 114 | 74 |
| Sept. 22 | A. H. Wong | 2.08 | 51 | 32.5 |
| Nov. 19 | .....do | 3.34 | 102 | 66 |
| Jan. 18 | .....do | 2.37 | 61 | 39.5 |
| Mar. 7 | H. A. R. Austin | 3.98 | 123 | 80 |
| Apr. 22 | .....do | 3.83 | 116 | 75 |

*Daily discharge, in million gallons, of New Hanakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 74 | 74 | 80 | 47 | 75 | 57 | 77 | 78 | 72 | 72 | 75 | 57 |
| 2 | 74 | 74 | 80 | 42 | 78 | 67 | 70 | 78 | 72 | 70 | 76 | 45 |
| 3 | 74 | 74 | 75 | 40 | 75 | 80 | 65 | 75 | 75 | 65 | 74 | 40 |
| 4 | 74 | 74 | 70 | 40 | 78 | 80 | 73 | 75 | 67 | 62 | 64 | 40 |
| 5 | 74 | 74 | 70 | 38 | 75 | 80 | 73 | 67 | 70 | 57 | 69 | 38 |
| 6 | 74 | 74 | 70 | 42 | 72 | 80 | 64 | 62 | 80 | 54 | 79 | 36 |
| 7 | 72 | 74 | 65 | 34 | 70 | 80 | 59 | 59 | 80 | 52 | 79 | 34 |
| 8 | 74 | 74 | 72 | 33 | 67 | 80 | 52 | 54 | 80 | 50 | 80 | 33 |
| 9 | 74 | 74 | 62 | 31 | 65 | 80 | 50 | 70 | 80 | 50 | 79 | 32 |
| 10 | 79 | 74 | 59 | 36 | 62 | 80 | 48 | 78 | 80 | 45 | 79 | 37 |
| 11 | 74 | 72 | 54 | 33 | 75 | 80 | 48 | 75 | 80 | 45 | 79 | 34 |
| 12 | 74 | 74 | 52 | 45 | 78 | 78 | 50 | 78 | 80 | 47 | 78 | 30 |
| 13 | 77 | 77 | 50 | 52 | 78 | 78 | 44 | 75 | 80 | 42 | 72 | 29 |
| 14 | 74 | 74 | 52 | 38 | 78 | 80 | 42 | 75 | 78 | 40 | 65 | 28 |
| 15 | 74 | 74 | 52 | 33 | 75 | 80 | 40 | 70 | 78 | 40 | 55 | 38 |
| 16 | 74 | 79 | 47 | 30 | 75 | 80 | 39 | 67 | 78 | 59 | 34 | 31 |
| 17 | 74 | 77 | 45 | 29 | 72 | 80 | 37 | 59 | 78 | 72 | 49 | 32 |
| 18 | 74 | 77 | 54 | 28 | 67 | 80 | 36 | 57 | 78 | 57 | 71 | 40 |
| 19 | 74 | 74 | 75 | 29 | 62 | 80 | 38 | 52 | 75 | 57 | 78 | 34 |
| 20 | 74 | 72 | 57 | 51 | 59 | 78 | 37 | 78 | 75 | 57 | 76 | 30 |
| 21 | 74 | 72 | 42 | 51 | 57 | 79 | 36 | 78 | 75 | 62 | 68 | 27 |
| 22 | 74 | 69 | 36 | 40 | 52 | 79 | 40 | 78 | 80 | 75 | 65 | 25 |
| 23 | 77 | 69 | 62 | 33 | 47 | 79 | 62 | 78 | 80 | 80 | 59 | 24 |
| 24 | 77 | 22 | 59 | 30 | 45 | 79 | 72 | 78 | 80 | 80 | 60 | 25 |
| 25 | 74 | 32 | 70 | 30 | 42 | 79 | 75 | 78 | 78 | 80 | 54 | 24 |
| 26 | 74 | 80 | 52 | 31 | 47 | 78 | 65 | 75 | 75 | 78 | 57 | 24 |
| 27 | 74 | 80 | 45 | 70 | 59 | 79 | 78 | 72 | 75 | 79 | 57 | 37 |
| 28 | 77 | 80 | 42 | 54 | 78 | 78 | 78 | 72 | 78 | 79 | 52 | 40 |
| 29 | 77 | 78 | 57 | 52 | 78 | 77 | 78 | ..... | 78 | 79 | 50 | 40 |
| 30 | 77 | 80 | 67 | 75 | 65 | 68 | 75 | ..... | 75 | 71 | 47 | 30 |
| 31 | 77 | 80 | ..... | 70 | ..... | 74 | 75 | ..... | 75 | ..... | 50 | ..... |

NOTE.—Oct. 19–26, Dec. 20 to Jan. 18, and Apr. 27 to May 25; recorder not operating and discharge estimated by adding 10 million gallons per day to the record at Halehaku weir.

*Monthly discharge of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 79 | 72 | 74.8 | 116 | 2,320 | 7,120 |
| August | 80 | 22 | 72.0 | 111 | 2,230 | 6,850 |
| September | 80 | 36 | 59.1 | 91.4 | 1,770 | 5,440 |
| October | 75 | 28 | 41.5 | 64.2 | 1,290 | 3,950 |
| November | 78 | 42 | 66.9 | 104 | 2,010 | 6,160 |
| December | 80 | 57 | 77.6 | 120 | 2,410 | 7,380 |
| January | 78 | 36 | 57.3 | 88.7 | 1,780 | 5,450 |
| February | 78 | 52 | 71.1 | 110 | 1,990 | 6,110 |
| March | 80 | 67 | 76.9 | 119 | 2,380 | 7,320 |
| April | 80 | 40 | 61.9 | 95.8 | 1,860 | 5,700 |
| May | 80 | 34 | 65.5 | 101 | 2,030 | 6,230 |
| June | 57 | 24 | 33.8 | 52.3 | 1,010 | 3,110 |
| The year | 80 | 22 | 63.2 | 97.8 | 23,100 | 70,800 |

### NEW HAMAKUA DITCH AT HALEHAKU WEIR, NEAR HUELO, MAUI.

LOCATION.—Just above crossing of Halehaku Stream, 7½ miles by trail west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1919.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by 25-foot Cippoletti weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSION.—None.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

*Daily discharge, in million gallons, of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 69.6 | 69.2 | 68.8 | 37.5 | 63.9 | 44.2 | 67.4 | 67.7 | 45.9 | 67.1 | 65.2 | 42.4 |
| 2 | 69.2 | 68.8 | 68.9 | 30.2 | 69.2 | 48.7 | 59.5 | 62.3 | 55.5 | 51.1 | 66.3 | 32.2 |
| 3 | 67.8 | 69.0 | 64.5 | 26.3 | 68.2 | 43.2 | 55.0 | 66.7 | 55.9 | 45.6 | 64.5 | 27.4 |
| 4 | 69.4 | 68.9 | 50.7 | 26.6 | 68.6 | 35.2 | 63.4 | 63.0 | 47.1 | 42.5 | 53.7 | 24.1 |
| 5 | 69.1 | 69.1 | 47.6 | 25.6 | 68.8 | 38.8 | 63.3 | 58.5 | 42.7 | 41.1 | 59.4 | 25.8 |
| 6 | 68.1 | 68.9 | 48.7 | 25.9 | 68.8 | 39.5 | 53.8 | 46.9 | 61.0 | 38.5 | 68.6 | 23.8 |
| 7 | 68.8 | 69.0 | 45.6 | 25.5 | 67.4 | 38.6 | 49.2 | 37.7 | 67.5 | 36.2 | 68.7 | 22.6 |
| 8 | 69.9 | 68.9 | 47.4 | 22.2 | 59.0 | 38.3 | 41.7 | 34.5 | 68.3 | 32.3 | 69.6 | 22.7 |
| 9 | 69.2 | 68.6 | 52.0 | 21.3 | 46.6 | 38.7 | 39.8 | 44.9 | 67.4 | 32.3 | 69.2 | 21.6 |
| 10 | 20.4 | 68.4 | 46.4 | 22.5 | 42.8 | 38.9 | 37.9 | 68.6 | 69.1 | 31.5 | 68.6 | 23.7 |
| 11 | 69.5 | 68.5 | 39.9 | 23.3 | 60.5 | 38.6 | 38.2 | 62.1 | 67.6 | 30.5 | 69.3 | 24.4 |
| 12 | 68.8 | 68.9 | 37.5 | 28.0 | 69.3 | 38.5 | 40.1 | 65.2 | 69.3 | 31.5 | 68.2 | 21.1 |
| 13 | 69.1 | 70.1 | 36.0 | 37.9 | 69.1 | 38.5 | 33.9 | 65.6 | 69.0 | 30.5 | 62.4 | 19.4 |
| 14 | 69.4 | 68.2 | 33.0 | 34.1 | 69.3 | 38.8 | 31.7 | 62.0 | 69.1 | 27.9 | 55.4 | 19.3 |
| 15 | 69.2 | 69.0 | 30.5 | 25.5 | 68.9 | 38.9 | 30.1 | 62.1 | 68.9 | 25.9 | 44.7 | 22.0 |
| 16 | 69.0 | 71.6 | 31.3 | 22.2 | 68.9 | 47.3 | 28.9 | 53.3 | 69.1 | 43.3 | 23.8 | 23.7 |
| 17 | 68.5 | 69.2 | 31.9 | 20.7 | 65.1 | 67.7 | 26.9 | 40.3 | 69.6 | 65.9 | 39.2 | 21.6 |
| 18 | 69.0 | 68.6 | 34.3 | 19.2 | 49.8 | 69.1 | 26.1 | 36.1 | 69.0 | 61.4 | 60.7 | 25.8 |
| 19 | 68.9 | 67.7 | 56.9 | 19.0 | 44.1 | 68.3 | 25.0 | 33.3 | 69.1 | 52.6 | 68.3 | 26.9 |
| 20 | 68.5 | 73.2 | 52.9 | 40.6 | 41.1 | 68.4 | 23.5 | 59.0 | 68.7 | 38.5 | 65.7 | 21.5 |
| 21 | 69.8 | 69.4 | 35.1 | 40.9 | 39.5 | 68.7 | 22.7 | 69.3 | 67.8 | 44.5 | 58.3 | 11.6 |
| 22 | 68.9 | 68.7 | 25.7 | 30.2 | 36.4 | 68.9 | 25.8 | 69.0 | 60.7 | 60.9 | 54.7 | 17.5 |
| 23 | 71.6 | 69.0 | 37.7 | 23.2 | 34.7 | 68.8 | 35.9 | 64.1 | 55.1 | 68.6 | 48.7 | 16.2 |
| 24 | 68.5 | 10.8 | 46.9 | 20.4 | 32.3 | 68.9 | 58.3 | 69.5 | 57.1 | 68.9 | 50.2 | 16.2 |
| 25 | 70.2 | 23.0 | 46.8 | 19.9 | 29.7 | 68.9 | 65.1 | 69.1 | 69.1 | 68.8 | 43.9 | 15.9 |
| 26 | 68.9 | 69.6 | 40.9 | 40.3 | 28.9 | 68.4 | 53.5 | 66.2 | 67.8 | 69.1 | 38.4 | 15.1 |
| 27 | 69.0 | 69.0 | 34.1 | 56.2 | 30.7 | 69.0 | 58.9 | 52.6 | 67.6 | 68.6 | 36.2 | 22.1 |
| 28 | 69.2 | 69.3 | 28.2 | 52.0 | 59.4 | 68.4 | 68.8 | 47.2 | 68.9 | 68.8 | 34.6 | 22.5 |
| 29 | 69.5 | 67.8 | 46.6 | 39.3 | 67.5 | 66.9 | 67.9 | ..... | 68.9 | 68.9 | 32.5 | 32.4 |
| 30 | 68.7 | 69.1 | 59.3 | 62.9 | 58.3 | 57.6 | 65.1 | ..... | 68.6 | 60.6 | 29.8 | 23.8 |
| 31 | 68.5 | 69.1 | ..... | 63.1 | ..... | 64.2 | 63.0 | ..... | 69.0 | ..... | 29.4 | ..... |

*Monthly discharge of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 71.6 | 20.4 | 67.6 | 105 | 2,090 | 6,430 |
| August | 73.2 | 10.8 | 65.8 | 102 | 2,040 | 6,260 |
| September | 68.9 | 25.7 | 44.2 | 68.4 | 1,330 | 4,070 |
| October | 63.1 | 19.0 | 31.7 | 49.0 | 982 | 3,020 |
| November | 69.3 | 28.9 | 54.9 | 84.9 | 1,650 | 5,050 |
| December | 69.1 | 35.2 | 53.4 | 82.6 | 1,660 | 5,080 |
| January | 68.8 | 22.7 | 45.8 | 70.9 | 1,420 | 4,360 |
| February | 69.5 | 33.3 | 57.0 | 88.2 | 1,600 | 4,900 |
| March | 69.6 | 42.7 | 64.2 | 99.3 | 1,990 | 6,110 |
| April | 69.1 | 25.9 | 49.1 | 76.0 | 1,470 | 4,520 |
| May | 69.6 | 23.8 | 53.8 | 83.2 | 1,670 | 5,120 |
| June | 42.4 | 11.6 | 22.8 | 35.3 | 685 | 2,100 |
| The year | 73.2 | 10.8 | 50.9 | 78.8 | 18,600 | 57,000 |

### OLD HAMAKUA DITCH AT HONOPOU, NEAR HUELO, MAUI.

LOCATION.—250 feet below intake in Honopou Stream and 7 miles by road and trail west of Huelo.

RECORDS AVAILABLE.—January 25, 1918, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sides and bottom of ditch are of hardpan with small amount of rock and gravel; banks high and steep; straight for 250 feet above and 150 feet below gage. Control is concrete slab 12 inches thick rising 4 inches above bed of ditch, 5 feet below gage.

EXTREMES OF DISCHARGE.—1918–1919: Maximum stage recorded, 3.24 feet probably at noon December 3, 1918 (discharge, 58 million gallons per day, or 90 second-feet); minimum stage recorded, 0.37 foot 5.20 p.m. June 7, 1919 (discharge, 0.05 million gallons per day, or 0.08 second-feet).

DIVERSIONS.—Ditch heads at Nailiilihaele Stream and picks up water from streams west of that point.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 1 million gallons per day. Operation of water-stage recorder satisfactory except November 26 to January 18 when clock was stopped. Records good when water stage recorder was operating.

*Discharge measurements of Old Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 5 | C. T. Bailey | 2.00 | 34 | 21.8 |
| Nov. 19 | A. H. Wong | .70 | 2.3 | 1.5 |
| Mar. 8 | H. A. R. Austin | 2.22 | 42.5 | 27.5 |
| Apr. 22 | do | .93 | 6.1 | 3.9 |
| May 25 | A. H. Wong | .43 | .09 | .06 |

*Daily discharge, in million gallons, of Old Hamakua ditch at Honopou, near Huelo, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 22 | 24 | 13.3 | 0.5 | 9.2 | ..... | 11.5 | 5.0 | 2.3 | 3.6 | 0.3 |
| 2 | 29 | 24 | 10.4 | .4 | 14.2 | ..... | 12.4 | 6.0 | 1.4 | .7 | .2 |
| 3 | 29 | 28 | 2.8 | .4 | 6.9 | ..... | 10.4 | 6.9 | .7 | .7 | .1 |
| 4 | 24 | 27 | .7 | .4 | 22. | ..... | 5.6 | 2.5 | .4 | .7 | .1 |
| 5 | 26 | 27 | .5 | .3 | 20 | ..... | 2.7 | 6.3 | .3 | 28 | .1 |
| 6 | 20 | 29 | .7 | .4 | 18.0 | ..... | 1.0 | 30 | .3 | 7.3 | .1 |
| 7 | 18.0 | 27 | .6 | .3 | 10.1 | ..... | .6 | 32 | .2 | 1.3 | .1 |
| 8 | 21 | 25 | 2.0 | .3 | 6.9 | ..... | .5 | 28 | .3 | 2.6 | .2 |
| 9 | 27 | 19.0 | .4 | .2 | 4.9 | ..... | 17.1 | 29 | .2 | 17.0 | .2 |
| 10 | 33 | 17.1 | .2 | .2 | 3.2 | ..... | 12.4 | 34 | .2 | 2.9 | .1 |
| 11 | 26 | 17.1 | .3 | .2 | 22 | ..... | 7.5 | 33 | .2 | 1.0 | .1 |
| 12 | 26 | 26 | .3 | .2 | 29 | ..... | 18.0 | 32 | .2 | .7 | .1 |
| 13 | 26 | 30 | .3 | .3 | 28 | ..... | 9.5 | 27 | .2 | .6 | .2 |
| 14 | 25 | 32 | .4 | .2 | 24 | ..... | 6.9 | 19.0 | .3 | .5 | .1 |
| 15 | 25 | 29 | .4 | .2 | 17.1 | ..... | 4.0 | 14.2 | .3 | .3 | .1 |
| 16 | 24 | 34 | .4 | .2 | 11.5 | ..... | 2.1 | 19.0 | 1.4 | .2 | .2 |
| 17 | 19.0 | 29 | .3 | .2 | 7.8 | ..... | .8 | 28 | 4.3 | .3 | .2 |
| 18 | 18.0 | 36 | .5 | .2 | 4.0 | ..... | .7 | 15.2 | .6 | 14.0 | .1 |
| 19 | 18.0 | 29 | 7.4 | .2 | 2.0 | 0.2 | .6 | 11.0 | .7 | .7 | .1 |
| 20 | 19.0 | 12.4 | .6 | 3.5 | 1.0 | .2 | 24 | 9.2 | 1.0 | .4 | .2 |
| 21 | 22 | 12.4 | .4 | .3 | .8 | .3 | 13.5 | 7.0 | 1.3 | .7 | .1 |
| 22 | 25 | 11.5 | .4 | .2 | .7 | .3 | 21 | 25 | 8.3 | .4 | .2 |
| 23 | 26 | 11.3 | 1.2 | .2 | .7 | 2.5 | 16.2 | 18.0 | 19.0 | .3 | .2 |
| 24 | 26 | 7.8 | .6 | .2 | .7 | 6.0 | 12.4 | 11.5 | 19.0 | .3 | .2 |
| 25 | 26 | 6.9 | 1.7 | .1 | .7 | 8.8 | 15.2 | 8.0 | 16.2 | .2 | .3 |
| 26 | 25 | 5.6 | .3 | 3.2 | ..... | 1.9 | 6.6 | 5.6 | 6.3 | .2 | .1 |
| 27 | 25 | 3.7 | .3 | 2.1 | ..... | 11.5 | 5.1 | 3.1 | 4.1 | .2 | .1 |
| 28 | 25 | 9.6 | .3 | .3 | ..... | 17.1 | 5.0 | 4.0 | 2.9 | .2 | 9.2 |
| 29 | 26 | 14.2 | 5.4 | .3 | ..... | 14.2 | ..... | 4.0 | 1.4 | .2 | .2 |
| 30 | 25 | 11.5 | 3.8 | 11.3 | ..... | 8.0 | ..... | 2.7 | .6 | .2 | .1 |
| 31 | 25 | 14.2 | ..... | 2.2 | ..... | 14.2 | ..... | 2.9 | ..... | .5 | ..... |

NOTE.—Nov. 26 to Jan. 18, clock stopped and discharge estimated in million gallons per day by comparison with record at Opana weir as follows: Nov. 26–31, 4.0; Jan. 1–5, 3.0; and Jan. 6–18, 0.2.

*Monthly discharge of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 33 | 18.0 | 24.2 | 37.4 | 751 | 2,300 |
| August | 36 | 3.7 | 20.3 | 31.4 | 630 | 1,930 |
| September | 13.3 | .2 | 1.90 | 2.94 | 56.9 | 175 |
| October | 11.3 | .1 | .94 | 1.45 | 29.2 | 89 |
| November | 29 | .7 | 9.51 | 14.7 | 285 | 876 |
| December | ..... | ..... | [a] 15.0 | 23.2 | 465 | 1,430 |
| January | 17.1 | ..... | 3.32 | 5.14 | 103 | 316 |
| February | 24 | .5 | 8.69 | 13.4 | 243 | 747 |
| March | 34 | 2.5 | 15.5 | 24.0 | 479 | 1,470 |
| April | 19.0 | .2 | 3.15 | 4.87 | 94.6 | 290 |
| May | 28 | .2 | 2.80 | 4.33 | 86.9 | 266 |
| June | 9.2 | .1 | .45 | .70 | 13.6 | 41 |
| The year | ..... | ..... | 8.87 | 13.7 | 3,240 | 9,930 |

[a] Discharge estimated from Opana weir record.

### KAUHIKOA DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance below crossing of Opana Stream, 8 miles by road west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1919.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—By 25-foot sharp-crested weir.
CHANNEL AND CONTROL.—Large pool at weir.
EXTREMES OF DISCHARGE.—See monthly-discharge table.
DIVERSIONS.—None.
REGULATION.—By gates at frequent intervals.
UTILIZATION.—Irrigation of sugar cane.
ACCURACY.—Records good.
COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

*Daily discharge, in million gallons, of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ..... | 38.8 | 5.8 | ..... | 3.5 | ..... | 3.8 | 8.5 | ..... | 4.2 | 7.5 | ..... |
| 2 | ..... | 36.2 | 11.6 | ..... | 10.4 | 8.1 | ..... | ..... | ..... | ..... | 5.6 | ..... |
| 3 | ..... | 38.1 | 1.7 | ..... | 3.7 | 36.7 | ..... | ..... | ..... | ..... | ..... | ..... |
| 4 | ..... | 35.6 | ..... | ..... | 18.9 | 19.2 | 2.4 | ..... | ..... | ..... | ..... | ..... |
| 5 | ..... | 27.6 | ..... | ..... | 34.1 | 19.2 | 1.8 | ..... | ..... | ..... | 7.6 | ..... |
| 6 | ..... | 31.0 | ..... | ..... | 16.4 | 19.3 | ..... | ..... | 27.7 | ..... | 15.4 | ..... |
| 7 | ..... | 29.2 | ..... | ..... | 4.3 | 19.2 | ..... | ..... | 39.3 | ..... | 10.6 | ..... |
| 8 | ..... | 19.7 | ..... | ..... | ..... | 19.2 | ..... | ..... | 35.2 | ..... | 11.4 | ..... |
| 9 | ..... | 20.5 | ..... | ..... | ..... | 19.2 | ..... | 12.6 | 37.3 | ..... | 19.1 | ..... |
| 10 | ..... | 12.5 | ..... | ..... | ..... | 19.2 | ..... | 11.8 | 39.4 | ..... | 12.1 | ..... |
| 11 | ..... | 6.7 | ..... | ..... | 16.6 | 19.2 | ..... | .9 | 24.0 | ..... | 2.6 | ..... |
| 12 | ..... | 13.2 | ..... | ..... | 73.3 | 19.1 | ..... | 7.8 | 25.0 | ..... | ..... | ..... |
| 13 | ..... | 41.9 | ..... | ..... | 59.6 | 19.1 | ..... | 1.5 | 24.9 | ..... | ..... | ..... |
| 14 | ..... | 43.1 | ..... | ..... | 37.5 | 19.2 | ..... | ..... | 24.9 | ..... | ..... | ..... |
| 15 | 2.7 | 29.0 | ..... | ..... | 15.8 | 19.0 | ..... | ..... | 25.3 | ..... | ..... | ..... |
| 16 | 32.6 | 70.7 | ..... | ..... | 13.9 | 13.9 | ..... | ..... | 29.7 | ..... | 17.5 | ..... |
| 17 | 22.5 | 74.0 | ..... | ..... | 5.3 | 12.2 | ..... | ..... | 39.5 | 3.5 | ..... | ..... |
| 18 | 9.6 | 53.7 | ..... | ..... | ..... | 12.2 | ..... | ..... | 27.0 | ..... | 17.5 | ..... |
| 19 | 7.6 | 25.1 | 8.7 | ..... | ..... | 12.2 | ..... | ..... | 26.7 | ..... | 6.7 | ..... |
| 20 | 13.5 | 25.0 | 1.7 | 1.5 | ..... | 12 2 | ..... | 5.9 | 24.6 | ..... | 1.1 | ..... |
| 21 | 20.3 | 25.1 | ..... | .6 | ..... | 12.0 | ..... | 5.6 | 6.4 | ..... | ..... | 5.6 |
| 22 | 26.3 | 25.1 | ..... | ..... | ..... | 12.0 | ..... | 17.0 | 8.3 | 4.8 | ..... | ..... |
| 23 | 33.4 | 25.1 | ..... | ..... | ..... | 12.0 | ..... | 1.1 | 23.8 | 21.6 | ..... | ..... |
| 24 | 45.1 | 24.4 | ..... | ..... | ..... | 12.0 | ..... | ..... | 23.0 | 28.1 | ..... | ..... |
| 25 | 53.3 | 20.9 | ..... | ..... | ..... | 12.0 | ..... | 9.0 | 20.4 | 29.9 | ..... | ..... |
| 26 | 51.9 | 22.1 | ..... | ..... | ..... | 12.0 | ..... | ..... | 19.9 | 19.2 | ..... | ..... |
| 27 | 44.7 | 17.1 | ..... | ..... | ..... | 12.0 | 3.9 | ..... | 9.8 | 14.3 | ..... | ..... |
| 28 | 8.9 | 22.2 | ..... | ..... | 2.1 | 12.1 | 9.3 | ..... | 5.2 | 11.6 | ..... | 9.9 |
| 29 | 53.8 | 33.1 | 6.0 | ..... | 5.4 | 9.3 | 11.7 | ..... | ..... | 6.5 | ..... | ..... |
| 30 | 44.2 | 18.2 | ..... | 2.2 | 3.6 | ..... | 4.1 | ..... | ..... | ..... | ..... | ..... |
| 31 | 42.0 | 11.1 | ..... | 2.3 | ..... | 5.7 | ..... | ..... | 2.5 | ..... | ..... | ..... |

NOTE.—No flow on days for which discharge is not given.

*Monthly discharge of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July (17 days) | 53.8 | 2.7 | 30.1 | 46.6 | 512 | 1,570 |
| August | 74.0 | 6.7 | 29.5 | 45.6 | 916 | 2,810 |
| September (6 days) | 11.6 | 1.7 | 5.92 | 9.16 | 35.5 | 109 |
| October (4 days) | 2.3 | .6 | 1.65 | 2.55 | 6.6 | 20 |
| November (17 days) | 73.3 | 2.1 | 19.1 | 29.6 | 324 | 996 |
| December (29 days) | 36.7 | 5.7 | 15.5 | 24.0 | 449 | 1,380 |
| January (7 days) | 11.7 | 1.8 | 5.29 | 8.18 | 37.0 | 114 |
| February (11 days) | 17.0 | .9 | 7.43 | 11.5 | 81.7 | 251 |
| March (24 days) | 39.5 | 2.5 | 23.7 | 36.7 | 570 | 1,750 |
| April (10 days) | 29.9 | 3.5 | 14.4 | 22.3 | 144 | 441 |
| May (13 days) | 19.1 | 1.1 | 10.4 | 16.1 | 135 | 413 |
| June (2 days) | 9.9 | 5.6 | 7.75 | 12.0 | 15.5 | 48 |
| The period (140 days) | 74.0 | .6 | 23.0 | 35.6 | 3,230 | 9,900 |

### LOWRIE DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance west of Halehaku Gulch, 8 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1919.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir 16⅔ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool back of weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

*Daily discharge, in million gallons, of Lowri ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 56.9 | 57.5 | 57.6 | 32.2 | 55.8 | 45.5 | 55.9 | 51.6 | 51.4 | 51.6 | 55.1 | 42.4 |
| 2 | 57.8 | 56.8 | 56.4 | 30.4 | 55.7 | 53.9 | 55.6 | 55.7 | 51.3 | 50.6 | 47.9 | 32.2 |
| 3 | 57.2 | 57.4 | 53.1 | 27.5 | 52.7 | 56.9 | 54.9 | 51.3 | 54.1 | 51.7 | 54.6 | 31.5 |
| 4 | 57.9 | 57.3 | 51.9 | 30.7 | 56.8 | 55.0 | 56.0 | 51.3 | 45.5 | 49.1 | 53.1 | 29.9 |
| 5 | 57.0 | 57.7 | 54.4 | 27.9 | 55.7 | 57.1 | 53.4 | 41.5 | 51.1 | 45.8 | 56.0 | 28.4 |
| 6 | 57.5 | 57.6 | 54.9 | 29.7 | 53.3 | 57.2 | 55.0 | 42.6 | 55.7 | 42.9 | 47.5 | 28.3 |
| 7 | 57.4 | 57.0 | 50.7 | 23.7 | 54.6 | 56.1 | 49.3 | 38.0 | 52.8 | 39.9 | 56.1 | 26.5 |
| 8 | 57.3 | 57.2 | 54.2 | 20.3 | 48.9 | 55.8 | 46.7 | 35.7 | 55.3 | 38.4 | 56.0 | 25.7 |
| 9 | 57.5 | 56.6 | 47.9 | 22.7 | 52.3 | 56.1 | 43.9 | 46.1 | 55.3 | 41.0 | 57.3 | 24.7 |
| 10 | 59.9 | 56.5 | 45.4 | 25.5 | 49.0 | 56.3 | 43.1 | 48.5 | 55.5 | 35.6 | 56.2 | 29.2 |
| 11 | 57.7 | 57.1 | 42.4 | 23.2 | 56.2 | 56.2 | 40.0 | 54.5 | 55.7 | 35.9 | 56.7 | 26.8 |
| 12 | 57.8 | 57.6 | 39.7 | 39.0 | 56.2 | 56.3 | 34.1 | 55.4 | 55.8 | 38.5 | 57.0 | 22.1 |
| 13 | 57.5 | 56.4 | 37.6 | 37.7 | 56.8 | 55.7 | 35.7 | 55.1 | 55.6 | 31.9 | 53.2 | 22.6 |
| 14 | 57.4 | 57.2 | 34.0 | 25.3 | 55.9 | 55.7 | 33.4 | 55.9 | 55.7 | 30.5 | 48.7 | 22.0 |
| 15 | 57.3 | 57.9 | 33.4 | 22.5 | 56.8 | 56.0 | 34.3 | 52.9 | 55.7 | 32.2 | 48.5 | 32.0 |
| 16 | 56.9 | 59.1 | 36.0 | 22.6 | 53.1 | 56.0 | 31.9 | 39.8 | 55.0 | 49.6 | 45.5 | 20.9 |
| 17 | 57.5 | 58.0 | 35.5 | 20.9 | 49.9 | 56.0 | 30.3 | 39.9 | 54.8 | 52.7 | 48.4 | 25.9 |
| 18 | 57.7 | 58.0 | 42.3 | 20.1 | 49.9 | 56.0 | 29.0 | 37.6 | 54.4 | 40.6 | 56.2 | 31.6 |
| 19 | 57.4 | 58.0 | 53.7 | 24.2 | 48.3 | 56.2 | 27.1 | 34.2 | 54.0 | 46.7 | 54.8 | 25.9 |
| 20 | 57.5 | 58.0 | 46.3 | 51.1 | 45.6 | 56.4 | 26.8 | 50.1 | 54.2 | 41.5 | 52.9 | 23.1 |
| 21 | 57.6 | 57.9 | 28.6 | 27.1 | 44.0 | 56.4 | 26.6 | 48.4 | 54.1 | 51.1 | 56.9 | 19.6 |
| 22 | 58.9 | 57.9 | 25.4 | 25.5 | 40.7 | 56.4 | 31.1 | 52.2 | 54.9 | 55.3 | 51.2 | 18.9 |
| 23 | 57.5 | 58.0 | 52.4 | 22.1 | 37.7 | 56.3 | 47.4 | 52.2 | 33.9 | 55.0 | 56.0 | 17.9 |
| 24 | 57.5 | 57.9 | 47.4 | 21.0 | 35.3 | 56.0 | 54.9 | 53.3 | .9 | 55.5 | 52.1 | 20.0 |
| 25 | 57.8 | 57.8 | 49.1 | 22.3 | 32.8 | 56.0 | 56.3 | 52.4 | ..... | 55.2 | 47.5 | 17.3 |
| 26 | 57.5 | 57.9 | 34.5 | 50.2 | 32.3 | 55.9 | 42.6 | 52.1 | ..... | 54.8 | 42.3 | 18.8 |
| 27 | 57.7 | 57.8 | 30.6 | 54.8 | 45.7 | 56.2 | 55.1 | 51.6 | ..... | 54.4 | 43.6 | 29.2 |
| 28 | 57.5 | 58.1 | 29.1 | 37.6 | 56.4 | 55.7 | 54.4 | 51.2 | ..... | 52.2 | 39.2 | 44.0 |
| 29 | 57.6 | 55.7 | 39.9 | 38.1 | 56.5 | 53.9 | 58.8 | ..... | 8.1 | 50.0 | 36.8 | 31.2 |
| 30 | 57.5 | 57.7 | 52.4 | 55.0 | 47.8 | 51.9 | 51.9 | ..... | 54.7 | 53.9 | 34.6 | 20.8 |
| 31 | 57.3 | 56.4 | ..... | 46.1 | ..... | 55.7 | 53.4 | ..... | 56.6 | ..... | 37.6 | ..... |

NOTE.—No flow March 25–28.

*Monthly discharge of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 59.9 | 56.9 | 57.6 | 89.1 | 1,790 | 5,480 |
| August | 59.1 | 55.7 | 57.5 | 89.0 | 1,780 | 5,470 |
| September | 57.6 | 25.4 | 43.9 | 67.9 | 1,320 | 4,040 |
| October | 55.0 | 20.1 | 30.9 | 47.8 | 957 | 2,940 |
| November | 56.8 | 32.3 | 49.8 | 77.1 | 1,490 | 4,580 |
| December | 57.2 | 45.5 | 55.5 | 85.9 | 1,720 | 5,280 |
| January | 58.8 | 26.6 | 44.2 | 68.4 | 1,370 | 4,200 |
| February | 55.9 | 34.2 | 48.3 | 74.7 | 1,350 | 4,150 |
| March (27 days) | 56.6 | .9 | 49.7 | 76.9 | 1,340 | 4,120 |
| April | 55.5 | 30.5 | 46.1 | 71.3 | 1,380 | 4,240 |
| May | 57.3 | 34.6 | 50.3 | 77.8 | 1,560 | 4,790 |
| June | 44.0 | 17.3 | 26.3 | 40.7 | 789 | 2,420 |
| The year (361 days) | 59.9 | .9 | 46.7 | 72.3 | 16,800 | 51,700 |

### HAIKU DITCH AT PEAHI WEIR, NEAR HUELO, MAUI.

LOCATION.—In Peahi, 8 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1919.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir, 16⅓ feet long with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

*Daily discharge, in million gallons, of Haiku ditch at Peahi weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 79.4 | 80.7 | 34.3 | 3.9 | 46.2 | 3.7 | 21.8 | 23.2 | 3.4 | 18.3 | 55.8 | 7.2 |
| 2 | 93.9 | 74.7 | 41.5 | 3.8 | 50.2 | 9.9 | 12.8 | 18.1 | 16.6 | 4.0 | 27.4 | 2.1 |
| 3 | 89.6 | 80.8 | 15.7 | 3.9 | 18.0 | 81.3 | 12.2 | 18.7 | 8.0 | 3.6 | 19.1 | 2.0 |
| 4 | 88.1 | 73.9 | 6.8 | 3.8 | 49.0 | 72.9 | 37.7 | 18.8 | 3.5 | 3.3 | 9.8 | 2.0 |
| 5 | 95.4 | 66.3 | 6.6 | 3.8 | 35.9 | 72.9 | 13.9 | 15.8 | 17.8 | 3.1 | 77.7 | 1.9 |
| 6 | 59.6 | 69.6 | 7.7 | 4.0 | 45.5 | 77.2 | 9.4 | 3.4 | 79.7 | 2.8 | 70.5 | 1.9 |
| 7 | 40.2 | 61.1 | 6.4 | 3.9 | 24.7 | 57.9 | 4.8 | 2.7 | 78.6 | 2.5 | 50.4 | 1.8 |
| 8 | 82.1 | 64.0 | 18.8 | 3.8 | 10.0 | 51.4 | 3.5 | 2.6 | 74.9 | 2.5 | 49.9 | 1.8 |
| 9 | 95.0 | 46.3 | 12.5 | 3.8 | 5.2 | 48.5 | 3.2 | 41.9 | 74.6 | 2.5 | 69.7 | 1.8 |
| 10 | 89.4 | 47.1 | 6.2 | 3.8 | 4.0 | 48.5 | 3.2 | 28.2 | 86.4 | 2.5 | 36.3 | 1.8 |
| 11 | 88.4 | 29.6 | 5.8 | 3.8 | 50.7 | 48.5 | 12.0 | 9.4 | 81.8 | 2.5 | 25.4 | 2.0 |
| 12 | 89.7 | 57.0 | 5.1 | 3.8 | 86.9 | 50.3 | 9.0 | 34.6 | 86.3 | 2.5 | 29.5 | 1.8 |
| 13 | 89.6 | 66.1 | 5.0 | 7.7 | 81.0 | 44.9 | 3.1 | 15.3 | 80.8 | 2.3 | 16.1 | 1.7 |
| 14 | 86.1 | 78.0 | 4.9 | 4.3 | 40.3 | 55.2 | 2.8 | 18.3 | 67.0 | 2.0 | 8.1 | 1.7 |
| 15 | 89.7 | 67.7 | 4.9 | 3.8 | 36.0 | 85.8 | 2.8 | 18.2 | 54.4 | 2.0 | 3.4 | 1.7 |
| 16 | 81.9 | 88.8 | 4.9 | 3.8 | 45.9 | 76.5 | 2.8 | 12.6 | 70.4 | 21.7 | 2.5 | 1.8 |
| 17 | 78.6 | 88.8 | 4.9 | 3.8 | 17.9 | 85.4 | 2.3 | 2.0 | 68.6 | 43.6 | 3.6 | 1.9 |
| 18 | 51.2 | 88.8 | 6.0 | 3.6 | 4.2 | 78.0 | 2.8 | 2.0 | 47.2 | 21.1 | 70.3 | 1.8 |
| 19 | 50.5 | 88.8 | 29.3 | 3.6 | 4.9 | 82.9 | 2.8 | 2.0 | 46.3 | 7.4 | 32.4 | 1.8 |
| 20 | 53.2 | 88.8 | 4.8 | 33.5 | 3.8 | 82.3 | 2.8 | 49.6 | 47.7 | 6.0 | 18.0 | 1.6 |
| 21 | 81.8 | 85.0 | 4.8 | 9.6 | 3.6 | 86.1 | 2.7 | 16.0 | 18.2 | 17.7 | 27.8 | 1.6 |
| 22 | 76.2 | 86.7 | 4.7 | 3.7 | 3.6 | 88.2 | 3.2 | 33.9 | 61.2 | 64.0 | 5.9 | 1.5 |
| 23 | 89.2 | 83.7 | 9.5 | 3.7 | 3.5 | 80.2 | 9.3 | 19.4 | 78.9 | 70.3 | 10.3 | 1.5 |
| 24 | 92.8 | 81.8 | 8.0 | 3.6 | 3.5 | 65.7 | 20.8 | 19.2 | 88.7 | 71.4 | 3.2 | 1.5 |
| 25 | 93.2 | 76.9 | 12.0 | 3.6 | 3.5 | 64.5 | 27.4 | 25.6 | 85.7 | 64.4 | 3.0 | 1.5 |
| 26 | 91.7 | 42.1 | 7.3 | 25.7 | 3.5 | 32.6 | 7.6 | 3.4 | 85.7 | 61.1 | 2.8 | 1.5 |
| 27 | 90.8 | 47.2 | 7.6 | 12.5 | 5.7 | 42.8 | 45.7 | 2.8 | 86.0 | 53.6 | 2.7 | 1.5 |
| 28 | 97.3 | 52.6 | 3.8 | 7.2 | 44.8 | 23.7 | 45.4 | 2.5 | 66.6 | 40.0 | 2.4 | 2.2 |
| 29 | 93.9 | 55.6 | 7.2 | 6.1 | 44.8 | 7.0 | 37.2 | ..... | 54.9 | 30.0 | 2.2 | 2.0 |
| 30 | 92.6 | 48.9 | 36.9 | 43.3 | 4.4 | 10.3 | 11.5 | ..... | 28.6 | 9.3 | 2.1 | 1.6 |
| 31 | 90.6 | 45.3 | ..... | 15.6 | ..... | 44.4 | 32.5 | ..... | 38.8 | ..... | 1.9 | ..... |

*Monthly discharge of Haiku ditch at Peahi weir, near Huelo, Maui, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 97.3 | 40.2 | 82.6 | 128 | 2,560 | 7,860 |
| August | 88.8 | 29.6 | 68.2 | 106 | 2,110 | 6,490 |
| September | 41.5 | 3.8 | 11.1 | 17.2 | 334 | 1,020 |
| October | 43.3 | 3.6 | 7.90 | 12.2 | 245 | 752 |
| November | 86.9 | 3.5 | 25.8 | 39.9 | 775 | 2,380 |
| December | 88.2 | 3.7 | 56.8 | 87.9 | 1,760 | 5,400 |
| January | 45.7 | 2.3 | 13.2 | 20.4 | 409 | 1,260 |
| February | 49.6 | 2.0 | 16.4 | 25.4 | 460 | 1,410 |
| March | 88.7 | 3.4 | 57.7 | 89.3 | 1,790 | 5,490 |
| April | 71.4 | 2.0 | 21.3 | 33.0 | 638 | 1,960 |
| May | 77.7 | 1.9 | 23.9 | 37.0 | 740 | 2,270 |
| June | 7.2 | 1.5 | 1.95 | 3.02 | 58.5 | 180 |
| The year | 97.3 | 1.5 | 32.6 | 50.4 | 11,900 | 36,500 |

## MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Maui at points other than regular gaging stations are listed below.

*Miscellaneous measurements on Maui during the year ending June 30, 1919.*

| Date. | Stream. | Locality. | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Apr. 19 | Waihee ditch | 1,000 feet above Lowrie ditch, near Huelo | 2.9 | 1.9 |
| May 26 | Honomanu | Haiku-uka boundary | .95 | .60 |
| 27 | Kolea | Just east of Honomanu ditchman's house, near Huelo. | 1.45 | .95 |
| 27 | Ulawine | (Tributary to Kolea). Just above intake of Honomanu ditch. | .55 | .35 |
| 27 | First stream west of Honomanu stream. | Just below intake of Honomanu ditch | .50 | .30 |
| 27 | New Wailua | First gulch east of Honomanu stream, just below trail. | .30 | .20 |
| 27 | Second tributary east of Honomanu. | 300 feet above trail | .70 | .45 |
| Mar. 10 | Koolau ditch at Alo division weir. | Huelo | 167 | 108 |
| Apr. 18 | ....do | ....do | 63 | 40.5 |
| Mar. 12 | Koolau ditch at Nahiku weir. | Nahiku | 15.8 | 10.2 |
| Apr. 20 | ....do | ....do | 20.9 | 13.5 |
| June 19 | ....do | ....do | 8.6 | 5.6 |

## ISLAND OF MOLOKAI.

### HALAWA STREAM NEAR HALAWA, MOLOKAI.

LOCATION.—250 feet below confluence of two main branches, 2 miles above mouth of stream and Halawa school house.

RECORDS AVAILABLE.—July 1, 1917, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 150 feet above and 100 feet below gage; banks high and steep. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.59 feet, 12.10 a. m. December 3 (discharge, 620 million gallons per day, or 960 second-feet). Minimum stage recorded during year, 0.35 foot, June 9 (discharge, 3.0 million gallons per day, or 4.64 second-feet).

1917–1919: Maximum stage recorded, 7.5 feet at 8 a. m. April 4, 1918 (discharge, from extension of rating curve, 730 million gallons per day, or 1,130 second-feet); minimum stage recorded, 0.35 foot October 13–15 and 19, 1917 (discharge, 0.8 million gallons per day, or 1.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—For irrigation of taro and for domestic supply.

ACCURACY.—Stage-discharge relation unchanged throughout the year. Rating curve well defined below 100 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records good below and poor above 100 million gallons per day.

*Discharge measurements of Halawa Stream near Halawa, Molokai, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| July 8 | C. T. Bailey | 0.82 | 14.7 | 9.5 |
| Oct. 16 | ....do | .49 | 6.8 | 4.4 |
| Jan. 10 | A. H. Wong | .59 | 8.8 | 5.7 |
| Apr. 16 | ....do | 2.60 | 127 | 82 |
| June 7 | H. A. R. Austin | .41 | 4.3 | 2.8 |

*Daily discharge, in million gallons, of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15.3 | 14.0 | 15.0 | 6.3 | 20 | 9.1 | 8.2 | 13.8 | 6.1 | 4.7 | 24 | 11.6 |
| 2 | 11.9 | 9.3 | 11.9 | 5.1 | 15.7 | 42 | 9.6 | 7.4 | 8.2 | 4.5 | 9.1 | 6.3 |
| 3 | 10.3 | 9.3 | 9.7 | 4.5 | 15.6 | 129 | 21 | 13.5 | 20 | 4.2 | 7.5 | 5.6 |
| 4 | 9.9 | 14.5 | 8.3 | 4.7 | 26 | 17.3 | 22 | 14.5 | 7.7 | 4.0 | 12.9 | 7.4 |
| 5 | 32 | 9.5 | 7.5 | 5.8 | 17.8 | 23 | 8.0 | 7.1 | 6.3 | 3.8 | 80 | 6.6 |
| 6 | 13.7 | 9.1 | 7.5 | 15.6 | 8.2 | 79 | 12.4 | 4.8 | 8.0 | 3.7 | 15.3 | 4.6 |
| 7 | 11.9 | 9.7 | 6.5 | 7.5 | 6.6 | 37 | 7.2 | 4.2 | 19.5 | 3.7 | 13.7 | 3.5 |
| 8 | 9.1 | 7.7 | 7.1 | 11.2 | 5.8 | 17.7 | 5.9 | 3.7 | 19.3 | 3.4 | 17.1 | 3.2 |
| 9 | 9.5 | 6.9 | 5.8 | 6.6 | 5.3 | 13.7 | 5.4 | 80 | 7.9 | 6.3 | 26 | 3.1 |
| 10 | 103 | 6.2 | 5.5 | 5.1 | 5.0 | 18.5 | 5.4 | 9.1 | 12.3 | 4.3 | 29 | 3.6 |
| 11 | 18.0 | 5.6 | 5.3 | 4.4 | 7.1 | 15.3 | 5.1 | 7.0 | 7.5 | 3.7 | 20 | 4.5 |
| 12 | 12.2 | 5.6 | 5.1 | 4.4 | 13.7 | 9.1 | 5.5 | 10.5 | 29 | 10.0 | 11.5 | 3.5 |
| 13 | 24 | 36 | 6.9 | 11.1 | 5.8 | 7.4 | 4.8 | 5.6 | 12.9 | 5.4 | 9.5 | 3.1 |
| 14 | 13.4 | 20 | 5.9 | 6.3 | 4.7 | 15.0 | 4.3 | 5.5 | 9.5 | 4.1 | 8.0 | 3.1 |
| 15 | 11.9 | 8.5 | 5.0 | 6.6 | 4.3 | 21 | 4.2 | 5.4 | 7.1 | 28 | 7.2 | 11.8 |
| 16 | 11.9 | 135 | 6.5 | 4.4 | 4.0 | 11.2 | 3.8 | 5.0 | 8.8 | 104 | 7.1 | 5.3 |
| 17 | 9.1 | 34 | 7.9 | 4.4 | 3.9 | 17.3 | 3.7 | 4.5 | 7.5 | 75 | 12.3 | 43 |
| 18 | 8.2 | 23 | 6.3 | 4.3 | 4.0 | 12.4 | 3.5 | 4.2 | 5.6 | 41 | 16.2 | 14.8 |
| 19 | 22 | 14.5 | 5.4 | 6.1 | 3.9 | 9.3 | 3.3 | 3.8 | 8.3 | 47 | 8.7 | 8.9 |
| 20 | 21 | 27 | 4.8 | 5.2 | 3.6 | 26 | 3.2 | 23 | 16.5 | 28 | 6.6 | 8.3 |
| 21 | 33 | ..... | 4.4 | 4.7 | 3.3 | 37 | 3.2 | 9.5 | 40 | 21 | 10.1 | 7.7 |
| 22 | 12.4 | ..... | 4.0 | 13.6 | 3.2 | 10.7 | 3.6 | 13.3 | 173 | 24 | 7.9 | 7.7 |
| 23 | 22 | ..... | ..... | 5.9 | 3.8 | 9.3 | 6.6 | 35 | 48 | 30 | 9.5 | 7.5 |
| 24 | 39 | ..... | ..... | 5.4 | 3.1 | 10.9 | 4.6 | 17.5 | 16.8 | 14.0 | 7.2 | 7.5 |
| 25 | 22 | ..... | ..... | 4.6 | 3.2 | 10.7 | 5.2 | 9.7 | 10.5 | 16.2 | 6.6 | 10.4 |
| 26 | 13.2 | 9.3 | ..... | 8.1 | 61 | 7.4 | 3.9 | 6.8 | 8.3 | 14.2 | 5.8 | 49 |
| 27 | 9.9 | 9.3 | ..... | 8.4 | 17.4 | 6.2 | 11.5 | 12.0 | 7.4 | 12.4 | 8.2 | 12.4 |
| 28 | 29 | ..... | 4.2 | 8.6 | 35 | 5.8 | 17.0 | 6.2 | 9.1 | 10.5 | 7.2 | 9.3 |
| 29 | 37 | ..... | 21 | 28 | 52 | 7.1 | 7.2 | ..... | 9.5 | 9.3 | 6.5 | 13.0 |
| 30 | 11.2 | ..... | 35 | 91 | 13.7 | 72 | 5.0 | ..... | 5.8 | 17.6 | 5.5 | 7.2 |
| 31 | 21 | ..... | ..... | 14.9 | ..... | 24 | 16.5 | ..... | 5.4 | ..... | 16.0 | ..... |

NOTE.—No record Aug. 21–25, Aug. 28 to Sept. 1, and Sept. 23–27. Discharge has been estimated as follows in million gallons per day: Aug. 21–25, 12; Aug. 28–31, 25; Sept. 1 as shown; Sept. 23–27, 4.0.

*Monthly discharge of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 103 | 8.2 | 20.2 | 31.3 | 627 | 1,920 |
| August | 135 | 5.6 | 18.9 | 29.2 | 584 | 1,800 |
| September | 35 | 4.0 | 7.76 | 12.0 | 233 | 714 |
| October | 91 | 4.3 | 10.4 | 16.1 | 323 | 989 |
| November | 61 | 3.1 | 12.6 | 19.5 | 377 | 1,160 |
| December | 129 | 5.8 | 23.6 | 36.5 | 732 | 2,250 |
| January | 22 | 3.2 | 7.46 | 11.5 | 231 | 710 |
| February | 80 | 3.7 | 12.2 | 18.9 | 343 | 1,050 |
| March | 173 | 5.4 | 18.1 | 28.0 | 562 | 1,720 |
| April | 104 | 3.4 | 18.6 | 28.8 | 558 | 1,710 |
| May | 80 | 5.5 | 13.9 | 21.5 | 432 | 1,320 |
| June | 49 | 3.1 | 9.78 | 15.1 | 294 | 900 |
| The year | 173 | 3.1 | 14.5 | 22.4 | 5,300 | 16,200 |

### MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Molokai at points other than regular gaging stations are listed below:

*Miscellaneous measurements on Molokai during the year ending June 30, 1919.*

| Date. | Stream. | Tributary to— | Locality. | Discharge. | |
|---|---|---|---|---|---|
| | | | | Second-feet. | Million gallons per day. |
| May 29 | Intake ditch | Kalaupapa water supply. | Near Kalaupapa | 4.2 | 2.7 |
| 29 | Waikolu | | do | 8.5 | 5.5 |
| 29 | do | | Above gaging station | 8.3 | 5.4 |
| June 1 | do | | Near Kalaupapa | 8.8 | 5.7 |
| 8 | Wailau, right branch. | Wailau | Elevation 650 feet, Wailau | 3.8 | 2.4 |
| 8 | Wailau (main stream). | | do | 14.8 | 9.5 |
| 8 | Wailau, left branch. | Wailau | Elevation 800 feet, Wailau | 7.7 | 5.0 |
| 8 | Tributary | Left branch of Wailau. | Elevation 540 feet, Wailau | 1.65 | 1.05 |
| 8 | Wailau, left branch. | Wailau | At mouth, elevation 420 feet, Wailau. | 10.5 | 6.8 |
| 9 | Anapuni | Pelekunu, on right | Near Pelekunu | 5.1 | 3.3 |
| 9 | Pelekunu | | Above Anapuni and below upper branches. | 4.8 | 3.1 |
| 9 | Pilipililau | Pelekunu, on left | | 2.0 | 1.3 |
| 10 | Papala | | Between Halawa and Wailau; elevation 50 feet. | 7.6 | 4.9 |
| 11 | Waikolu | Kalaupapa water supply. | Elevation 600 feet and 1,000 feet above intake to Kalaupapa water supply. | 7.7 | 5.0 |
| 11 | Intake ditch | Kalaupapa water supply and diverts from Waikolu. | Near Kalaupapa | 4.3 | 2.8 |

## ISLAND OF HAWAII.

### OLAA FLUME AT KAUMANA, NEAR HILO, HAWAII.

LOCATION.—1,000 feet above house of Olaa Sugar Co.'s ditchman at Kaumana and 7 miles by road above Hilo.

RECORDS AVAILABLE.—December 1, 1917, to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from foot plank across flume 5 feet above gage.

CHANNEL AND CONTROL.—Channel is semicircular Armco metal flume 45 inches in diameter, straight for several hundred feet above and below station. Control is bottom of flume, not well defined but permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 1.70 feet at 1 p. m. December 8 (discharge, 14.2 million gallons per day, or 22 second-feet); minimum stage recorded during the year, 0.75 foot at 6 p. m. April 19 (discharge, 1.8 million gallons per day, or 2.8 second-feet).

1917–1919: Maximum stage recorded, 1.77 feet at 1 p. m. April 3, 1918 (discharge, 16.3 million gallons per day, or 25.2 second-feet); minimum stage recorded, −0.07 foot at noon December 31, 1917 (discharge, zero).

DIVERSIONS.—None.

REGULATION.—By headgates.

UTILIZATION.—For fluming cane to Olaa Sugar Co.'s mill and for water supply for mill.

ACCURACY.—Stage-discharge relation affected somewhat by growth of moss in flume. Two rating curves not well defined; one applicable December 2 to 11, 1917, and March 16, 1918, to June 24, 1920, and the other December 12, 1917, to February 15, 1918. Discharge from February 16 to March 15, 1918, computed by shifting-channel method. Operation of water-stage recorder fair. Records fair.

*Discharge measurements of Olaa flume at Kaumana, near Hilo, Hawaii, during the years ending June 30, 1918 and 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| 1917–18. | | | | |
| Sept. 30 | H. A. R. Austin | 0.34 | 0.65 | 0.4 |
| Dec. 2 | do | 1.31 | 11.0 | 7.1 |
| 2 | do | 1.32 | 11.0 | 7.1 |
| Jan. 1 | do | .89 | 6.3 | 4.1 |
| 13 | do | 1.22 | 13.0 | 8.4 |
| Feb. 24 | do | 1.65 | 24.5 | 15.8 |
| Mar. 24 | do | 1.57 | 17.8 | 11.5 |
| May 1 | do | 1.57 | 13.5 | 8.7 |
| June 9 | do | 1.46 | 12.5 | 8.1 |
| 9 | do | 1.45 | 12.5 | 8.1 |
| 1918–19. | | | | |
| Sept. 8 | R. D. Klise | 1.49 | 15.8 | 10.2 |
| 8 | do | 1.49 | 15.7 | 10.1 |
| Nov. 24 | A. H. Wong | 1.34 | 14.5 | 9.4 |
| Jan. 6 | do | 1.44 | 13.6 | 8.8 |
| Mar. 27 | H. A. R. Austin | 1.475 | 15.3 | 9.9 |
| May 1 | do | 1.53 | 16.9 | 10.9 |
| June 20 | do | 1.33 | 12.1 | 7.8 |

*Daily discharge, in million gallons, of Olaa flume at Kaumana, near Hilo, Hawaii, for the years ending June 30 1918–1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1917–18. | | | | | | | | | | | | |
| 1 | | | | | | 7.0 | 4.0 | 10.4 | 11 | 12.0 | 11.4 | 13.8 |
| 2 | | | | | | 7.0 | 4.0 | 9.7 | 13 | 13.4 | 11.2 | 13.4 |
| 3 | | | | | | 6.7 | 4.0 | 9.4 | 14 | 14.5 | 12.6 | 12.8 |
| 4 | | | | | | 6.1 | 4.6 | 13.3 | 13 | 14.0 | 14.2 | 12.2 |
| 5 | | | | | | 6.5 | 6.1 | 15.3 | 13 | 14.5 | 14.2 | 11.6 |
| 6 | | | | | | 7.0 | 6.1 | 13.3 | 13 | 13.4 | 14.2 | 11.4 |
| 7 | | | | | | 6.4 | 6.0 | 14.3 | 12 | 11.8 | 13.0 | 10.8 |
| 8 | | | | | | 6.2 | 5.9 | 14.3 | 12 | 11.2 | 11.8 | 10.8 |
| 9 | | | | | | 6.4 | 5.7 | 14.3 | 11 | 13.6 | 11.0 | 10.4 |
| 10 | | | | | | 7.4 | 5.4 | 17.3 | 11 | 14.2 | 11.0 | 9.5 |
| 11 | | | | | | 7.2 | 6.0 | 16.3 | 12 | 14.2 | 11.2 | 9.3 |
| 12 | | | | | | 2.6 | 9.5 | 15.3 | 14 | 13.8 | 10.4 | 10.8 |
| 13 | | | | | | 2.1 | 8.7 | 14.3 | 13 | 13.6 | 10.8 | 12.4 |
| 14 | | | | | | 1.2 | 8.0 | 13.3 | 11 | 13.8 | 11.6 | 10.8 |
| 15 | | | | | | 3.0 | 7.7 | 12.4 | 10 | 13.2 | 11.4 | 9.8 |
| 16 | | | | | | 3.2 | 7.4 | 14 | 10.2 | 12.4 | 12.2 | 10.8 |
| 17 | | | | | | 4.5 | 7.1 | 15 | 10.0 | 12.2 | 11.8 | 11.2 |
| 18 | | | | | | 4.9 | 6.7 | 14 | 9.7 | 12.0 | 12.4 | 11.6 |
| 19 | | | | | | 2.6 | 6.4 | 16 | 9.8 | 11.2 | 11.4 | 10.8 |
| 20 | | | | | | 1.7 | 6.1 | 17 | 10.2 | 11.2 | 10.8 | 10.0 |
| 21 | | | | | | .8 | 5.7 | 17 | 10.0 | 11.8 | 10.8 | 10.4 |
| 22 | | | | | | .3 | 5.3 | 16 | 10.2 | 11.6 | 11.4 | 11.4 |
| 23 | | | | | | .3 | 5.0 | 16 | 11.4 | 11.2 | 11.8 | 11.0 |
| 24 | | | | | | 2.2 | 4.8 | 15 | 11.6 | 11.4 | 11.4 | 10.8 |
| 25 | | | | | | 1.1 | 5.7 | 14 | 12.2 | 11.4 | 11.0 | 11.6 |
| 26 | | | | | | 2.9 | 10.8 | 12 | 13.8 | 10.8 | 11.4 | 11.8 |
| 27 | | | | | | 1.1 | 12.4 | 11 | 12.8 | 11.6 | 11.4 | 10.4 |
| 28 | | | | | | .1 | 11.5 | 12 | 12.2 | 12.2 | 11.2 | 10.0 |
| 29 | | | | | | .4 | 11.5 | ..... | 11.2 | 11.6 | 13.6 | 9.7 |
| 30 | | | | | | .07 | 12.2 | ..... | 11.8 | 11.4 | 14.0 | 8.6 |
| 31 | | | | | | 1.8 | 11.3 | ..... | 12.4 | ..... | 14.2 | ..... |

*Daily discharge, in million gallons, of Olaa flume at Kaumana, near Hilo, Hawaii, for the years ending June 30, 1918–1919*—Continued.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1918-19. | | | | | | | | | | | | |
| 1 | 8.8 | 11.6 | 11.6 | 8.9 | ..... | 9.7 | 11.2 | 11.6 | 4.2 | 6.2 | 9.3 | 2.2 |
| 2 | 10.4 | 10.4 | 11.4 | 8.2 | ..... | 9.5 | 10.4 | 11.8 | 5.0 | 5.5 | 9.3 | 2.1 |
| 3 | 11.4 | 10.2 | 10.4 | 7.8 | ..... | 9.3 | 9.8 | 11.4 | 5.3 | 5.0 | 9.5 | 2.1 |
| 4 | 11.2 | 9.5 | 10.4 | 8.3 | ..... | 10.8 | 9.7 | 11.2 | 5.5 | 4.6 | 9.7 | 2.2 |
| 5 | 11.0 | 9.3 | 10.6 | 8.8 | ..... | 11.2 | 8.9 | 10.4 | 5.5 | 4.3 | 8.8 | 2.2 |
| 6 | 10.6 | 9.5 | 9.8 | 7.9 | ..... | 11.6 | 9.8 | 9.1 | 6.0 | 4.1 | 7.8 | 2.2 |
| 7 | 9.5 | ..... | 9.8 | 7.0 | ..... | 12.6 | 10.8 | 7.8 | 8.4 | 3.8 | 7.1 | 2.1 |
| 8 | 9.7 | ..... | 10.0 | 6.7 | ..... | 14.0 | 10.0 | 7.0 | 12.8 | 3.6 | 6.7 | 2.0 |
| 9 | 9.8 | ..... | 9.7 | 6.7 | ..... | 12.8 | 9.1 | 6.2 | 13.0 | 3.5 | 6.1 | 2.3 |
| 10 | 11.4 | ..... | 10.4 | 6.2 | ..... | 10.8 | 8.6 | 5.7 | 12.8 | 3.2 | 9.8 | 2.8 |
| 11 | 12.2 | 11.6 | 11.0 | 6.4 | ..... | 11.0 | 8.1 | 5.0 | 12.8 | 3.2 | 12.0 | ..... |
| 12 | 12.0 | 11.2 | 10.4 | 8.9 | ..... | 11.0 | 7.4 | 4.5 | 12.4 | 3.0 | 11.4 | ..... |
| 13 | 11.0 | 10.6 | 9.8 | 10.6 | ..... | 10.6 | 7.3 | 4.4 | 11.0 | 2.9 | 10.4 | ..... |
| 14 | 10.0 | 12.0 | 9.1 | 9.7 | ..... | 9.5 | 7.3 | 4.5 | 11.0 | 2.7 | 9.5 | ..... |
| 15 | 10.6 | 12.0 | 8.6 | 7.9 | ..... | 10.4 | 7.0 | 4.7 | 11.0 | 2.5 | 8.6 | ..... |
| 16 | 11.2 | 11.8 | 8.8 | 7.0 | ..... | 11.4 | 6.2 | 4.5 | 9.8 | 2.4 | 7.9 | ..... |
| 17 | 10.8 | 12.0 | 9.3 | 2.8 | ..... | 11.4 | 5.7 | 4.1 | 10.0 | 2.3 | 7.4 | ..... |
| 18 | 10.2 | 12.0 | 10.4 | 2.9 | ..... | 10.8 | 5.1 | 3.8 | 10.2 | 2.1 | 6.8 | ..... |
| 19 | ..... | 11.6 | 11.0 | 6.6 | ..... | 10.6 | 4.7 | 3.5 | 10.2 | 2.1 | 6.0 | ..... |
| 20 | ..... | 11.2 | 12.8 | 12.2 | ..... | 12.2 | 4.3 | 3.4 | 10.4 | 2.4 | 5.3 | 7.1 |
| 21 | ..... | 10.8 | 11.4 | 10.0 | ..... | 12.4 | 4.1 | 3.3 | 10.4 | 3.0 | 4.8 | 7.0 |
| 22 | 12.0 | 10.2 | 9.7 | 1.9 | ..... | 11.8 | 3.8 | 3.5 | 11.2 | 4.1 | 4.4 | 6.5 |
| 23 | 12.2 | 10.4 | 10.2 | ..... | ..... | 10.2 | 4.4 | 3.6 | 11.8 | 6.8 | 4.0 | 5.7 |
| 24 | 13.2 | 10.8 | 12.0 | ..... | ..... | 8.9 | 7.9 | 3.8 | 11.2 | 9.3 | 3.6 | 5.3 |
| 25 | 13.4 | 10.6 | 12.0 | ..... | 7.0 | 8.2 | 10.6 | 3.9 | 10.8 | 13.4 | 3.3 | 4.8 |
| 26 | 13.6 | 10.6 | 12.4 | ..... | 6.8 | 8.1 | 9.7 | 4.0 | 10.4 | 11.8 | 3.1 | 4.4 |
| 27 | 13.6 | 10.8 | 11.2 | ..... | 6.4 | 7.8 | 9.7 | 3.8 | 9.7 | 10.2 | 3.0 | 4.2 |
| 28 | 13.4 | 10.4 | 10.2 | ..... | 6.2 | 9.3 | 12.4 | 3.7 | 8.2 | 10.6 | 2.8 | 4.2 |
| 29 | 13.4 | 10.4 | 11.2 | ..... | 8.2 | 9.3 | 12.8 | ..... | 7.6 | 10.4 | 2.6 | 4.6 |
| 30 | 13.4 | 10.0 | 10.6 | ..... | 9.7 | 8.6 | 12.4 | ..... | 7.3 | 9.1 | 2.4 | 4.5 |
| 31 | 12.8 | 10.2 | ..... | ..... | ..... | 10.4 | 11.2 | ..... | 6.7 | ..... | 2.3 | ..... |

NOTE.—Recorder not working or not working properly and discharge estimated in million gallons per day as follows, during the year ending June 30, 1919: July 19–21, 11.0; Aug. 7–10, 10.5; Oct. 23–31, 5.0; Nov. 1–24, 8.0; June 11–15, 4.0; and June 16–19, 6.0.

*Monthly discharge of Olaa flume at Kaumana, near Hilo, Hawaii, for the years ending June 30, 1918–1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| 1917-18. | | | | | | |
| December | 7.4 | 0.07 | 3.57 | 5.52 | 111 | 340 |
| January | 12.4 | 4.0 | 7.15 | 11.1 | 222 | 680 |
| February | 17.3 | 9.4 | 14.0 | 21.7 | 392 | 1,200 |
| March | 14 | 9.7 | 11.7 | 18.1 | 362 | 1,110 |
| April | 14.5 | 10.8 | 12.5 | 19.3 | 375 | 1,150 |
| May | 14.2 | 10.4 | 12.0 | 18.6 | 371 | 1,140 |
| June | 13.8 | 8.6 | 11.0 | 17.0 | 330 | 1,010 |
| The period | ..... | ..... | ..... | ..... | 2,160 | 6,630 |
| 1918-19. | | | | | | |
| July | 13.6 | 8.8 | 11.5 | 17.8 | 356 | 1,090 |
| August | 12.0 | 9.3 | 10.8 | 16.7 | 334 | 1,030 |
| September | 12.8 | 8.6 | 10.5 | 16.2 | 316 | 967 |
| October | 12.2 | 1.9 | 6.72 | 10.4 | 208 | 639 |
| November | ..... | ..... | 7.88 | 12.2 | 236 | 725 |
| December | 14.0 | 7.8 | 10.5 | 16.2 | 326 | 999 |
| January | 12.8 | 3.8 | 8.40 | 13.0 | 260 | 799 |
| February | 11.8 | 3.3 | 5.86 | 9.07 | 164 | 504 |
| March | 13.0 | 4.2 | 9.44 | 14.6 | 293 | 898 |
| April | 13.4 | 2.1 | 5.27 | 8.15 | 158 | 485 |
| May | 12.0 | 2.3 | 6.64 | 10.3 | 206 | 632 |
| June | 7.1 | 2.0 | 4.15 | 6.42 | 124 | 382 |
| The year | ..... | ..... | 8.17 | 12.6 | 2,980 | 9,150 |

### WAILUKU RIVER NEAR HILO, HAWAII.

LOCATION.—Below confluence of all main branches, 300 feet above intake of Hilo Electric Light Co.'s power canal, and 1½ miles above Hilo.

RECORDS AVAILABLE.—March 21, 1911, to July 21, 1913, and January 2 to June 30, 1919.

GAGE.—Stevens continuous water-stage recorder. March 21, 1911, to July 13, 1913, Barrett and Lawrence water-stage recorder at same location and datum.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and 350 feet below gage; right bank slopes gently; left bank steep and high. Control is concrete diversion dam and portal of power canal; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 22.0 feet at 9.45 a. m. July 10 (discharge, 10,400 million gallons per day or 16,100 second feet); minimum stage not recorded because float was resting on mud in well.

Maximum stage recorded during period of record 24.5 feet, high-water mark of flood February 19, 1918 (discharge estimated from extension of rating curve, 9,000 million gallons per day, or 13,900 second feet); minimum stage recorded, 4.11 feet June 7, 1912 (discharge, 21 million gallons per day, or 32 second feet).

DIVERSIONS.—Hilo Boarding School ditch and several plantation flumes divert small amount of water above station.

REGULATION.—None.

UTILIZATION.—For power, fluming sugar cane, and irrigation of taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well-defined throughout. Operation of water-stage recorder unsatisfactory at times as given in footnote to table of daily discharge. Observer unintelligent and gage height corrections to notes on records of stage recorder uncertain. Records good.

*Discharge measurements of Wailuku River near Hilo, Hawaii, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 9 | R. D. Klise | 7.85 | 196 | 127 |
| Nov. 4 | A. H. Wong | 8.86 | 390 | 252 |
| Dec. 31 | ....do | 8.22 | 220 | 142 |
| Mar. 20 | H. A. R. Austin | 8.12 | 213 | 138 |
| May 1 | ....do | 7.26 | 133 | 86 |
| June 20 | ....do | 6.53 | 87 | 56 |

*Daily discharge, in million gallons, of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 238 | 480 | 200 | 166 | 116 | ..... | 142 | 96 | 85 | 64 | 80 | 40 |
| 2 | 840 | 380 | 178 | 142 | 570 | ..... | 132 | 85 | 72 | 57 | 68 | 64 |
| 3 | 565 | 294 | 154 | 124 | 405 | 883 | 116 | 80 | 68 | 50 | 60 | ..... |
| 4 | 535 | 238 | 132 | 108 | 431 | 821 | 102 | 116 | 57 | 47 | 60 | ..... |
| 5 | 455 | 254 | 124 | 90 | 684 | 380 | 90 | 57 | 64 | ..... | 57 | ..... |
| 6 | 314 | 222 | 116 | 85 | 405 | 1,050 | 80 | 54 | 108 | ..... | 50 | ..... |
| 7 | 238 | 254 | 102 | 80 | 274 | 608 | 68 | 47 | 704 | ..... | 45 | ..... |
| 8 | 190 | 206 | 102 | 108 | 238 | 2,900 | 60 | 45 | 671 | ..... | 40 | ..... |
| 9 | 178 | 178 | 116 | 85 | 778 | 765 | 57 | 45 | 520 | ..... | 124 | ..... |
| 10 | 4,260 | 423 | 96 | 80 | 455 | 1,530 | 57 | 42 | 1,740 | ..... | 178 | 50 |
| 11 | 1,040 | 222 | 85 | 132 | 1,540 | 2,530 | 57 | 42 | ..... | ..... | 132 | 60 |
| 12 | 625 | 206 | 80 | 396 | 2,490 | 1,150 | 54 | 47 | ..... | ..... | 72 | 85 |
| 13 | 455 | 1,720 | 76 | 222 | ..... | 455 | 54 | 60 | ..... | ..... | 60 | 50 |
| 14 | 380 | 430 | 72 | 166 | ..... | 1,110 | 47 | 60 | ..... | ..... | 64 | 50 |
| 15 | 480 | 405 | 80 | 132 | ..... | 1,890 | 45 | 50 | ..... | ..... | 57 | 90 |
| 16 | 314 | 1,560 | 96 | 132 | ..... | 595 | ..... | ..... | ..... | ..... | 50 | 72 |
| 17 | 274 | 2,110 | 102 | 102 | ..... | 625 | ..... | ..... | 238 | ..... | ..... | 54 |
| 18 | 238 | 2,530 | 102 | 121 | ..... | 505 | ..... | ..... | 166 | ..... | ..... | 57 |
| 19 | 206 | ..... | 206 | 611 | ..... | 1,670 | ..... | ..... | 142 | ..... | ..... | 57 |
| 20 | 178 | ..... | 154 | 685 | ..... | 3,060 | ..... | ..... | 142 | ..... | ..... | 57 |
| 21 | 314 | ..... | 116 | 356 | ..... | 625 | ..... | 47 | 142 | 60 | ..... | 47 |
| 22 | 222 | ..... | 90 | 274 | ..... | ..... | ..... | 45 | 154 | 222 | ..... | 42 |
| 23 | 571 | ..... | 142 | 206 | ..... | ..... | 142 | 47 | 154 | 96 | ..... | 36 |
| 24 | 706 | ..... | 132 | 166 | ..... | ..... | 142 | 45 | 124 | 190 | ..... | 38 |
| 25 | 3,080 | ..... | 178 | 154 | ..... | ..... | 64 | 54 | 102 | 380 | ..... | 36 |
| 26 | 3,220 | ..... | 190 | 166 | ..... | ..... | 47 | 45 | 85 | 190 | ..... | 47 |
| 27 | 1,000 | ..... | 154 | 142 | ..... | ..... | 108 | 38 | 76 | 238 | ..... | 72 |
| 28 | 2,050 | ..... | 348 | 124 | ..... | ..... | 142 | 47 | 72 | 190 | ..... | 166 |
| 29 | 1,920 | ..... | 384 | 108 | ..... | ..... | 154 | ..... | 68 | 132 | ..... | 132 |
| 30 | 920 | ..... | 206 | 108 | ..... | 178 | 96 | ..... | 72 | 96 | ..... | 100 |
| 31 | 625 | ..... | ..... | 116 | ..... | 154 | 80 | ..... | 68 | ..... | ..... | ..... |

NOTE.—Recorder not working properly and discharge estimated for the following periods in million gallons per day: Aug. 19–31, 500; Nov. 13–15, 500; Nov. 16–25, 200; Nov. 26–30, 500; Dec. 1 and 2, 200; Dec. 22–29, 400; Jan. 16–22, 40; Feb. 16–20, 45; Mar. 11–16, 200; Apr. 5–20, 40; May 17 to June 1, 40; June 3–9, 40; Dec. 4 as shown.

*Monthly discharge of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 4,260 | 178 | 859 | 1,330 | 26,600 | 81,700 |
| August | 2,530 | 178 | 600 | 928 | 18,600 | 57,100 |
| September | 384 | 72 | 144 | 223 | 4,310 | 13,300 |
| October | 685 | 80 | 183 | 283 | 5,690 | 17,400 |
| November | 2,490 | 116 | 480 | 743 | 14,400 | 44,200 |
| December | 3,060 | 154 | 874 | 1,350 | 27,100 | 83,100 |
| January | 154 | ..... | 77.9 | 121 | 2,420 | 7,410 |
| February | 116 | 38 | 54.2 | 83.9 | 1,520 | 4,660 |
| March | 1,740 | 57 | 229 | 354 | 7,090 | 21,800 |
| April | 380 | ..... | 88.4 | 137 | 2,650 | 8,140 |
| May | 178 | ..... | 58.0 | 89.7 | 1,800 | 5,520 |
| June | 166 | 36 | 59.4 | 91.9 | 1,780 | 5,470 |
| The year | 4,260 | | 312 | 483 | 114,000 | 350,000 |

### HILO BOARDING SCHOOL DITCH NEAR HILO, HAWAII.

LOCATION.—200 feet below upper crossing of County road at Piihonua, 3½ miles west of Hilo.

RECORDS AVAILABLE.—February 23, 1918, to June 30, 1919.

GAGE.—Gurley 8-day water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by 3-foot sharp-crested weir with full contractions.

CHANNEL AND CONTROL.—Weir basin is pool about 10 by 20 feet having a set of baffles 15 feet above weir to prevent velocity of approach.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.25 feet at 6.45 p. m. April 24 (weir overflowed; discharge, about 8.3 million gallons or 12.8 second-feet); minimum stage recorded, 0.04 foot at 5 p. m. July 12 (discharge, 0.05 million gallons per day, or 0.08 second-foot).

DIVERSIONS.—Ditch diverts from Wailuku River. One small diversion above station occasionally used for fluming cane.

REGULATION.—By spillways and check gate for diversion.

UTILIZATION.—For irrigation and for domestic supply.

ACCURACY.—Conditions at weir good for stages below 2.2 million gallons per day, above that stage there is slight velocity of approach. Records good.

The following discharge measurement was made by James E. Stewart:

March 27, 1919: Gage height 0.71 foot; discharge, 5.6 second-feet, or 3.6 million gallons per day.

*Daily discharge, in million gallons, of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.1 | 0.3 | ..... | 2.3 | 1.9 | 2.1 | 1.5 | 4.5 | 4.8 | 3.3 | 4.1 | 1.5 |
| 2 | 3.5 | ..... | ..... | 2.0 | 2.8 | 2.0 | 1.4 | 4.5 | 4.7 | 2.8 | 3.9 | .9 |
| 3 | 3.3 | ..... | ..... | 1.9 | 2.7 | 2.2 | 1.4 | 4.4 | 4.6 | 2.2 | 3.8 | .9 |
| 4 | 3.2 | ..... | ..... | 1.6 | 2.6 | 1.5 | 1.4 | 4.1 | 4.0 | 2.0 | 3.5 | .8 |
| 5 | 3.1 | ..... | ..... | 1.6 | 2.8 | 1.4 | 1.5 | 3.7 | 4.3 | 1.7 | 3.5 | .7 |
| 6 | 3.0 | ..... | ..... | 1.6 | 2.6 | 1.6 | 1.4 | 3.4 | 4.8 | 1.7 | 3.1 | .8 |
| 7 | 2.7 | ..... | ..... | 1.4 | 2.4 | 2.3 | 1.9 | 3.2 | 6.4 | 1.6 | 2.7 | .8 |
| 8 | 2.5 | ..... | ..... | 2.0 | 2.1 | 2.7 | 2.4 | 3.0 | 6.4 | 1.6 | 2.4 | .8 |
| 9 | 2.4 | ..... | 1.9 | 1.8 | 2.5 | 1.5 | 3.1 | 2.7 | 6.3 | 1.7 | 4.4 | .7 |
| 10 | 2.1 | ..... | 1.8 | 2.0 | 2.4 | 1.7 | 3.0 | 2.6 | 6.5 | 1.5 | 4.8 | 1.7 |
| 11 | .1 | ..... | 1.8 | 2.7 | 3 0 | 2.4 | 3.3 | 2.5 | 6.2 | 1.8 | 4.8 | 2.4 |
| 12 | .2 | ..... | 1.8 | 3.4 | 3.3 | 2.3 | 3.2 | 2.9 | 5.8 | 1.9 | 4.2 | 2.1 |
| 13 | .8 | ..... | 1.8 | 3 0 | 2.7 | 2.1 | 3.1 | 3.5 | 5.6 | 2.7 | 3.6 | 2.0 |
| 14 | .8 | ..... | 1.6 | 2.5 | 2.4 | 2.6 | 3.2 | 3.5 | 5.4 | 1.5 | 3.6 | 2.3 |
| 15 | .8 | ..... | 1.7 | 2.3 | 2.3 | 2.7 | 2.1 | 3.2 | 5.2 | 1.2 | 3.0 | 2.3 |
| 16 | .8 | ..... | 2.0 | 2.4 | 2.1 | 2.1 | 2.2 | 2.7 | 5.3 | 1.1 | 2.4 | 1.0 |
| 17 | .8 | ..... | 2.0 | 2.1 | 2.1 | 2.0 | 2.1 | 2.4 | 5.6 | 1.1 | 2.6 | 1.9 |
| 18 | .9 | ..... | 2.0 | 2.3 | 2.2 | 1.8 | 1.8 | 2.3 | 5.3 | 1.1 | 2.5 | 2.2 |
| 19 | .8 | ..... | 2.5 | 3.2 | 2.5 | 1.8 | 1.5 | 2.3 | 4.5 | 1.4 | 2.6 | 1.3 |
| 20 | .8 | ..... | 2.3 | 3.0 | 2.5 | 2.7 | 1.5 | 2.3 | 3.9 | 2.5 | 2.3 | .8 |
| 21 | .9 | ..... | 1.6 | 2.7 | 2.3 | 3.2 | 1.2 | 3.1 | 4.4 | 2.9 | 2.1 | 1.3 |
| 22 | .8 | ..... | .4 | 2.6 | 2.3 | 3.1 | 1.7 | 3.0 | 4.6 | 5.3 | 2.0 | 1.6 |
| 23 | .9 | ..... | 2.6 | 2.5 | 3.5 | 2.6 | 4.7 | 3.2 | 5.1 | 5.8 | 2,0 | 1.3 |
| 24 | 1.1 | ..... | 3.4 | 2.3 | 2.2 | 1.8 | 5.0 | 3.3 | 4.4 | 6.7 | 2.3 | .9 |
| 25 | 1.7 | ..... | 3.8 | 2.3 | 1.7 | 1.6 | 4.3 | 3.7 | 4.1 | 6.8 | 2.3 | 1.4 |
| 26 | 1.3 | ..... | 4.0 | 2.1 | 1.7 | 1.2 | 3.6 | 3.0 | 3.8 | 6.3 | 2.1 | 1.8 |
| 27 | .5 | ..... | 3.7 | 2.0 | 2.1 | 1.5 | 4.8 | 2.7 | 3.7 | 5.8 | 2.0 | 1.8 |
| 28 | .7 | ..... | 4.3 | 1.9 | 2.2 | 1.5 | 5.1 | 3.6 | 3.5 | 4.7 | 2.0 | 2.0 |
| 29 | .6 | ..... | 3.8 | 1.8 | 4.0 | 1.5 | 5.2 | ..... | 3.5 | 4.6 | 1.9 | 1.8 |
| 30 | .4 | ..... | 2.5 | 1.8 | 2.8 | 1.6 | 4.5 | ..... | 4.8 | 4.3 | 1.8 | 1.7 |
| 31 | .3 | ..... | ..... | 1.8 | ..... | 1.5 | 4.4 | ..... | 3.5 | ..... | 1.6 | ..... |

NOTE.—Clock stopped and discharge estimated in million gallons per day as follows: Aug. 2-5, 0.3; Aug. 6 to Sept. 8, 2.0.

*Monthly discharge of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 3.5 | 0.1 | 1.45 | 2.24 | 44.9 | 138 |
| August | ..... | .3 | 1.73 | 2.68 | 53.5 | 165 |
| September | 4.3 | .4 | 2.31 | 3.57 | 69.3 | 213 |
| October | 3.4 | 1.4 | 2.22 | 3.43 | 68.9 | 211 |
| November | 4.0 | 1.7 | 2.49 | 3.85 | 74.7 | 229 |
| December | 3.2 | 1.2 | 2.02 | 3.13 | 62.6 | 192 |
| January | 5.2 | 1.2 | 2.82 | 4.36 | 87.5 | 268 |
| February | 4.5 | 2.3 | 3.19 | 4.94 | 89.3 | 274 |
| March | 6.5 | 3.5 | 4.87 | 7.54 | 151 | 463 |
| April | 6.8 | 1.1 | 2.99 | 4.63 | 89.6 | 275 |
| May | 4.8 | 1.6 | 2.90 | 4.49 | 89.9 | 276 |
| June | 2.4 | .7 | 1.45 | 2.24 | 43.5 | 133 |
| The period | 6.8 | .1 | 2.53 | 3.91 | 925 | 2,840 |

### LOWER HAMAKUA DITCH AT MAIN WEIR, NEAR KUKUIHAELE, HAWAII.

LOCATION.—Just below portal of last tunnel from Waipio Gulch, half a mile southwest of Pacific sugar mill, at Kukuihaele. This ditch diverts all ordinary run-off from headwaters of the Waipio basin below the Upper Hamakua ditch.

RECORDS AVAILABLE.—July 18, 1910, to June 30, 1919.

GAGE.—Watson water-stage recorder.

DISCHARGE MEASUREMENTS.—Measured by weir consisting of six 5-foot panels, sharp crested and with a good stilling basin above. Current-meter measurements made in ditch below weir have checked determination by weir formulas within 2 per cent.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Records good.

COOPERATION.—Records furnished by the Hawaiian Irrigation Co.

*Daily discharge, in million gallons, of Lower Hamakua ditch at main weir, near Kukuihaele, Hawaii, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 34.6 | 34.9 | 35.9 | 33.6 | 34.9 | 34.4 | 34.2 | 35.5 | 34.2 | 31.1 | 36.1 | 32.5 |
| 2 | 34.9 | 35.1 | 35.1 | 33.1 | 39.8 | 36.4 | 33.4 | 34.6 | 38.0 | 30.7 | 34.9 | 28.6 |
| 3 | 34.9 | 35.5 | 34.9 | 32.1 | 37.4 | 31.1 | 34.2 | 35.1 | 41.4 | 30.9 | 32.3 | 28.6 |
| 4 | 34.2 | 34.9 | 34.9 | 31.1 | 36.6 | 9.1 | 34.9 | 34.2 | 36.1 | 30.1 | 30.9 | 28.2 |
| 5 | 34.2 | 34.5 | 35.1 | 31.1 | 37.4 | 36.8 | 34.2 | 34.2 | 41.6 | 29.9 | 32.2 | 27.7 |
| 6 | 34.2 | 34.5 | 34.9 | 31.1 | 36.8 | 34.2 | 35.2 | 33.6 | 39.8 | 29.7 | 33.6 | 27.4 |
| 7 | 34.2 | 34.9 | 34.9 | 32.3 | 31.7 | 5.7 | 34.2 | 33.0 | 46.3 | 29.3 | 34.6 | 28.2 |
| 8 | 34.6 | 34.9 | 35.1 | 32.5 | 31.7 | 4.4 | 34.9 | 33.0 | 42.0 | 29.3 | 34.2 | 31.7 |
| 9 | 34.9 | 34.9 | 35.7 | 32.5 | 41.4 | 29.6 | 34.2 | 33.6 | 45.4 | 28.7 | 34.9 | 33.9 |
| 10 | 34.9 | 34.2 | 35.7 | 34.2 | 31.1 | 36.1 | 34.2 | 33.6 | 41.9 | 28.7 | 34.2 | 31.4 |
| 11 | 34.2 | 34.9 | 35.7 | 39.7 | 42.4 | 34.2 | 34.2 | 34.2 | 36.8 | 28.9 | 34.3 | 36.0 |
| 12 | 34.2 | 34.3 | 35.7 | 39.7 | 46.1 | 33.6 | 35.5 | 34.4 | 35.5 | 36.1 | 30.9 | 30.4 |
| 13 | 34.2 | 35.1 | 35.7 | 40.1 | 47.5 | 33.0 | 35.5 | 34.2 | 35.9 | 35.7 | 30.5 | 30.4 |
| 14 | 34.9 | 34.4 | 36.4 | 33.2 | 42.7 | 32.3 | 35.4 | 34.9 | 33.6 | 30.7 | 34.0 | 31.8 |
| 15 | 35.5 | 34.5 | 36.4 | 32.2 | 36.1 | 36.2 | 35.7 | 34.2 | 32.3 | 29.3 | 34.6 | 32.6 |
| 16 | 34.9 | 34.3 | 36.3 | 32.2 | 34.9 | 36.2 | 35.1 | 34.2 | 34.2 | 28.7 | 32.7 | 35.6 |
| 17 | 34.9 | 34.1 | 39.5 | 31.8 | 40.7 | 33.6 | 34.7 | 33.8 | 34.2 | 29.3 | 30.5 | 40.6 |
| 18 | 34.9 | 34.6 | 45.4 | 31.1 | 31.6 | 33.0 | 34.6 | 33.5 | 35.1 | 28.7 | 35.0 | 38.3 |
| 19 | 34.2 | 34.7 | 47.6 | 31.1 | 33.0 | 34.2 | 34.4 | 33.5 | 35.9 | 29.3 | 33.9 | 40.1 |
| 20 | 34.2 | 34.5 | 39.5 | 42.7 | 33.0 | 35.5 | 33.8 | 33.5 | 36.6 | 36.1 | 32.3 | 47.9 |
| 21 | 34.9 | 34.5 | 35.5 | 39.8 | 31.1 | 35.2 | 34.2 | 36.8 | 34.2 | 35.9 | 34.2 | 36.0 |
| 22 | 34.2 | 34.5 | 34.2 | 45.4 | 30.5 | 35.9 | 34.2 | 35.9 | 33.6 | 36.1 | 33.0 | 31.0 |
| 23 | 34.9 | 34.5 | 35.7 | 38.7 | 29.9 | 35.9 | 35.5 | 40.3 | 34.7 | 35.5 | 32.3 | 29.6 |
| 24 | 34.2 | 35.1 | 34.8 | 34.9 | 29.9 | 35.9 | 36.1 | 40.3 | 34.9 | 36.1 | 33.0 | 31.2 |
| 25 | 35.5 | 34.7 | 34.7 | 34.2 | 29.5 | 35.2 | 35.5 | 35.3 | 34.9 | 35.7 | 34.2 | 32.9 |
| 26 | 34.9 | 35.1 | 34.4 | 44.6 | 28.9 | 37.1 | 36.8 | 33.5 | 35.1 | 35.8 | 31.3 | 34.0 |
| 27 | 34.2 | 34.3 | 32.2 | 44.8 | 29.7 | 34.2 | 35.6 | 34.2 | 33.4 | 35.3 | 29.9 | 39.5 |
| 28 | 34.2 | 30.5 | 32.1 | 34.9 | 32.3 | 34.9 | 34.2 | 34.0 | 33.6 | 34.3 | 28.7 | 40.8 |
| 29 | 34.9 | 35.6 | 32.3 | 34.5 | 32.6 | 34.7 | 34.2 | ..... | 33.6 | 34.6 | 28.1 | 40.6 |
| 30 | 33.6 | 34.5 | 37.1 | 36.4 | 33.4 | 34.2 | 34.2 | ..... | 32.3 | 34.3 | 27.5 | 42.6 |
| 31 | 32.9 | 32.3 | ..... | 43.2 | ..... | 34.2 | 35.1 | ..... | 31.7 | ..... | 28.1 | ..... |

*Monthly discharge of Lower Hamakua ditch at main weir, near Kukuihaele, Hawaii, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 35.5 | 32.9 | 34.5 | 53.4 | 1,070 | 3,280 |
| August | 35.6 | 30.5 | 34.5 | 53.4 | 1,070 | 3,280 |
| September | 47.6 | 32.1 | 36.1 | 55.9 | 1,080 | 3,320 |
| October | 45.4 | 31.1 | 35.5 | 54.9 | 1,100 | 3,380 |
| November | 47.5 | 28.9 | 35.2 | 54.5 | 1,050 | 3,240 |
| December | 37.1 | 4.4 | 31.8 | 49.2 | 987 | 3,030 |
| January | 36.8 | 33.4 | 34.8 | 53.8 | 1,080 | 3,310 |
| February | 40.3 | 33.0 | 34.7 | 53.7 | 971 | 2,980 |
| March | 46.3 | 31.7 | 36.4 | 56.3 | 1,130 | 3,460 |
| April | 36.1 | 28.7 | 32.2 | 49.8 | 965 | 2,960 |
| May | 36.1 | 27.5 | 32.5 | 50.3 | 1,010 | 3,090 |
| June | 47.9 | 27.4 | 34.0 | 52.6 | 1,020 | 3,130 |
| The year | 47.9 | 4.4 | 34.3 | 53.1 | 12,500 | 38,500 |

### UPPER HAMAKUA DITCH AT PUUALALA AND RESERVOIR No. 3 WEIRS, NEAR KUKUIHAELE, HAWAII.

LOCATION.—Puualala weir is in Lalakea tract, adjacent to forest reserve and close to Kaala mountain and Pacific sugar mill fence. Reservoir No. 3 weir is on a branch from main ditch just before it enters reservoir No. 3, 1 mile south of Puualala or main weir.

RECORDS AVAILABLE.—January 1, 1913, to June 30, 1919. Records given herewith show the combined flow of the main ditch and its diversion to reservoir No. 3 which occurs above the main weir.

GAGE.—Watson water-stage recorder at each weir.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weirs with good stilling basins above.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—This ditch diverts all ordinary run-off from upper headwaters of Waipio Gulch.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Records good.

COOPERATION.—Records furnished by the Hawaiian Irrigation Co.

*Daily discharge, in million gallons, of Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, Hawaii, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18.1 | 6.2 | 10.7 | 5.6 | 7.5 | 10.0 | 20.9 | 22.5 | 9.7 | 0.9 | 16.0 | 6.4 |
| 2 | 18.0 | 6.5 | 6.3 | 1.6 | 20 | 10.2 | 25.2 | 13.1 | 14.1 | 1.0 | 6.5 | 3.5 |
| 3 | 16.5 | 6.9 | 4.3 | 1.4 | 20.3 | 12.7 | 19.5 | 12.1 | 22.7 | .9 | 3.4 | 1.5 |
| 4 | 15.9 | 6.8 | .0 | 1.8 | 16.9 | 13.4 | 17.2 | 7.4 | 10.8 | .9 | 2.7 | 1.3 |
| 5 | 8.0 | 6.3 | .0 | 1.7 | 19.2 | 12.9 | 12.8 | 6.4 | 27 | .9 | 2.8 | 1.2 |
| 6 | 4.7 | 7.7 | 2.1 | 2.9 | 16.6 | 21.8 | 12.0 | 3.7 | 16.9 | .9 | 27.6 | 1.2 |
| 7 | 3.8 | 16.4 | 10.05 | 4.2 | 14.5 | 11.4 | 11.9 | 3.2 | 31 | .9 | 11.1 | 1.2 |
| 8 | 17.3 | 8.9 | 20.3 | 10.1 | 6.7 | 10.4 | 10.7 | 2.8 | 25 | 1.0 | 16.5 | 3.8 |
| 9 | 21.5 | 8.5 | 14.5 | 7.4 | 5.8 | 5.6 | 9.4 | 16.9 | 35 | .9 | 31.3 | 11.5 |
| 10 | 26.1 | 17.1 | 9.5 | 12.3 | 6.3 | 6.2 | 8.3 | 27 | 44.1 | .9 | 19.7 | 8.7 |
| 11 | 13.8 | 13.9 | 7.1 | 26.3 | 22.1 | 15.6 | 11.1 | 18.4 | 24.4 | 4.6 | 8.7 | 18.1 |
| 12 | 17.5 | 9.2 | 6.3 | 26.3 | 37.6 | 10.4 | 7.4 | 12.3 | 12.2 | 7.0 | 7.6 | 8.0 |
| 13 | 15.9 | 20.3 | 6.0 | 11.1 | 34 | 1.0 | 7.5 | 23.9 | 7.0 | 12.6 | 4.8 | 6.6 |
| 14 | 18.4 | 19.2 | 5.9 | 7.0 | 20 | 11.1 | 6.6 | 12.9 | 4.2 | 7.6 | 21.9 | 4.1 |
| 15 | 19.0 | 13.4 | 2.2 | 6.0 | 10.1 | 16.7 | 6.4 | 12.7 | 2.5 | 3.3 | 16.8 | 9.5 |
| 16 | 16.6 | 20.9 | 4.3 | 5.9 | 8.2 | 12.5 | 4.7 | 12.3 | 26.5 | 1.6 | 6.9 | 15.1 |
| 17 | 19.5 | 24.9 | 5.6 | 6.1 | 6.9 | 12.1 | 4.3 | 7.3 | 35 | 1.6 | 5.1 | 22.8 |
| 18 | 13.0 | 21.9 | 5.7 | 2.6 | 6.7 | 12.8 | 3.9 | 6.2 | 12.4 | 1.6 | 12.2 | 25.2 |
| 19 | 6.8 | 14.3 | 9.6 | 3.6 | 5.8 | 22.3 | 2.8 | 6.6 | 17.6 | 3.3 | 8.0 | 33.2 |
| 20 | 13.9 | 22.3 | 9.4 | 25.9 | 5.8 | 20.3 | 1.8 | 14.8 | 27 | 12.5 | 6.5 | 31.6 |
| 21 | 18.5 | 22.4 | 8.6 | 23.9 | 3.8 | 17.9 | 1.7 | 12.6 | 9.8 | 17.6 | 14.1 | 17.2 |
| 22 | 15.6 | 17.3 | 7.0 | 24.2 | 2.9 | 8.9 | 3.5 | 18.2 | 11.3 | 42.6 | 8.3 | 6.5 |
| 23 | 18.7 | 19.5 | 6.4 | 17.7 | 2.1 | 10.9 | 33 | 32.9 | 44.4 | 28.2 | 7.8 | 2.3 |
| 24 | 15.9 | 10.2 | 8.1 | 10.6 | 2.1 | 20.4 | 30.1 | 20.6 | 21.4 | 24 | 8.1 | 13.4 |
| 25 | 19.9 | 6.4 | 7.4 | 6.2 | 2.1 | 11.6 | 27.2 | 15.6 | 8.7 | 35.8 | 7.5 | 8.0 |
| 26 | 37.4 | 6.6 | 6.6 | 25.9 | 1.1 | 8.0 | 27 | 7.1 | 6.4 | 25 | 5.5 | 16.4 |
| 27 | 23.5 | 6.4 | 4.2 | 24.6 | 1.5 | 26.4 | 28.4 | 7.0 | 5.4 | 19.1 | 4.1 | 29.1 |
| 28 | 22.6 | 8.7 | 2.9 | 6.6 | 18.4 | 24.1 | 20.7 | 5.6 | 5.4 | 16.8 | 3.5 | 28.9 |
| 29 | 26.3 | 8.3 | 13.6 | 6.4 | 34.6 | 14.2 | 19.6 | ..... | 4.2 | 11.3 | 2.1 | 23.6 |
| 30 | 18.2 | 6.7 | 20.8 | 6.0 | 12.7 | 30 | 17.3 | ..... | 3.1 | 6.9 | 1.6 | 29.6 |
| 31 | 12.2 | 6.3 | ..... | 5.7 | ..... | 20.2 | 13.9 | ..... | 2.0 | ..... | 2.9 | ..... |

*Monthly discharge of Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, Hawaii, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 37.4 | 3.8 | 17.2 | 26.6 | 533 | 1,640 |
| August | 24.9 | 6.2 | 12.6 | 19.5 | 390 | 1,200 |
| September (28 days) | 20.8 | 2.1 | 8.07 | 12.5 | 226 | 693 |
| October | 26.3 | 1.4 | 10.6 | 16.4 | 328 | 1,010 |
| November | 37.6 | 1.1 | 12.4 | 19.2 | 372 | 1,110 |
| December | 30.0 | 1.0 | 14.3 | 22.1 | 442 | 1,360 |
| January | 33.0 | 1.7 | 13.8 | 21.4 | 427 | 1,310 |
| February | 32.9 | 2.8 | 12.9 | 20.0 | 362 | 1,110 |
| March | 44.4 | 2.0 | 17.0 | 26.3 | 527 | 1,620 |
| April | 42.6 | .9 | 9.74 | 15.1 | 292 | 897 |
| May | 31.3 | 1.6 | 9.73 | 15.1 | 302 | 926 |
| June | 33.2 | 1.2 | 13.0 | 20.1 | 390 | 1,200 |
| The year (363 days) | 44.4 | .9 | 12.6 | 19.5 | 4,590 | 14,100 |

### KEHENA DITCH NEAR KOHALA, HAWAII.

LOCATION.—At old Honokane weir, just below head of west branch of Honokanenui Gulch, 13 miles by trail southeast of Kohala Ditch Co.'s headquarters at Hawi and 15 miles by road and horse trail southeast of Kohala post office.

RECORDS AVAILABLE.—December 28, 1917, to June 30, 1919.

GAGE.—Stevens 8-day water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from a plank across ditch 100 feet above old weir.

CHANNEL AND CONTROL.—Weir basin has concrete walls and is about 25 feet long and 20 feet wide. Control is old wooden weir of three 5-foot panels, with imperfect contractions and no longer sharp crested.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.57 feet at 5.30 p. m. December 3 (discharge, 78 million gallons per day, or 121 second-feet); minimum stage recorded, ditch dry June 7.

1917–1919: Maximum stage recorded 2.16 feet at 8.15 p. m. January 27, 1918 (discharge, 113 million gallons per day, or 175 second-feet); (revised data).

DIVERSIONS.—Ditch diverts water from about 22 small streams.

REGULATION.—By headgates.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 0.5 million gallons per day and records good above that stage. Operation of water-stage recorder satisfactory except for two short periods. Records good when water-stage recorder was operating.

*Discharge measurements of Kehena ditch near Kohala, Hawaii, during the year ending June 30, 1919.*

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Sept. 13 | R. D. Klise | 0.07 | 0.75 | 0.5 |
| Nov. 9 | A. H. Wong | .46 | 15.4 | 9.9 |
| Jan. 4 | ....do | .76 | 34.5 | 22.4 |
| Mar. 24 | H. A. R. Austin | .62 | 26 | 16.8 |
| May 4 | ....do | .11 | 1.6 | 1.0 |

*Daily discharge, in million gallons, of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1919.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 13.7 | 5.8 | 0.2 | 1.8 | 19.3 | 6.1 | 12.6 | 11.1 | 6.4 | 0.8 | 10.7 | 1.1 |
| 2 | 17.6 | 4.0 | .2 | .9 | 30 | 21 | 9.1 | 8.8 | ..... | .7 | 3.8 | .8 |
| 3 | 11.8 | 2.8 | .2 | .7 | ..... | 40 | 9.1 | 7.8 | ..... | .4 | 1.7 | .5 |
| 4 | 9.8 | 2.4 | .2 | .4 | ..... | 13.2 | 21 | 3.3 | ..... | .5 | 1.3 | .4 |
| 5 | 3.5 | 2.0 | .2 | .3 | ..... | 32 | 6.9 | 2.2 | ..... | .2 | 13.8 | .2 |
| 6 | 2.2 | 3.0 | .2 | 1.3 | ..... | 37 | 15.6 | 1.5 | ..... | .2 | 23 | .1 |
| 7 | 1.7 | 12.2 | .2 | 1.7 | ..... | 26 | 5.2 | .9 | ..... | .2 | 8.4 | 0 |
| 8 | 6.0 | 4.7 | 3.2 | 5.2 | ..... | 26 | 4.7 | .8 | ..... | .2 | 26 | .3 |
| 9 | 15.2 | 2.8 | 2.8 | 4.0 | 11.5 | 17.4 | 3.5 | 24 | ..... | .2 | 29 | 2.6 |
| 10 | 22 | 4.2 | 1.1 | 7.5 | 4.0 | 7.3 | 4.5 | 10.4 | ..... | .1 | 8.1 | 2.0 |
| 11 | 7.5 | 6.6 | 1.1 | 19.0 | 27 | 1.8 | 5.8 | 5.5 | ..... | .4 | 4.0 | 3.3 |
| 12 | 13.9 | 4.7 | .8 | 31 | 46 | 5.9 | 3.0 | 10.7 | ..... | 7.5 | 2.8 | 1.1 |
| 13 | 17.2 | 18.4 | .5 | 9.4 | 32 | 10.4 | 2.4 | 17.4 | ..... | 5.2 | 2.4 | .9 |
| 14 | 15.3 | 15.5 | .5 | 6.4 | 10.6 | 16.2 | 2.4 | 7.8 | ..... | 4.0 | 24 | 1.1 |
| 15 | 23 | 5.5 | .5 | 4.5 | 4.0 | 31 | 1.7 | 9.1 | ..... | 2.6 | 6.9 | 3.5 |
| 16 | 12.2 | 29 | .5 | 3.3 | 2.6 | 17.9 | 1.3 | 6.1 | 5.0 | .3 | 3.0 | 5.3 |
| 17 | 10.4 | 34 | .7 | 2.6 | 4.7 | 21 | .9 | 3.5 | 18.3 | .3 | 1.8 | 8.1 |
| 18 | 5.0 | 23 | 2.2 | 2.0 | 2.6 | 23 | .8 | 2.4 | 5.5 | .3 | 4.0 | 6.1 |
| 19 | 3.0 | 10.4 | 18.4 | 3.8 | 2.4 | 30 | .7 | 2.2 | 9.8 | .2 | 2.0 | 6.9 |
| 20 | 8.6 | 38 | 5.2 | 31 | 1.7 | 16.6 | .7 | 11.1 | 13.7 | .2 | 1.5 | 8.4 |
| 21 | 19.3 | 21 | 2.2 | 7.8 | 1.1 | 10.7 | .7 | 11.4 | 7.2 | 3.2 | 5.0 | 2.6 |
| 22 | 12.6 | 15.2 | 1.5 | 8.8 | .9 | 10.5 | 1.1 | 5.0 | 16.8 | 42 | 3.0 | 1.3 |
| 23 | 19.6 | 16.4 | 4.2 | 4.2 | .7 | 15.3 | 17.2 | 17.4 | 54 | 18.8 | 3.0 | 1.1 |
| 24 | 21 | 6.1 | 4.5 | 1.8 | .5 | 15.7 | 23 | 11.8 | 22 | 31 | 4.2 | 9.9 |
| 25 | 38 | 3.8 | 2.4 | 2.8 | .7 | 11.8 | 18.3 | 13.4 | 5.2 | 40 | 3.8 | 4.5 |
| 26 | 14.7 | 2.6 | 1.8 | 19.2 | .5 | 8.5 | 10.8 | 5.0 | 3.0 | 9.1 | 3.3 | 8.6 |
| 27 | 15.2 | 2.0 | 1.1 | 9.4 | 11.3 | 12.0 | 28 | 7.5 | 2.2 | 5.2 | 2.8 | 16.6 |
| 28 | 28 | 1.3 | .3 | 3.3 | 23 | 5.0 | 19.6 | 5.8 | 1.7 | 5.0 | 2.6 | 27 |
| 29 | 23 | .9 | 6.8 | 2.0 | 24 | 3.3 | 9.4 | ..... | 1.3 | 3.8 | 2.6 | 12.2 |
| 30 | 11.4 | .7 | 5.6 | 3.0 | 5.5 | 2.2 | 5.2 | ..... | .9 | 2.2 | 1.8 | 8.4 |
| 31 | 10.1 | .4 | ..... | 6.4 | ..... | 10.6 | 13.9 | ..... | .9 | ..... | .7 | ..... |

NOTE.—No record and discharge estimated in million gallons per day for the following periods: Nov. 3–8, 10; Mar. 2-15, 4.0.

*Monthly discharge of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1919.*

| Month. | Discharge. | | | | Total run-off. | |
|---|---|---|---|---|---|---|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 38 | 1.7 | 14.0 | 21.7 | 432 | 1,330 |
| August | 38 | .4 | 9.66 | 14.9 | 299 | 919 |
| September | 18.4 | .2 | 2.31 | 3.57 | 69.3 | 213 |
| October | 31 | .3 | 6.63 | 10.3 | 206 | 631 |
| November | 46 | .5 | 10.9 | 16.9 | 327 | 1,000 |
| December | 40 | 1.8 | 16.3 | 25.2 | 505 | 1,550 |
| January | 28 | .7 | 8.36 | 12.9 | 259 | 795 |
| February | 24 | .8 | 8.00 | 12.4 | 224 | 687 |
| March | 54 | .9 | 7.42 | 11.5 | 230 | 706 |
| April | 42 | .1 | 6.16 | 9.53 | 185 | 567 |
| May | 29 | .7 | 6.81 | 10.5 | 211 | 648 |
| June (29 days) | 27 | .1 | 5.00 | 7.74 | 145 | 445 |
| The year (364 days) | 54 | .1 | 8.50 | 13.2 | 3,090 | 9,490 |

## MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Hawaii at points other than regular gaging stations are listed below.

*Miscellaneous measurements on Hawaii, during the year ending June 30, 1919:*

| Date. | Stream. | Locality. | Discharge. | |
|---|---|---|---|---|
| | | | Second-feet. | Million gallons per day. |
| Mar. 26 | Kohala ditch | Above tunnel No. 18, near Kohala | 17.0 | 11.0 |
| 26 | .....do | Below tunnel No. 18, near Kohala | 13.9 | 9.0 |

# INDEX.