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UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

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SURFACE WATER SUPPLY OF HAWAII

JULY 1, 1919, TO JUNE 30, 1920

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Prepared in cooperation with the
TERRITORY OF HAWAII

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SURFACE WATER SUPPLY OF HAWAII, JULY 1, 1919, TO JUNE 30, 1920.

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, 1920. 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 mainte-

nance 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 433 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 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 Hawaiian department of the United States Army, 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—Hawaiian Sugar Co., Makee Sugar Co., Kauai Electric Co., Waimea Sugar Co., Lihue Plantation Co., Kekaha Sugar Co., and Princeville Plantation; Island of Oahu—United States Army Constructing Quartermaster Department and Wahiawa Water Co.; Island of Maui—Wailuku Sugar Co., Pioneer Mill Co., Olowalu Sugar Co., Honolua Ranch, 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 five 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.

"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 section. 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 flow for the day when the total discharge for the day was greatest. Obviously, this does not correspond to the rate of flow at the crest of the flood, which is given under the heading "Extremes of discharge." Likewise in the column, "Minimum," the quantity given is the flow for the day when the total discharge for the day was least. 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 James E. Stewart, district engineer, Honolulu, Hawaii, by Max H. Carson, office engineer, W. V. Hardy, R. D. Klise, H. A. R. Austin, B. F. Rush, Reid Jerman, A. H. Wong, E. E. Goo, John Kaheaku, and Shiro Takabayashi. The manuscript has been prepared by Max H. Carson and reviewed by E. D. Burchard.

GAGING-STATION RECORDS.

ISLAND OF KAUAI.

WAIMEA RIVER NEAR WAIMEA, KAUAI.

LOCATION.—250 feet above ford and 2 miles north of Waimea.

RECORDS AVAILABLE.—July 9, 1910, to October 31, 1919, when station was discontinued.

GAGE.—Vertical and inclined staff installed October 5, 1911; read by Miss Kikuyo Yokotake. July 9, 1910, to October 4, 1911, staff gage about 1 mile downstream.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 400 feet above and 800 feet below gage; banks high; bed of stream sandy. Control composed of sand, gravel, and boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.91 feet at 6 a. m. October 28 (discharge, 298 million gallons per day, or 461 second-feet); minimum stage recorded, 4.31 feet at 6 p. m. September 6 (discharge, 0.4 million gallons per day or 0.6 second-foot).

1910–1919: Maximum stage recorded 18.8 feet at 4.30 p. m. January 25, 1916 (discharge, computed from extension of the rating curve, approximately 10,700 million gallons per day, or 16,600 second-feet); channel practically dry at times, as all water is diverted above.

DIVERSIONS.—Large number of diversions above station.

REGULATION.—By diversions.

OBJECT OF STATION.—To determine discharge below all diversions. Territory owns land and water. Data of value in connection with flood problems.

UTILIZATION.—All water passing this station is wasted, as none is diverted below.

ACCURACY.—Stage-discharge relation probably permanent July 1 to October 31 when station was discontinued. Rating curve well defined. Gage read to hundredths twice daily. Records good.

Discharge measurements of Waimea River near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	Shiro Takabayashi	4.84	15.4	10.0
Aug. 25	do	4.52	5.1	3.3

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

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	2.9	6.6	2.4	1.4	16	52	65	1.8	1.6
2	2.6	4.4	5.0	1.6	17	24	59	1.5	1.6
3	2.6	30	1.8	1.6	18	4.8	2.9	1 2	1.8
4	2.0	16.8	1.0	1.5	19	2.3	2.6	1.0	1.6
5	1.9	1.9	1.0	1.7	20	75	2.1	1.0	14.0
6	1.9	1.9	.6	67	21	60	22	1.3	5.6
7	1.6	1.8	2.4	6.2	22	9.7	7.0	1.4	2.6
8	16.4	1.4	9.7	2.7	23	7.6	71	1.4	3.8
9	27	1.2	151	1.6	24	6.2	49	1.6	25
10	73	1.4	39	1.4	25	3.4	22	2.2	11.2
11	88	1.9	6.2	1.9	26	2.7	5.4	2.3	6.6
12	79	1.8	2.9	6.6	27	2.0	2.8	1.3	5.6
13	84	1.8	2.8	3.6	28	1.7	2.0	1.2	151
14	79	1.7	2.4	2.2	29	35	1.8	1.2	76
15	64	1.5	2.0	1.8	30	21	1.6	1.2	14.0
					31	10.0	1.9	.....	5.8

Monthly discharge of Waimea River near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	88	1.6	27.2	42.1	843	2,590
August	71	1.2	12.7	19.6	394	1,210
September	151	.6	8.39	13.0	252	772
October	151	1.4	13.9	21.5	431	1,320
The period	.....	.....	.....	.....	1,920	5,890

HAUAIKINANA STREAM NEAR WAIMEA, KAUAI.

LOCATION.—About 1 mile east of Kokee, 12 miles north of Waimea (20 miles from Waimea by road and trail), and 200 feet above Kokee-Mohihi trail.

RECORDS AVAILABLE.—July 1, 1919, to June 30, 1920. Miscellaneous measurements 1911–1916.

GAGE.—Stevens continuous water-stage recorder.

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

CHANNEL AND CONTROL.—Rocky boulder-strewn bed and high rocky banks. Control composed of large boulders. Subject to shift at high floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.25 feet at 5.30 p. m. December 3 (discharge, 135 million gallons per day or 209 second-feet); minimum stage recorded 1.67 feet at 9 a. m. December 1 (discharge, 0.27 million gallons per day or 0.42 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of high-level (3,100 feet) diversion to serve semi-arid Territorial lands now idle on account of lack of water.

UTILIZATION.—After it reaches Waimea River low-water flow is used for power and irrigation.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 0.4 and 14 million gallons per day, used July 1 to March 18 and March 19 to June 30. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records fair below 14 million gallons per day when water-stage recorder was operating.

Discharge measurements of Kauaikinana Stream near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 30	W. V. Hardy	1.70	0.5	0.3
Oct. 6	do	1.95	1.6	1.0
Dec. 14	Shiro Takabayashi	1.93	1.45	.95
Jan. 21	do	2.76	20.8	13.4
Mar. 9	do	2.14	4.2	2.7
May 22	do	1.92	.95	.6
June 12	M. H. Carson	2.08	2.2	1.4

Daily discharge, in million gallons, of Kauaikinana Stream near Waimea, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	0.5	1.2	0.3	0.3	0.3	4.2	4.4	1.7	2.1	1.0	1.1
2	.....	.....	.7	.4	.3	3.0	2.8	4.2	1.5	1.8	1.0	1.0
3	.....	.....	.5	.4	.3	25	2.6	4.4	1.4	1.8	1.0	.8
4	.....	.....	.4	.4	.3	8.5	2.5	3.8	1.4	1.8	.9	.8
5	.....	.....	.4	.4	.3	.....	2.3	3.4	1.3	1.7	.8	.8
6	.....	.....	.4	.9	.5	.....	26	3.3	2.8	1.8	.8	.8
7	.....	.....	.4	.5	2.1	.....	21	3.4	4.3	1.7	.8	.7
8	.....	.....	.4	.4	.5	.....	4.6	3.5	11.3	1.6	.8	.6
9	.....	.....	2.6	.4	.5	.....	8.2	3.2	2.8	1.6	.8	.6
10	.....	.....	.....	.4	.7	.....	10.3	3.0	4.8	1.5	.8	.6
11	.....	.5	.....	.4	4.2	.....	3.5	3.1	16.0	1.5	.8	1.1
12	0.6	.4	.....	.3	.9	.....	2.8	3.1	25	1.3	.8	2.1
13	1.1	.4	.....	.3	.6	.....	4.6	2.6	16.6	1.3	.8	2.1
14	1.3	.4	.....	.3	.5	1.0	7.7	2.5	4.9	1.3	.7	1.5
15	1.3	.4	.....	.3	.4	4.3	42	2.4	3.8	1.3	.7	1.1
16	1.1	.5	.....	.3	.4	1.8	50	2.5	3.1	1.2	.7	1.0
17	.6	.6	.....	.3	.4	1.7	50	2.2	2.7	1.2	.8	.8
18	.5	.4	.....	.3	3	1.4	65	2.1	8.6	3.2	1.2	.8
19	2.1	.4	.....	.3	.3	1.1	28	2.1	13.6	1.7	1.1	.6
20	4.2	1.5	.....	.5	.3	1.0	17.3	2.2	5.2	1.4	.8	.6
21	1.3	1.6	.....	.5	.3	.9	18.6	2.2	3.1	1.6	.8	.5
22	.7	.6	.....	.4	.6	14.0	18.5	2.0	4.2	3.0	.8	.5
23	.6	.5	.3	2.4	.5	18.0	10.8	2.0	6.0	3.4	.8	.5
24	.5	.4	.3	.6	.6	3.4	8.7	2.0	5.2	1.7	1.1	.5
25	.6	.4	.3	.6	.5	2.5	7.4	3.5	6.9	1.5	1.0	.5
26	.5	.4	.3	.4	.4	10.1	14.6	5.6	4.0	1.3	1.0	.4
27	.4	.4	.3	.4	.4	3.9	10.1	2.2	2.9	1.2	.9	.4
28	.5	.4	.3	.4	.3	3.4	6.5	1.9	2.6	1.2	.8	.4
29	.9	.4	.3	.4	.3	3.5	6.0	1.7	2.4	1.2	5.0	.4
30	.6	.4	.3	.3	.3	7.4	5.1	.....	2.2	1.0	4.2	.4
31	.5	.3	.....	.3	.....	4.7	4.5	.....	2.1	.....	1.5	.....

NOTE.—Recorder not yet installed July 1–11 and not working properly August 2–10, Sept. 10–22, and Dec. 5–13. Discharge estimated in million gallons per day as follows: July 1–11 and Aug. 2–10, 0.5; Sept. 10–22, 0.4; Dec. 5–13, 1.5. Estimates made by comparison with flow of adjacent streams.

Monthly discharge of Kauaikinana Stream near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.2	0.4	0.82	1.27	25.4	78
August	1.6	.3	.53	.82	16.3	50
September	2.6	.3	.49	.76	14.6	45
October	2.4	.3	.47	.73	14.5	45
November	4.2	.3	.61	.94	18.3	56
December	25	.3	4.34	6.71	134	413
January	65	2.3	15.0	23.2	466	1,430
February	5.6	1.7	2.91	4.50	84.5	259
March	25	1.3	5.63	8.71	174	536
April	3.4	1.0	1.66	2.57	49.9	153
May	5.0	.7	1.13	1.75	35.0	108
June	2.1	.4	.80	1.24	24.0	74
The year	65	.3	2.89	4.47	1,060	3,250

KAWAIKOI STREAM NEAR WAIMEA, KAUAI.

LOCATION.—3 miles northeast of Knudsen's mountain house and 21 miles by road and trail from Waimea.[2]

RECORDS AVAILABLE.—April 13, 1909, to July 11, 1917, and July 1, 1919, to June 30, 1920. No record of value after December 17, 1916, until July 2, 1919.

GAGE.—Stevens continuous water-stage recorder, installed August 4, 1919; Staff April 13, 1909, to May 26, 1910; Friez water-stage recorder May 26, 1910, to October 11, 1911; Barrett and Lawrence water-stage recorder October 11, 1911, to August 4, 1919.

DISCHARGE MEASUREMENTS.—Made by wading or from cable suspended near trail crossing 300 feet downstream.

CHANNEL AND CONTROL.—One channel at all stages, straight for 100 feet above and below station; banks high and wooded. Control composed of rock ledge and boulders. Shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 8.69 feet at 3.50 a. m. March 19 (discharge, 569 million gallons per day or 880 second-feet); minimum stage recorded during the year 1.22 feet at 8.30 a. m. November 5 and 10.40 a. m. December 2 (discharge, 1.5 million gallons per day or 2.3 second-feet).

1909–1920: Maximum stage recorded during period of record, 15.2 feet December 18, 1916 (discharge not determined); minimum stage recorded in November and December, 1919.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of diverting flood water into high-level (3,100 feet) ditch to serve Territorial lands now idle on account of lack of irrigation.

UTILIZATION.—After it reaches Waimea River, low water is used for power and irrigation.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 10 million gallons per day and fairly well defined up to 30 million gallons per day. Operation of water-stage recorder satisfactory after August 4; unsatisfactory prior to that. Records good after August 4. Only fair prior to that.

[2] This statement supersedes distances previously published, as the station has not been moved.

Discharge measurements of Kawaikoi Stream near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 30	W. V. Hardy	1.26	2.5	1.65
Oct. 14	Shiro Takabayashi	1.34	3.9	2.5
Dec. 14	do	1.58	6.4	4.1
Jan. 23	do	2.22	26.5	17.1
Mar. 10	do	2.10	19.9	12.9
May 22	do	1.44	4.2	2.7
June 11	M. H. Carson	2.46	45	29
12	do	2.10	24.9	16.1

Daily discharge, in million gallons, of Kawaikoi Stream near Waimea, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1			35	2.8	1.8	1.6	25	8.4	3.6	9.6	3.9	3.4
2			9.4	6.9	1.6	98	13.9	7.8	3.3	9.2	3.7	2.8
3	4.2		4.5	3.9	1.6	96	13.9	7.4	3.2	8.4	3.5	2.5
4	4.4		3.7	2.3	1.6	28	10.9	7.1	3.2	8.0	3.4	2.3
5	4.4	3.9	3.8	9.4	1.5	30	13.7	6.8	3.2	7.6	3.2	8.5
6	4.4	3.8	6.0	22	4.2	19.0	71	6.8	32	8.6	3.9	7.7
7	4.7	3.6	8.8	4.8	13.1	10.7	57	7.1	46	9.2	3.2	3.7
8	6.1	8.1	10.9	5.0	3.4	7.1	16.7	17.7	88	6.9	3.2	4.1
9	43	14.5	48	2.9	16.0	15.1	31	10.1	16.7	6.3	3.1	3.0
10	13.4	7.1	11.3	2.2	7.5	16.8	39	7.6	55	5.8	3.0	11.6
11	12.0	3.4	5.2	3.4	88	8.2	13.7	8.7	99	5.8	3.0	24
12	6.0	2.6	3.7	9.6	12.9	5.8	11.4	10.8	138	5.4	2.9	30
13	24	2.4	3.0	3.2	6.0	4.7	26	6.9	95	5.1	2.9	23
14	29	3.9	2.6		3.3	5.5	42	5.8	23	6.1	2.8	15.0
15	32	10.8	2.4		2.5	15.3	109	5.1	15.6	5.2	2.7	9.0
16	12.9	16.6	2.2		2.1	6.9	129	4.7	12.9	4.7	2.7	10.5
17	5.8	5.7	2.2		1.8	7.2	112	4.4	13.3	4.3	2.8	7.1
18	5.4	3.2	2.1		1.8	6.4	117	4.2	75	22	10.6	5.1
19	31	8.9	1.9		1.7	4.5	34	4.1	138	10.6	7.4	3.7
20		54	2.4		1.6	3.8	25	4.0	67	14.2	3.9	3.2
21		29	2.2		6.6	3.3	40	3.9	32	63	3.2	2.8
22		10.5	2.0		15.2	15.5	35	3.8	54	54	2.8	2.7
23		5.8	3.8	12.7	4.0	40	17.9	4.1	76	27	2.8	3.8
24		4.0	1.8	10.7	6.6	8.4	15.6	3.9	64	11.4	3.9	3.2
25		3.3	1.8	3.9	2.9	5.8	13.7	10.9	85	8.2	4.2	2.8
26		3.0	1.7	2.3	2.1	26	26	28	38	6.4	10.3	2.5
27		2.8	1.6	1.8	1.8	15.6	21	6.9	23	5.2	4.4	2.5
28		2.5	1.6	3.8	1.6	22	12.4	4.7	16.7	4.7	3.2	2.4
29		2.4	1.6	4.4	1.6	47	16.9	4.0	13.7	4.4	14.3	3.1
30		2.2	1.7	2.6	1.6	66	9.6		12.1	4.1	24	3.2
31		9.8		2.0		38	9.0		11.2		5.2	

NOTE.—July 1-2 recorder not yet installed: Discharge estimated at 4.0 million gallons per day. Recorder not working properly and discharge estimated in million gallons per day as follows: July 20 to Aug. 4, 5; Oct. 14-19, 1.8; Oct. 20-22, 10. Estimates made by comparison with adjacent streams.

48298—24—WSP 516——2

Monthly discharge of Kawaikoi Stream near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	43	.....	10.0	15.5	311	951
August	54	2.2	7.99	12.4	248	760
September	48	1.6	6.23	9.64	187	574
October	22	.....	5.24	8.11	162	499
November	38	1.5	5.60	8.66	168	516
December	96	1.6	19.5	30.2	603	1,860
January	129	9.0	36.2	56.0	1,120	3,440
February	28	3.8	7.44	11.5	216	662
March	138	3.2	43.8	67.8	1,360	4,170
April	63	4.1	11.7	18.1	351	1,080
May	24	2.7	4.95	7.66	153	471
June	30	2.3	6.97	10.8	209	642
The year	138	1.5	13.9	21.5	5,100	15,600

WAIAKOALI STREAM NEAR WAIMEA, KAUAI.

LOCATION.—150 feet below Kokee-Mohihi trail, one-fourth mile below Waiakoali Camp, and 12 miles northeast of Waimea (22 miles from Waimea by road and trail).

RECORDS AVAILABLE.—April 13, 1909, to December 4, 1912, and July 1, 1919, to June 30, 1920. Occasional measurements 1913 to 1917 reported as miscellaneous.

GAGE.—Stevens continuous water-stage recorder installed July 30, 1919. Staff gage April 13, 1909, to December 4, 1912.

DISCHARGE MEASUREMENTS.—Made by wading or from cable suspended near the trail.

CHANNEL AND CONTROL.—Channel a series of pools with mud and silt bottom divided by rapids of boulders and cobblestones. High sloping banks covered with ferns and underbrush. Control, large boulders; not subject to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year 7.34 feet at 4.20 a. m. March 19 (discharge, 216 million gallons per day or 334 second-feet); minimum stage recorded during the year 1.19 feet at 10 a. m. December 2 (discharge, 0.49 million gallons per day or 0.76 second-foot).

1909–1920: Maximum stage recorded during period of record, in 1920. Minimum stage recorded, 1.45 feet (old staff gage), November 29, 1909 (discharge, 0.4 second-foot or 0.3 million gallons per day).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of diverting flood water into high-level (3,100 feet) ditch to serve Territorial lands now idle on account of lack of irrigation.

UTILIZATION.—After it reaches Waimea River low water is used for power and irrigation.

ACCURACY.—Stage-discharge relation permanent. Rating table well defined between 0.5 million gallons per day and 15 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Waiakoali Stream near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 30	W. V. Hardy	0.76	0.8	0.5
Oct. 14	Shiro Takabayashi	1.06	1.25	.8
Dec. 14	do	1.38	3.1	2.0
Jan. 22	do	2.75	23	14.9
Mar. 9	do	1.87	6.5	4.2
May 22	do	1.40	1.3	.85
June 11	M. H. Carson	1.48	2.1	1.35

Daily discharge, in million gallons, of Waiakoali Stream near Waimea, Kauai, for the year ending June 30, 1920.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.2	1.3	0.6	0.7	0.5	6.6	4.2	1.8	3.4	1.4	1.5
2	2.3	1.7	.7	.6	5.3	3.3	4.0	1.6	2.9	1.4	1.2
3	1.6	.9	.8	.6	33	3.2	3.6	1.6	2.9	1.3	1.1
4	1.2	.8	.7	.6	16.0	2.8	3.4	1.6	2.6	1.3	1.1
5	1.0	.8	.7	.5	7.4	6.8	3.3	1.6	2.5	1.2	1.2
6	1.0	.8	5.8	.8	8.5	17.1	3.3	3.1	2.5	1.2	1.8
7	.9	.8	1.4	5.4	4.0	18.5	3.2	4.4	2.3	1.2	1.4
8	.9	1.4	.9	1.4	2.9	6.5	3.2	13.1	2.2	1.2	1.1
9	.9	7.2	.9	1.4	.....	9.4	3.1	4.9	2.1	1.1	1.1
10	1.2	2.8	.8	1.1	.....	16.4	2.9	9.4	2.0	1.1	.....
11	1.2	1.3	.7	5.9	.....	6.3	2.9	16.0	2.0	1.1	.....
12	.9	.9	1.3	2.6	.....	5.0	3.5	36	2.0	1.1	6.0
13	.8	.8	.9	1.5	.....	11.2	2.6	27	1.8	1.1	7.4
14	.8	.7	.7	1.0	1.8	19.0	2.5	8.3	1.8	1.0	3.3
15	.9	.6	.6	.8	2.6	38	2.4	5.3	1.8	1.0	2.5
16	1.9	.6	.6	.7	2.0	51	2.2	4.0	1.6	1.0	2.1
17	1.6	.6	.6	.6	2.0	42	2.1	3.2	1.7	1.2	2.8
18	1.0	.6	.6	.6	2.1	34	2.1	9.9	6.3	1.7	1.8
19	1.0	.6	.5	.6	1.6	17.0	2.1	38	3.1	1.6	1.4
20	3.7	.6	.7	.5	1.4	12.8	2.1	10.8	2.2	1.2	1.3
21	5.6	.6	1.0	.6	1.2	17.0	1.9	8.3	3.6	1.1	1.2
22	2.1	.6	.7	1.1	1.5	15.2	1.9	8.9	6.4	1.0	1.0
23	1.4	.6	.7	1.0	6.0	10.2	2.0	19.1	4.8	1.1	1.8
24	1.0	.6	2.3	2.7	2.4	8.9	1.9	11.5	2.9	2.0	1.4
25	.8	.6	1.3	1.2	1.8	7.6	1.9	17.7	2.2	1.6	1.2
26	.8	.6	.8	.8	2.6	7.3	6.2	12.1	1.9	1.8	1.0
27	.7	.6	.7	.7	3.6	7.0	2.6	7.6	1.7	1.6	.9
28	.7	.6	1.2	.6	4.0	6.0	2.0	5.4	1.6	1.2	.8
29	.7	.6	1.4	.6	5.4	5.3	1.9	4.4	1.6	1.4	.8
30	.7	.6	1.0	.5	16.0	4.8	.....	4.2	1.7	1.2	.8
31	.6	.....	.8	.....	7.7	4.5	.....	3.9	.....	1.9	.....

NOTE.—Dec. 9–13 recorder not operating, and June 10–11 paper supply exhausted. Discharge estimated by comparison with flow of adjacent streams at 1.2 million gallons per day.

Monthly discharge of Waiakoali Stream near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July			2.03	3.14	63.0	193
August	5.6	0.6	1.33	2.06	41.1	127
September	7.2	.6	1.06	1.64	31.8	98
October	5.8	.5	1.05	1.62	32.4	100
November	5.9	.5	1.26	1.95	37.7	116
December	33	.5	4.82	7.46	149	459
January	51	2.8	13.6	21.0	421	1,290
February	6.2	1.9	2.80	4.33	81.3	249
March	38	1.6	9.80	15.2	304	932
April	6.4	1.6	2.60	4.02	78.1	239
May	5.2	1.0	1.43	2.21	44.3	136
June	7.4	.8	1.75	2.71	52.4	161
The year	51	.5	3.65	5.65	1,340	4,100

NOTE.—Discharge for July estimated from flow of adjacent streams.

KOAIE STREAM AT ELEVATION 3,700 FEET, NEAR WAIMEA, KAUAI.

LOCATION.—4 miles east of Mohihi station, 1 mile below swamps, and 13 miles northeast of Waimea (27 miles by trail from Waimea by way of Kokee).

RECORDS AVAILABLE.—July 1, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder installed September 5, 1919.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 200 feet upstream from gage.

CHANNEL AND CONTROL.—Channel covered with boulders and cobblestones and flanked by steep high banks; straight for 100 feet above and 400 feet below station. Control is bedrock across stream forming low falls. Right end is low and blocked by cobblestones and boulders which may shift slightly. Control is too wide to be very sensitive at low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.30 feet at 4.50 p. m. December 3, 1919 (discharge, 1,250 million gallons per day or 1,930 second-feet); minimum stage recorded, 0.39 foot at 12.30 a. m. September 28, 1919 (discharge, 1.3 million gallons per day or 2.0 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of flood water available for storage for use in irrigating high-level lands above Waimea and Kekaha.

UTILIZATION.—After it reaches Waimea River low water is used for power and irrigation.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 2 and 400 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Koaie Stream at elevation 3,700 feet, near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 15	Shiro Takabayashi	0.39	3.1	2.0
Dec. 13	do	.45	5.9	3.8
Jan. 24	J. E. Stewart	.58	5.6	3.6
Mar. 10	Shiro Takabayashi	.70	16.3	10.5
May 22	do	.55	4.2	2.7
June 13	M. H. Carson	.94	52.	33.5

Daily discharge, in million gallons, of Koaie Stream at elevation 3,700 feet, near Waimea, Kaui, for the year ending June 30, 1920.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	3.3	2.6	1.9	12.8	2.2	1.9	2.8	2.2	2.3
2	.....	2.8	3.0	48	6.6	2.2	1.9	11.8	2.1	2.1
3	.....	3.2	3.6	212	5.6	2.1	1.8	27	2.1	2.0
4	.....	2.8	2.6	21	3.6	2.0	1.8	40	2.0	1.9
5	.....	6.1	3.9	9.4	6.6	2.0	1.8	12.8	2.0	22
6	9.4	12.9	120	8.3	45	2.0	5.0	7.8	1.9	7.2
7	13.7	3.0	14.6	3.8	46	2.2	10.3	3.4	1.9	3.2
8	19.0	2.4	4.4	.....	8.8	2.1	50	2.8	1.9	2.3
9	75	2.2	8.3	.....	28	2.0	11.1	2.7	1.9	2.0
10	8.3	2.1	8.4	.....	31	1.9	21	2.4	2.0	8.3
11	4.4	4.2	22	.....	6.1	63	44	2.2	1.9	15.8
12	3.6	3.9	8.3	.....	3.9	8.3	205	2.2	1.9	22
13	3.2	2.6	5.0	.....	31	3.4	77	2.3	1.9	22
14	2.7	2.1	3.2	2.7	59	2.7	11.1	2.7	1.9	19
15	2.3	2.0	2.7	2.7	176	2.4	5.6	3.0	1.8	8.3
16	2.3	1.9	2.4	2.4	165	2.0	3.6	2.7	1.8	33
17	2.3	1.9	2.2	2.6	75	2.1	9.0	2.4	1.8	30
18	2.1	1.9	2.1	2.8	18.0	2.1	75	27	1.9	7.2
19	2.0	2.1	2.0	2.6	9.4	2.0	130	8.8	3.0	3.4
20	3.2	2.7	1.9	2.3	7.2	1.8	21	6.1	2.8	3.0
21	3.2	3.4	2.0	2.1	27	1.8	24	16.3	2.3	2.4
22	2.4	2.6	2.3	2.2	20	1.9	49	26	3.3	2.8
23	2.0	4.2	2.3	2.8	6.1	1.8	84	13.7	3.8	4.4
24	1.6	3.3	5.0	2.6	3.6	1.9	29	6.6	6.6	3.2
25	1.6	3.3	2.8	2.3	3.3	2.1	44	3.8	3.4	2.4
26	1.5	2.4	2.4	2.6	3.2	3.4	24	3.3	5.0	2.4
27	1.4	31	2.7	3.3	3.0	3.0	12.0	2.8	3.9	3.0
28	1.4	39	2.4	8.3	2.7	2.3	7.2	2.7	2.8	8.8
29	2.4	13.4	2.1	28	2.6	2.1	5.0	2.7	2.4	12.8
30	3.3	3.6	2.1	41	2.4	.....	3.4	2.4	3.3	3.9
31	.....	2.8	.....	16.3	2.4	.....	3.2	.....	2.7	.....

NOTE.—Sept. 1–5 recorder not yet installed. Dec. 8–13 and May 3–7, clock run down. Discharge estimated in million gallons per day from comparison with flow of adjacent streams as follows: Sept. 1–5, 8; Dec. 8–13, 3.3; May 3–7, graph estimated.

Monthly discharge of Koaie Stream at elevation 3,700 feet, near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	.....	8.39	13	a 260	798
August	.....	.....	6.45	9.98	a 200	614
September	75	1.4	7.14	11.0	214	657
October	39	1.9	5.65	8.74	175	538
November	120	1.9	8.31	12.9	249	765
December	212	1.9	14.6	22.6	454	1,390
January	176	2.4	26.5	41.0	823	2,520
February	63	1.8	4.51	6.98	131	401
March	205	1.8	31.4	48.6	973	2,990
April	40	2.2	8.44	13.1	253	777
May	6.6	1.8	2.59	4.01	80.2	246
June	33	1.9	8.80	13.6	264	810
The year	212	1.4	11.1	17.2	4,080	12,500

a Estimated by comparison with flow of adjacent streams.

WAIALAE RIVER AT ELEVATION 3,700 FEET, NEAR WAIMEA, KAUAI.

LOCATION.—2 miles below swamps and 15 miles by trail northeast of Waimea by way of Gay's mountain house.

RECORDS AVAILABLE.—January 26, 1920, to June 30, 1920, at present site and August 1, 1910, to January 25, 1916, at old site about 2 miles downstream from present location.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel rocky boulder strewn bed with steep high banks; straight for 300 feet above and 100 feet below station. Control, solid rock shoulder about 15 feet below intake.

EXTREMES OF DISCHARGE.—Maximum stage recorded 3.01 feet at 3.30 p. m. March 22, 1920 (discharge, 278 million gallons per day or 430 second-feet); minimum stage recorded 0.75 foot at 1 a. m. May 17, 1920 (discharge, 2.4 million gallons per day, or 3.7 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of flood water available for storage for use in irrigating high-level lands above Waimea and Kekaha.

UTILIZATION.—After it reaches Waimea River low water is used for irrigation.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 4 and 70 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Waialae River at elevation 3,700 feet, near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 26	J. E. Stewart	1.00	8.0	5.1
Mar. 10	Shiro Takabayashi	1.64	64	41
May 23	do	.90	4.5	2.9
June 14	M. H. Carson	1.23	21.7	14.0

Daily discharge, in million gallons, of Waialae River at elevation 3,700 feet, near Waimea, Kauai, for the year ending June 30, 1920.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	3.6	2.9	4.0	3.2	3.3	16	.....	3.3	4.4	3.6	2.6	28
2	.....	3.4	2.7	14.0	3.2	*3.0	17	.....	3.2	7.1	3.5	2.5	26
3	.....	3.4	2.7	21	.....	2.9	18	.....	3.0	39	33	2.6	6.4
4	.....	3.3	2.7	45	.....	2.7	19	.....	3.0	46	6.4	3.4	4.4
5	.....	3.3	2.7	9.0	.....	16.7	20	.....	3.0	8.5	4.7	3.1	4.0
6	.....	3.4	3.7	5.9	.....	5.8	21	.....	3.0	10.0	5.8	3.1	3.6
7	.....	3.3	4.8	4.7	3.1	4.2	22	.....	3.0	54	13.3	3.7	4.1
8	.....	3.2	33	4.1	3.0	3.4	23	.....	3.0	59	6.7	4.3	5.4
9	.....	3.1	6.4	3.8	2.8	3.2	24	.....	3.2	15.3	4.8	5.6	4.0
10	.....	3.0	17.0	3.7	2.9	6.4	25	.....	3.3	22	4.6	3.7	3.5
11	.....	40	16.4	3.6	2.8	16.1	26	4.7	3.3	12.2	4.1	4.4	3.4
12	.....	6.9	99	3.4	2.9	13.9	27	4.4	3.2	8.2	3.6	4.2	3.4
13	.....	4.4	46	3.4	3.0	15.3	28	4.2	3.0	6.4	3.6	3.4	7.5
14	.....	3.7	7.4	3.6	2.7	12.8	29	4.1	2.8	5.1	3.5	3.3	7.2
15	.....	3.4	5.3	3.7	2.7	6.9	30	3.8	.....	4.6	3.4	4.3	4.4
							31	3.6	.....	4.2	.....	3.5	.....

NOTE.—May 3–6, clock run down; discharge estimated at 3.2 million gallons per day.

Monthly discharge of Waialae River at elevation 3,700 feet, near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January 26-31	4.7	3.6	4.13	6.39	24.8	76
February	40	2.8	4.64	7.18	135	413
March	99	2.7	8.0	27.9	559	1,710
April	45	3.4	7.92	12.3	238	729
May	5.6	2.5	3.32	5.14	103	316
June	28	2.7	7.73	12.0	232	712
The period					1,290	3,960

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, 1920. Data from December 19, 1916, to June 30, 1918, have been revised in Water-Supply Paper 515.

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, 5.56 feet at 4.30 p. m. December 3 (discharge, about 1,160 million gallons per day, or 1,790 second-feet); minimum stage recorded, 0.69 foot 11 p. m. December 1 to 10 a. m. December 2 (discharge, 2.9 million gallons per day, or 3.7 second-feet).

1915–1920: Maximum stage recorded, 6.55 feet at 10.30 p. m. December 18, 1916 (discharge, approximately 1,700 millions gallon per day, or 2,630 second-feet); minimum stage recorded, December, 1919.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge above all diversions. Territorial land and water leased to Kekaha Sugar Co.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, used as follows: First curve July 1 to December 2 and January 16 to June 30; second curve, December 3 to January 15. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records fair.

Discharge measurements of Waialae River at elevation 800 feet, near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet	Million gallons per day.
July 17	Shiro Takabayashi	0.93	10.	6.5
Aug. 22	do	1.01	11.7	7.6
Sept. 3	W. V. Hardy	.92	8.8	5.7
Oct. 29	Shiro Takabayashi	1.31	23.9	15.4
Dec. 31	do	1.12	26.5	17
Jan. 28	J. E. Stewart	1.25	22.4	14.5
Apr. 27	Shiro Takabayashi	.84	8.8	5.7
May 24	do	1.13	15.6	10.1
June 28	M. H. Carson	.80	6.9	4.4

Daily discharge, in million gallons, of Waialae River at elevation 800 feet, near Waimea, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	5.8	18.1	13.0	7.2	6.2	3.0	17.2	10.7	4.1	7.0	.....	4.7
2	5.3	13.6	11.2	5.8	5.6	101	11.2	9.9	4.0	11.4	.....	3.8
3	5.0	7.8	10.4	5.2	8.6	318	9.4	9.4	3.8	28	.....	3.5
4	4.4	6.4	10.4	7.2	6.2	86	8.6	8.8	3.8	36	.....	3.2
5	3.8	6.4	7.6	5.3	7.0	33	8.8	8.3	3.7	17.4	.....	12.9
6	3.6	6.2	9.4	12.2	219	30	23	9.4	4.0	10.1	.....	11.1
7	3.6	5.5	13.2	6.8	42	17.6	48	9.1	6.4	7.0	.....	5.3
8	3.7	10.0	17.8	5.2	12.1	13.4	15.4	7.8	30	5.6	.....	4.0
9	5.8	8.3	50.	4.5	10.4	48	24	7.2	12.1	5.0	.....	3.4
10	12.5	6.6	16.1	4.7	7.8	45	56	6.8	17.9	4.7	.....	3.8
11	29	5.5	8.6	6.0	14.8	26	16.4	33	16.8	4.5	.....	12.7
12	10.1	4.7	6.4	11.5	9.1	17.2	13.4	17.5	77	4.2	.....	19.4
13	34	4.4	5.6	6.6	6.8	14.1	42	11.0	50	4.1	.....	19.6
14	28	5.2	5.0	5.2	5.3	12.5	93	7.8	13.8	4.1	.....	18.6
15	16.1	14.8	4.7	4.5	4.5	12.3	310	6.8	8.3	4.2	.....	11.8
16	9.6	21	4.5	4.4	4.0	10.7	340	6.2	6.4	4.2	.....	27
17	6.6	9.4	4.4	4.1	3.6	11.8	196	5.8	7.7	4.1	.....	28
18	5.6	6.2	4.4	4.0	3.4	12.0	58	5.6	23	36	.....	12.6
19	8.6	5.5	4.1	3.8	3.2	10.0	36	5.3	50	15.4	.....	6.6
20	26	14.8	4.4	9.7	3.0	9.2	37	5.2	14.8	8.1	.....	5.2
21	14.5	20.0	6.0	8.3	3.2	8.6	67	4.8	12.6	10.6	.....	4.2
22	9.4	9.4	5.0	6.2	3.5	8.4	46	4.7	37	18.1	.....	6.8
23	9.1	6.4	4.5	5.6	6.5	8.6	28	4.7	61	14.2	.....	10.4
24	6.6	5.5	4.7	9.6	11.4	8.4	23	4.5	19.3	8.1	.....	5.8
25	5.6	4.8	6.8	10.7	5.8	7.8	20.0	4.4	25	6.2	7.6	4.5
26	5.2	4.5	5.2	6.4	5.2	7.5	20.0	5.2	20.0	5.6	7.8	4.1
27	6.8	4.4	4.4	14.8	5.2	7.5	17.1	5.0	12.6	5.0	7.0	3.7
28	11.3	4.1	4.1	43	4.4	8.4	15.1	4.7	12.1	.....	5.0	6.2
29	17.1	4.0	4.5	22	3.6	16.5	13.5	4.4	8.1	.....	5.8	11.2
30	8.1	4.0	7.0	9.6	3.4	36	12.4	.....	9.3	.....	9.9	6.4
31	7.4	3.8	.....	7.0	.....	20.0	11.2	.....	6.2	.....	6.2	.....

NOTE.—Apr. 28 to May 24, recorder not working. Discharge estimated in million gallons per day as follows: Apr. 28–30, 4.8; May 1–5, 4.5; 6–10, 4.0; 11–15, 3.6; 16–20, 3.0; 21–24, 6.5. Estimates made by comparison with records for Waialae River at elevation 3,700 feet, and with records for two stations on Koaie River.

Monthly discharge of Waialae River, at elevation 800 feet, near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	34	3.6	10.6	16.4	328	1,010
August	21	3.8	8.11	12.5	251	772
September	50	4.1	8.78	13.6	263	808
October	43	3.8	8.62	13.3	267	820
November	219	3.0	14.5	22.4	435	1,330
December	318	3.0	31.2	48.3	968	2,970
January	340	8.6	52.8	81.7	1,640	5,020
February	33	4.4	8.07	12.5	234	718
March	77	3.7	18.7	28.9	581	1,780
April	36	4.1	10.1	15.6	303	930
May	.....	.....	4.86	7.52	151	462
June	28	3.2	9.35	14.5	280	861
The year	340	3.0	15.6	24.1	5,700	17,500

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, 1920. Staff at Flume No. 4, one mile below intake, March 18, 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, 3.50 feet 6 a. m. and 7 p. m. May 30 (discharge, 65 million gallons per day, or 101 second-feet); water occasionally shut off.

1907–1920: 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 head gates.

OBJECT OF STATION.—To measure water diverted from river by ditch. Land and water owned by Territory and leased to Kekaha Sugar Co.

UTILIZATION.—Water used for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Two rating curves used; one used July 1–31 and one used August 1 to June 30. Both 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 17	Shiro Takabayashi	2.80	74	47.5
Aug. 22	....do	3.30	92	59
Oct. 29	....do	3.34	93	60
Dec. 31	....do	3.20	86	56
Jan. 28	J. E. Stewart	2.91	74	48
Apr. 26	Shiro Takabayashi	2.77	69	44.5
May 24	....do	3.20	89	58
June 28	M. H. Carson	2.28	46	29.5

Daily discharge, in million gallons, of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	36	62	62	30	28	23	23	59	37	56	36	34
2	31	59	56	31	28	40	38	59	37	56	35	31
3	31	40	51	30	30	35	56	59	35	62	32	29
4	29	35	51	34	29	15.8	48	59	35	62	32	30
5	27	35	37	29	27	15.8	62	59	35	62	32	45
6	27	36	45	62	48	7.9	62	59	48	59	32	53
7	27	32	56	43	62	15.5	62	59	62	51	32	37
8	29	37	62	32	53	62	62	59	62	45	31	32
9	47	45	62	30	62	29	62	59	62	40	32	32
10	64	40	62	28	51	15.8	62	56	62	40	32	40
11	61	34	45	26	62	15.8	62	56	62	38	31	51
12	58	30	34	51	62	15.8	62	62	62	37	32	62
13	53	28	30	34	45	23	62	59	62	37	32	62
14	64	30	28	28	37	45	62	53	62	37	30	62
15	64	48	27	24	32	59	40	48	62	37	30	58
16	64	62	26	23	29	45	11.8	45	62	37	30	53
17	47	48	26	23	28	45	11.0	43	59	37	29	59
18	36	35	26	23	26	45	11.0	43	62	62	34	53
19	47	45	24	23	26	43	2.8	43	62	62	40	37
20	64	62	23	38	24	38	.....	40	62	56	35	35
21	64	62	26	40	26	35	.....	40	62	62	35	31
22	58	59	26	29	51	34	.....	38	62	62	35	35
23	58	38	23	29	43	62	.....	38	62	62	35	35
24	42	32	24	51	53	51	.....	37	62	62	51	34
25	39	29	40	48	38	38	.....	37	62	51	48	31
26	39	28	27	32	34	48	.....	62	62	45	45	30
27	42	26	23	28	30	59	10.0	53	62	40	40	30
28	53	26	23	62	28	59	48	40	62	40	36	31
29	64	26	23	62	26	62	59	40	62	38	37	48
30	50	24	29	43	26	62	59	.....	62	37	65	35
31	44	23	.....	35	.....	62	59	.....	59	.....	43	.....

NOTE.—No discharge for days for which discharge is not given.

Monthly discharge of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	64	27	47.1	72.9	1,460	4,480
August	62	23	39.2	60.7	1,220	3,730
September	62	23	36.6	56.6	1,100	3,370
October	62	23	35.5	54.9	1,100	3,380
November	62	24	38.1	58.9	1,140	3,510
December (29¾ days)	62	7.9	40.6	62.8	1,210	3,700
January (22¼ days)	62	2.8	48.8	75.5	1,100	3,370
February	62	37	50.5	78.1	1,460	4,490
March	62	35	57.1	88.3	1,770	5,430
April	62	37	49.1	76.0	1,470	4,520
May	65	29	36.1	55.9	1,120	3,430
June	62	29	41.0	63.4	1,230	3,770
The period (356¼ days)	65	2.8	43.2	66.8	15,400	47,200

KEKAHA DITCH BELOW TUNNEL NO. 12, NEAR WAIMEA, KAUAI.[3]

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 November 30, 1914, and July 20, 1916, to June 30, 1920.

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, 3.56 feet March 26–28 (discharge, 49 million gallons per day, or 76 second-feet) minimum water shut off December 6 and 7 and January 19–27.

1916–1920: Maximum stage recorded, 4.0 feet March 1–2, 1919, (discharge, 53 million gallons per day, or 82 second-feet); 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 head gates.

OBJECT OF STATION.—To determine discharge above first important lateral, also determine ditch losses between intake and station. Territorial land and water. Important in connection with proposed homesteads.

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

ACCURACY.—Stage-discharge relation changed slightly August 9. Rating curves well defined from 10 to 50 million gallons per day, used July 1 to August 9 and August 10 to June 30. Gage read to hundredths once a day. Records good.

[3] 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.

Discharge measurements of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 20	Shiro Takabayashi	3.52	60	39
Aug. 25	do	2.14	38.5	25
Nov. 19	do	2.05	35	22.8
Dec. 11	do	1.35	20.5	13.2
Jan. 9	J. E. Stewart	3.40	78	50
20	do	-.05	.1	.06
Feb. 26	Shiro Takabayashi	2.62	53	34
Mar. 12	do	3.20	83	53
Apr. 5	do	3.34	73	47
May 5	do	2.24	41.5	27
25	do	2.77	56	36
June 30	M. H. Carson	2.84	52	33.9

Daily discharge, in million gallons, of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	34	42	44	26	25	26	19.4	43	34	44	31	32
2	34	42	44	34	25	27	19.4	43	32	44	31	29
3	34	39	34	27	22	50	19.4	43	31	44	29	27
4	33	39	44	27	25	26	44	43	31	46	29	26
5	33	37	36	25	24	26	44	43	31	46	27	27
6	33	37	37	43	32	.....	46	43	31	46	25	46
7	27	36	34	39	48	.....	46	37	43	44	27	34
8	28	34	41	41	48	21	46	43	43	39	27	29
9	28	37	48	25	48	43	46	43	44	37	29	29
10	45	39	48	34	43	48	41	43	44	37	29	26
11	45	39	41	23	46	21	43	43	44	36	27	44
12	45	39	29	39	44	21	43	43	44	36	27	44
13	44	46	25	32	46	20.0	43	46	44	34	26	46
14	44	46	24	29	44	39	43	46	44	34	26	46
15	44	46	24	23	39	43	48	44	44	34	26	46
16	44	48	24	20.0	29	44	2.3	39	46	34	26	43
17	37	48	23	21	32	46	3.9	39	46	34	26	44
18	31	46	23	18.7	25	37	.9	37	46	36	29	44
19	31	46	23	19.4	27	36	.....	36	46	46	37	37
20	42	39	21	22	29	36	.....	34	48	44	31	31
21	42	39	25	18.0	25	34	.....	34	48	44	29	29
22	45	39	24	29	44	39	.....	34	48	44	29	27
23	37	37	21	31	25	41	.....	36	48	44	29	36
24	34	27	19.4	37	39	39	.....	34	48	44	36	34
25	34	26	23	41	24	31	.....	34	48	43	41	29
26	33	24	23	29	29	41	.....	37	50	43	39	27
27	31	24	21	24	27	43	.....	43	50	36	41	27
28	31	24	22	43	26	48	41	37	50	34	34	29
29	45	24	23	44	25	48	41	34	48	32	31	39
30	39	24	26	39	24	48	41	.....	46	32	44	39
31	39	24	.....	31	.....	48	43	.....	44	.....	43	.....

NOTE.—No discharge for days for which discharge is not given.

Monthly discharge of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	45	27	37.0	57.2	1,150	3,520
August	48	24	36.7	56.8	1,140	3,490
September	48	19.4	29.8	46.1	894	2,740
October	44	18.0	30.1	46.6	934	2,860
November	48	22	33.0	51.1	989	3,040
December (29 days)	50	20.0	36.9	57.1	1,070	3,280
January (22 days)	48	.9	34.7	53.7	764	2,350
February	46	34	39.8	61.6	1,150	3,540
March	50	31	43.4	67.1	1,340	4,130
April	46	32	39.7	61.4	1,190	3,660
May	44	25	31.0	48.0	961	2,950
June	46	26	34.9	54.0	1,050	3,210
The period (355 days)	50	.9	35.6	55.1	12,600	38,800

WAIMEA DITCH NEAR WAIMEA, KAUAI.

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

RECORDS AVAILABLE.—March 20, 1916, to June 30, 1920, at present site. November 4, 1911, to September 30, 1913, at old location at ditch intake. Station was reestablished February 28, 1916, but there was no gage height reading until March 20, 1916.

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.—1916–1920: Maximum stage recorded, 1.50 feet at 7.35 a. m. November 11, 1919 (discharge, 8.4 million gallons per day, or 13.0 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch diverts from Waimea River.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of Territorial water diverted for Waimea plantation (fee simple land).

UTILIZATION.—Water used 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. Gage read to hundredths twice daily. Records good.

Discharge measurements of Waimea ditch near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 18	W. V. Hardy	0.95	5.1	3.3
Aug. 25	Shiro Takabayashi	.87	5.3	3.4
Nov. 20	do	.85	5.1	3.3
Jan. 9	do	.86	5.0	3.2
Feb. 26	do	.83	4.1	2.7
Apr. 5	do	.85	4.7	3.0
May 5	do	.95	5.6	3.6
25	do	1.00	6.6	4.2
June 30	M. H. Carson	1.05	6.8	4.4

Daily discharge, in million gallons, of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.0	4.6	3.9	4.6	.....	4.2	3.2	2.3	3.9	3.0	4.0	4.2
2	2.6	6.6	5.5	4.4	.....	2.0	3.4	2.5	3.4	2.7	3.9	4.0
3	2.7	6.6	4.0	4.4	5.5	.2	3.4	3.0	3.6	3.0	4.0	4.0
4	3.0	5.0	4.4	4.2	5.7	.2	3.3	3.0	3.9	3.3	4.0	4.2
5	3.0	4.2	4.0	4.4	5.7	.....	5.0	3.0	4.4	3.0	4.1	3.4
6	3.0	4.2	4.2	5.7	6.6	4.0	4.0	2.5	4.0	3.0	4.2	5.7
7	3.0	4.0	5.0	5.7	5.2	2.5	5.0	2.6	5.5	2.7	4.0	5.0
8	3.3	3.6	5.7	4.6	3.6	.5	4.8	2.1	5.7	1.9	4.0	4.2
9	4.2	4.8	6.6	4.6	5.7	1.4	4.6	3.0	5.0	2.6	5.0	3.4
10	6.6	4.6	7.0	4.4	5.5	1.6	5.7	3.2	4.8	3.3	3.9	3.6
11	6.2	4.0	5.2	4.4	8.0	1.2	4.6	2.3	4.6	3.4	3.9	5.5
12	6.6	3.3	4.4	5.2	7.5	.9	3.4	4.4	4.4	3.5	4.6	6.6
13	5.5	3.2	4.2	5.0	6.6	.....	3.6	3.4	4.6	3.9	4.6	4.2
14	7.0	2.7	4.0	4.4	4.6	.....	4.4	3.4	4.4	3.9	4.2	4.2
15	7.0	3.9	4.0	4.2	3.4	.....	1.8	3.3	3.6	4.0	4.0	5.0
16	7.0	6.2	4.2	4.0	3.6	1.8	.....	3.4	4.0	3.9	4.0	4.4
17	5.7	6.6	4.4	3.6	3.3	1.1	.....	3.6	3.8	4.0	4.0	5.2
18	4.8	5.0	4.4	4.0	3.3	1.8	.....	3.6	2.7	4.4	4.6	5.2
19	4.4	3.9	4.0	4.4	3.3	1.6	.....	3.4	3.6	4.2	5.7	4.6
20	7.5	4.6	4.0	5.5	3.3	1.3	.....	3.2	1.5	4.2	4.6	3.9
21	7.5	6.6	4.8	4.0	3.6	1.1	.....	3.2	2.3	4.6	5.0	3.6
22	6.6	6.2	4.2	2.6	4.0	1.0	.....	3.3	2.3	4.6	4.6	4.6
23	5.7	4.4	3.9	2.5	4.0	3.9	.....	3.3	3.0	4.8	4.8	5.2
24	5.0	3.4	4.0	.....	3.3	3.2	.....	3.3	2.6	4.6	5.5	4.8
25	4.4	3.3	4.6	.....	3.9	2.7	.....	3.4	2.6	4.8	5.0	4.2
26	4.0	3.2	4.6	.....	3.4	3.2	.....	4.2	2.6	4.8	5.0	3.6
27	4.0	3.0	4.2	.....	3.4	4.8	.....	4.2	2.5	4.8	5.0	4.0
28	4.4	3.0	4.0	.....	3.3	4.4	.....	4.0	2.3	4.6	5.0	3.4
29	6.6	.....	4.0	.....	3.9	4.6	.....	4.0	1.8	4.8	4.2	5.5
30	6.2	3.3	4.0	.....	4.0	4.6	.....	.....	3.0	4.2	5.2	5.7
31	5.0	3.0	.....	.....	.....	3.3	.....	.....	2.7	.....	4.8	.....

NOTE.—No discharge for days for which discharge is not given.

Monthly discharge of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.5	2.6	5.05	7.81	156	480
August (30 days)	6.6	2.7	4.37	6.76	131	402
September	7.0	3.9	4.51	6.98	135	415
October 1–23	5.7	2.5	4.38	6.78	101	309
November 3–30	8.0	3.3	4.54	7.02	127	390
December (27 days)	4.8	.2	2.30	3.56	62.1	191
January (14½ days)	5.7	1.8	4.15	6.42	60.2	185
February	4.4	2.1	3.24	5.01	94.1	288
March	5.7	1.5	3.51	5.43	109	334
April	4.8	1.9	3.82	5.91	115	352
May	5.7	3.9	4.50	6.96	139	428
June	6.6	3.4	4.51	6.98	135	415
The period (334½ days)	8.0	.2	4.08	6.31	1,360	4,190

KAMENEHUNE DITCH NEAR WAIMEA, KAUAI.

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

RECORDS AVAILABLE.—October 9, 1911, to October 31, 1919, when station was discontinued.

GAGE.—Vertical staff on right bank; read by Uki Takata.

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, 1.24 feet at 6 a. m. October 6 (discharge, 4.8 million gallons per day, or 7.4 second-feet); minimum stage recorded, 0.60 foot at 7 a. m. and 6 p. m. July 4 and 6 p. m. September 20 (discharge, 0.9 million gallons per day, or 1.4 second-feet).

1911–1919: Maximum stage recorded, 1.98 feet at 6 a. m. August 4, 1918 (discharge, 12.1 million gallons per day or 18.7 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts from Waimea River.

REGULATION.—By head gates.

OBJECT OF STATION. To determine amount of water diverted by ditch which irrigates rice and taro in village of Waimea.

UTILIZATION.—Water used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve poorly defined. Gage read to hundredths twice daily. Records poor.

Discharge measurements of Kamenehune ditch near Waimea, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 18	W. V. Hardy	0.78	2.7	1.75
Aug. 25	Shiro Takabayashi	.84	3.5	2.3

Daily discharge, in million gallons, of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	2.2	1.9	2.3	2.1	16	2.7	3.6	2.1	1.8
2	2.0	1.6	3.3	2.2	17	2.7	3.3	1.7	2.0
3	1.4	3.5	2.4	2.4	18	2.8	2.3	1.3	2.0
4	.9	2.7	1.4	2.2	19	2.8	2.2	1.3	2.2
5	1.7	2.1	1.4	2.2	20	3.4	2.0	1.3	2.5
6	1.6	1.8	1.2	4.0	21	2.8	2.8	1.7	2.3
7	2.2	1.7	2.5	2.4	22	2.4	2.7	1.5	2.0
8	2.0	2.0	3.5	1.6	23	2.4	3.3	1.7	2.3
9	2.8	1.9	3.3	1.8	24	2.2	2.9	1.7	3.2
10	3.0	1.6	2.4	1.8	25	2.0	2.8	2.0	3.0
11	3.4	2.0	1.8	2.0	26	1.6	2.6	2.0	3.2
12	3.5	1.6	1.6	2.3	27	1.2	2.1	1.9	2.4
13	3.3	1.4	1.8	2.8	28	1.1	1.6	1.7	3.8
14	3.3	1.3	2.0	2.5	29	3.6	1.3	1.8	3.4
15	3.0	1.5	2.0	2.0	30	3.5	1.3	2.0	2.5
					31	2.8	1.1	.....	2.0

Monthly discharge of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.6	0.9	2.46	3.81	76.3	234
August	3.6	1.1	2.15	3.33	66.5	205
September	3.5	1.2	1.95	3.02	58.6	180
October	4.0	1.6	2.43	3.76	75.3	231
The period					277	850

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, 1920. August 16, 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 and subject to overflow at high stages. Banks covered with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.90 feet at 5 p. m. January 15 (discharge, 2,550 million gallons per day, or 3,950 second-feet); minimum stage recorded, 0.42 foot at 5 p. m. March 2 (discharge, 7.6 million gallons per day, or 11.8 second-feet).

1910–1920: 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.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial land below.

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 curves fairly well defined between 10 and 200 million gallons per day used July 1 to January 16 and January 17 to June 30. Gage read to hundredths once daily. Records fair.

Discharge measurements of Hanapepe River at Koula, near Eleele, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 19	Shiro Takabayashi	1.11	68	43.8
Aug. 26	do	.71	27.5	17.9
Nov. 29	do	.73	25	16.3
Jan. 29	J. E. Stewart	1.14	54	35
Feb. 27	Shiro Takabayashi	.48	13.6	8.8
Apr. 3	do	2.19	223	144
May 5	W. N. Hardy	.49	13.2	8.5
27	Shiro Takabayashi	.92	37.5	24.1
June 27	M. H. Carson	.98	37	23.9

Daily discharge, in million gallons, of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	56	123	88	23	34	18	20	16.6	7.8	850	8.6	8.9
2	19.0	45	20	26	41	1,180	16.2	14.8	7.6	116	8.6	8.6
3	18.0	30	26	23	30	2,350	17.1	11.6	7.9	88	8.4	8.6
4	15.8	23	45	22	23	220	18.0	11.1	7.9	1,450	8.5	9.4
5	15.8	26	47	20	34	82	15.8	10.8	8.6	99	8.5	156
6	17.1	23	43	19.5	41	72	15.3	10.3	10.0	33	8.4	16.6
7	20	20	65	19.0	34	54	14.4	10.3	8.6	16.6	8.4	11.6
8	18.0	18.0	45	18.0	30	54	14.8	11.6	164	16.6	8.2	10.3
9	20	15.8	350	17.1	34	1,260	15.8	9.4	121	13.0	8.2	9.4
10	20	15.8	54	16.2	30	104	33	9.1	41	10.3	8.2	73
11	82	18.0	26	17.1	23	82	20	700	68	9.8	8.1	83
12	23	16.6	23	18.0	18.0	72	15.8	134	33	16.6	8.9	68
13	30	26	20	17.1	20	70	17.1	33	13.0	10.3	8.5	58
14	138	23	15.8	14.4	17.1	54	54	11.6	10.3	10.3	8.4	73
15	43	43	18.0	14.4	15.3	50	1,860	10.3	8.5	13.4	8.2	54
16	50	54	18.0	14.0	14.4	50	1,820	10.3	8.1	10.0	8.5	78
17	23	21	20	18.0	14.0	47	300	9.6	400	9.4	8.2	73
18	20	18.0	18.5	16.6	13.5	45	78	10.3	220	149	10.3	24
19	13.5	20	19.0	27	13.5	45	73	10.3	51	21	13.0	22
20	200	34	26	300	13.5	43	63	9.4	24	11.6	9.4	13.7
21	72	30	23	116	17.1	43	68	10.3	400	10.3	16.6	13.0
22	43	20	19.5	19.0	20	30	63	10.3	149	49	54	83
23	93	18.0	18.5	23	34	20	58	9.6	134	13.0	280	110
24	26	15.8	16.2	34	23	18.0	54	9.3	33	9.6	121	15.9
25	22	14.8	34	28	20	17.6	54	8.9	164	9.4	90	12.5
26	19.5	16.6	22	19.0	30	17.1	58	8.4	33	9.1	149	21
27	65	15.8	20	26	34	16.6	58	8.0	20	9.1	22	18.8
28	27	14.8	23	164	19.0	16.2	49	8.0	13.0	8.9	12.5	54.0
29	110	14.4	26	93	18.5	17.1	41	7.9	11.6	9.4	11.4	30
30	30	15.8	30	37	18.5	24	36	.....	10.3	9.1	10.1	21
31	63	15.8	.....	34	.....	22	.....	.....	9.4	.....	9.4	.....

NOTE.—No gage reading Jan. 31; discharge estimated at 27 million gallons per day.

Monthly discharge of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	200	13.5	45.6	70.6	1,410	4,340
August	123	14.4	26.0	40.2	806	2,470
September	350	15.8	40.6	62.8	1,220	3,740
October	300	14.0	40.3	62.4	1,250	3,830
November	41	13.5	24.2	37.4	727	2,230
December	2,350	16.2	200	309	6,190	19,000
January	1,860	14.4	163	252	5,050	15,500
February	700	7.9	39.1	60.5	1,140	3,480
March	400	7.6	70.9	110	2,200	6,750
April	1,450	8.9	163	150	3,080	9,480
May	280	8.1	31.0	48.0	960	2,950
June	156	8.6	41.3	63.9	1,240	3,800
The year	2,350	7.6	69.0	107	25,300	77,600

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, 1920.

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

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Wooden flume; straight for 50 feet 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. April 4 (discharge, 34 million gallons per day, or 53 second-feet); ditch occasionally dry.

1910–1920: Maximum stage recorded during period of record 3.20 feet [4] 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 head gates.

OBJECT OF STATION.—To determine discharge of ditch at boundary between fee simple land above and Territorial land below.

UTILIZATION.—Water used 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 19	Shiro Takabayashi	2.68	45	29
Aug 26	do	2.16	31.5	20.4
Nov. 29	do	1.84	24.6	15.9
Feb. 27	do	2.16	31.5	20.2
Apr. 3	do	3.02	51	33
May 5	W. V. Hardy	2.31	36	23.1
27	Shiro Takabayashi	2.92	49	31.5
June 27	M. H. Carson	2.98	45.5	29.5

Daily discharge, in million gallons, of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	25	32	29	23	25	15.2	24	14.5	21	32	24	24
2	25	31	25	23	26	28	23	15.0	21	33	24	23
3	23	29	28	24	24	30	22	18.9	20	33	24	23
4	23	28	28	21	23	.....	22	18.9	20	34	24	24
5	22	28	27	22	25	.....	22	19.6	21	32	23	32
6	20	26	28	20	23	.....	22	19.6	24	32	23	31
7	22	25	28	20	28	.....	22	20	22	32	23	28
8	22	28	28	18.9	23	.....	22	21	32	32	23	28
9	22	25	32	18.9	24	.....	22	19.6	32	32	23	25
10	27	24	29	18.2	27	.....	29	20	28	32	24	31
11	32	23	28	19.6	25	.....	24	32	28	32	23	31
12	30	22	25	17.6	22	.....	22	31	28	31	24	32
13	32	25	24	17 6	22	.....	22	29	28	31	23	32
14	29	27	23	17.6	22	.....	32	27	28	32	22	32
15	29	29	22	17.6	18.9	.....	3.3	26	24	32	22	32
16	28	31	22	17.6	18.9	.....	.....	24	23	31	24	32
17	27	28	23	22	17.6	.....	.....	23	33	28	22	32
18	25	26	21	17.6	17.0	.....	.....	24	32	33	30	32
19	29	25	22	23	16.4	.....	.....	22	32	32	32	32
20	31	29	28	28	16.4	.....	.....	22	32	32	25	32
21	28	29	24	28	20	2.9	.....	22	33	30	31	32
22	29	28	22	25	20	12.8	.....	20	33	30	32	31
23	28	25	20	24	25	17.6	.....	20	32	32	32	32
24	27	24	19.6	24	22	19.6	.....	20	32	28	31	32
25	28	23	20	24	20	19.6	.....	22	32	27	32	32
26	31	22	23	23	23	19.6	.....	22	32	27	32	32
27	28	22	20	24	22	20	.....	22	32	25	31	32
28	32	21	23	28	20	20	.....	22	32	25	30	32
29	30	20	27	28	17.0	24	.....	21	30	28	28	32
30	31	21	27	28	16.4	28	.....	.....	30	24	27	32
31	31	21	.....	29	.....	26	4.2	.....	28	.....	24	.....

NOTE.—No discharge for days for which discharge is not given.

[4] 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, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	32	20	27.3	42.2	846	2,600
August	32	20	25.7	39.8	797	2,440
September	32	19.6	24.9	38.5	746	2,290
October	29	17.6	22.3	34.5	692	2,120
November	28	16.4	21.7	33.6	650	2,000
December (13⅛ days)	30	2.9	21.6	33.4	283	869
January (14 21/48 days)	32	3.3	23.4	36.2	338	1,040
February	32	14.5	22.0	34.0	638	1,960
March	33	20	28.2	43.6	875	2,680
April	34	24	30.5	47.2	914	2,810
May	32	22	26.2	40.5	812	2,490
June	32	23	30.2	46.7	907	2,780
The year (331 9/16 days)	34	2.9	25.6	39.6	8,500	26,100

MANUAHI STREAM AT KOULA, NEAR ELEELE, KAUAI.

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

RECORDS AVAILABLE.—May 13, 1917, to June 30, 1920.

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, over 6.00 feet at 5 p. m. January 15 (discharge, over 810 million gallons per day, or 1,250 second-feet); minimum stage, 0.16 foot at 5 p. m. May 11 and 5 p. m. May 17 (discharge, 0.50 million gallons per day, or 0.8 second-foot).

1917–1920: Maximum stage recorded January, 1920; minimum stage recorded 0.20 foot June 24, 1919 (discharge, 0.05 million gallons per day, or 0.08 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream in connection with water rights of Territorial lands below. Water rises on fee simple land.

UTILIZATION.—Manuahi Stream empties into Hanapepe River, part of flow of latter is diverted for irrigation of sugar cane, rice, and taro.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating tables July 1 to January 16 and January 17 to June 30, fairly well defined between 0.3 and 30 million gallons per day. Gage read to hundredths once daily except January 16 to February 26 when gage was out. Records fair when gage-height record was kept.

Discharge measurements of Manuahi Stream at Koula, near Eleele, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 19	Shiro Takabayashi	0.56	2.0	1.3
Aug. 26	do	.40	.45	.3
Nov. 29	do	.51	.75	.5
Jan. 29	J. E. Stewart	.52	4.6	3.0
Feb. 27	Shiro Takabayashi	.22	1.05	.7
Apr. 3	do	1.08	30.5	19.6
May 5	W. V. Hardy	.22	1.0	.65
27	Shiro Takabayashi	.61	10.6	6.8
June 27	M. H. Carson	.50	5.0	3.2

Daily discharge, in million gallons, of Manuahi Stream at Koula, near Eleele, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.9	14.2	6.6	0.7	4.4	0.8	0.8	.....	0.6	1.8	1.2	1.2
2	.8	4.4	1.4	1.1	3.5	258	.7	.....	.6	13.4	1.1	1.1
3	.6	2.3	1.1	1.1	2.9	530	.4	.....	.6	15.7	.9	1.1
4	.5	1.8	1.8	.8	2.3	108	.6	.....	.6	105	.8	1.3
5	.3	1.8	1.4	.7	1.8	12.8	.4	.....	.6	16.0	.7	25
6	.3	1.4	1.4	.6	6.6	7.8	.4	.....	.8	3.1	.7	7.4
7	.2	1.4	5.4	.6	5.4	5.4	.4	.....	.6	2.8	.6	3.1
8	.2	1.1	5.9	.4	3.5	3.5	.4	.....	1.8	2.8	.6	2.3
9	.3	.8	94	.4	2.9	240	.4	.....	1.1	3.1	.6	1.7
10	.4	.8	6.6	.3	2.3	55	5.9	.....	1.0	2.4	.5	13.4
11	10.8	.8	1.8	.3	1.4	14.2	1.8	.....	20.0	1.8	.5	7.4
12	2.7	.6	2.9	.4	.8	9.3	.7	.....	16.7	2.1	.6	6.2
13	3.5	1.1	2.1	.4	1.6	5.4	.8	.....	3.1	1.8	.6	5.0
14	12.5	.8	1.1	.3	1.2	4.4	11.5	.....	1.8	1.8	.6	6.2
15	4.3	1.4	.8	.3	.9	3.5	530	.....	.8	1.7	.5	3.1
16	2.9	4.4	.8	.3	.8	2.3	.....	.....	.6	1.4	.6	10.2
17	1.4	1.4	1.0	.4	.7	1.4	.....	.....	49	1.4	.5	7.4
18	.8	1.1	.8	.4	.5	1.1	.....	.....	3.1	20.0	.6	3.1
19	1.4	.8	1.1	.4	.5	.8	.....	.....	6.4	7.4	1.4	3.1
20	14.2	1.4	1.4	10.8	.4	.4	.....	.....	2.4	4.0	.7	3.1
21	3.9	1.1	1.1	4.4	1.1	.4	.....	.....	36	2.1	1.1	2.8
22	3.5	.8	.8	2.4	.8	.8	.....	.....	80	5.0	2.4	6.2
23	2.0	.7	.7	2.9	1.1	.7	.....	.....	25	4.0	5.0	15.0
24	1.6	.6	.5	55	3.0	.6	.....	.....	11.8	2.8	6.2	6.2
25	1.0	.6	1.1	4.4	1.8	.5	.....	.....	7.4	1.8	3.1	4.0
26	1.4	.4	.7	2.3	3.5	.4	.....	.....	5.5	1.6	7.4	7.4
27	1.1	.3	.6	2.9	2.9	.4	.....	0.6	3.9	1.4	3.9	3.5
28	1.8	.3	.8	14.2	1.2	.4	.....	.6	2.6	1.4	3.1	7.4
29	2.3	.3	.7	10.8	1.0	.4	.....	.6	2.1	1.4	2.6	6.2
30	1.4	.3	.8	6.6	.9	1.8	.....	.....	1.8	1.3	1.8	5.0
31	2.3	.3	.....	5.4	.....	1.4	.....	.....	1.7	.....	1.7	.....

NOTE.—Gage washed out and no record Jan. 16 to Feb. 26. Maximum stage Dec. 3 and Jan. 15 over top of gage and estimated by observer.

Monthly discharge of Manuahi Stream at Koula, near Eleele, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	14.2	0.2	2.62	4.05	81.3	249
August	14.2	.3	1.60	2.48	49.5	152
September	94	.5	4.91	7.60	147	452
October	55	.3	4.26	6.59	132	405
November	6.6	.4	2.06	3.19	61.7	190
December	530	.4	41.0	63.4	1,270	3,900
January	.....	.....	30.0	46.4	[a] 930	2,850
February	.....	.....	4.00	6.19	[a] 116	356
March	80	.6	9.35	14.5	290	890
April	105	1.3	7.74	12.0	232	713
May	7.4	.5	1.70	2.63	52.6	162
June	25	1.1	5.87	9.08	176	540
The year	.....	.2	9.67	15.0	3,540	10,900

[a] Discharge estimated by comparison with discharge of Hanapepe River.

SOUTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

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

RECORDS AVAILABLE.—December 10, 1911, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder used November 19, 1918, to June 30, 1920; Friez water-stage recorder used December 19, 1911, to November 8, 1918. Staff gage readings December 10–16, 1911.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages, straight for 600 feet above and 300 feet below station; right bank steep and high, left bank slopes gently. Control composed of solid rock ledge; somewhat shifting, owing to boulders lodging in water-worn grooves at left end of control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year (new gage), 11.25 feet at 7.25 p. m. January 16 (discharge, 29,000 million gallons per day, or 44,900 second-feet); minimum stage recorded, 1.06 feet at 6 p. m. July 9 (discharge, 6.8 million gallons per day, or 10.5 second-feet).

1911–1920: Maximum stage recorded in January, 1920; minimum stage recorded, 2.06 feet (on old gage) at 6 p. m. October 7, 1918 (discharge, 2.8 million gallons per day or 4.3 second-feet).

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

REGULATION.—By diversions above station.

OBJECT OF STATION.—To determine feasibility of diversion for homesteads after stream enters Territorial lands.

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

ACCURACY.—Stage-discharge relation not permanent. Two rating curves were used; one applicable July 1 to December 3, and one applicable December 4 to June 30. Both curves well defined between 8 and 15,000 million gallons per day. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge and March 1–24. Records good except for estimated periods for which they are poor.

Discharge measurements of South Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 9	Shiro Takabayashi	1.12	12.3	8.0
Aug. 30	.....do	1.14	10.9	7.0
Sept. 25	.....do	1.11	11.6	7.5
Nov. 16	.....do	1.36	20.5	13.2
Dec. 20	.....do	1.86	49	31.5
Jan. 15	J. E. Stewart	7.60	14,000	9,030
16	.....do	3.10	404	261
16	.....do	3.05	385	249
16	.....do	4.98	2,430	1,570
Feb. 14	Shiro Takabayashi	1.88	51	33
Mar. 24	.....do	2.49	175	113
May 19	.....do	2.10	88	57
19	M. H. Carson	2.02	77	50
June 20	.....do	1.76	43	27.5

Daily discharge, in million gallons, of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	27	187	45	10.7	34	8.2	22	24	7.0	136	15.2	15.7
2	17.0	75	21	10.7	32	456	22	18.6	.....	221	12.5	13.0
3	.....	48	32	13.0	26	677	42	14.6	.....	219	12.2	17.4
4	.....	51	54	14.1	17.0	225	26	14.6	.....	417	10.4	17.6
5	.....	39	62	14.5	.....	78	18.9	12.0	.....	191	10.2	119
6	.....	31	37	21	.....	57	17.0	10.8	.....	126	10.0	44
7	.....	26	36	15.8	.....	44	14.0	10.0	.....	89	9.8	23
8	.....	33	38	15.8	.....	37	13.5	10.4	.....	74	9.6	18.6
9	15.4	20.0	207	19.8	.....	179	12.2	10.2	.....	64	9.2	14.6
10	46	18.8	62	30	.....	112	22	18.0	.....	63	9.4	42
11	149	21	28	17.4	62	59	11.5	486	.....	53	8.3	37
12	34	15.8	17.8	34	47	69	12.0	243	.....	42	7.9	44
13	66	21	12.7	20.0	.....	44	15.9	83	.....	36	7.9	39
14	64	34	10.1	20.0	.....	46	92	32	.....	47	7.0	41
15	61	54	.....	19.9	.....	40	1,940	22	.....	38	7.0	28
16	34	91	.....	19.9	.....	36	4,140	19.6	.....	31	7.2	60
17	22	31	.....	18.3	12.7	32	1,010	19.2	.....	23	8.5	54
18	18.3	18.8	.....	19.4	10.7	31	219	16.0	.....	123	70	28
19	28	21	.....	18.8	9.3	32	146	13.2	.....	58	74	30
20	73	108	.....	21	8.7	31	116	11.8	.....	27	21	25
21	50	90	.....	138	8.7	17.9	116	10.4	.....	27	40	21
22	64	38	.....	30	41	16.6	98	8.3	.....	98	84	32
23	36	25	.....	63	38	12.2	73	7.5	.....	64	153	96
24	24	18.3	.....	100	46	11.0	65	8.3	.....	32	144	44
25	17.0	15.8	.....	135	24	12.7	62	8.3	208	27	101	22
26	53	13.0	.....	58	23	12.7	57	12.5	215	24	146	63
27	42	11.4	10.7	35	25	10.8	56	8.4	144	20.0	70	43
28	59	10.7	18.0	85	33	10.6	52	7.7	116	19.2	36	60
29	66	11.4	34	83	10.4	17.5	50	7.4	94	17.9	27	56
30	56	10.1	13.4	43	9.6	52	46	.....	152	16.3	25	25
31	85	8.2	.....	29	.....	26	45	.....	100	.....	22	.....

NOTE.—Recorder not working properly and discharge estimated as follows: Sept. 15–26, 10 million gallons per day; Nov. 5–10, 70 million gallons per day. Record unreliable on account of plugged intake and discharge estimated in million gallons per day as follows: July 3–8, 16; Nov. 13–16, 25. Estimates made by comparison with records for stations on adjacent streams.

Monthly discharge of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	149	.....	42.0	65.0	1,300	4,000
August	187	8.2	38.6	59.7	1,200	3,670
September	207	.....	28.6	44.3	859	2,630
October	138	10.7	37.8	58.5	1,170	3,600
November	.....	8.7	34.6	53.5	1,040	3,190
December	677	8.2	80.1	124	2,480	7,620
January	4,140	11.5	278	430	8,630	26,400
February	486	7.4	40.3	62.4	1,170	3,590
March	.....	.....	117	181	[a] 3,620	11,100
April	417	16.3	80.8	125	2,420	7,440
May	153	7.0	37.9	58.6	1,180	3,610
June	119	13.0	39.1	60.5	1,170	3,600
The year	4,140	7.0	71.7	111	26,200	80,400

[a] Estimated by comparison with flow of adjacent streams.

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 and 6 miles northwest of Lihue.

RECORDS AVAILABLE.—July 1, 1910, to November 30, 1919, when station was discontinued.

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, 2.88 feet at 3.20 p. m. September 6 (discharge, 29 million gallons per day, or 45 second-feet); minimum stage recorded, 1.08 feet at 9.22 a. m. November 11 (discharge, 4.9 million gallons per day, or 7.6 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 head gates.

OBJECT OF STATION.—To determine amount of water diverted from river for sugar cane irrigation. Most of water owned by Lihue plantation, but Waikoko Branch, which joins the main stream above the ditch diversion, has practically all of its catchment area on Territorial lands.

UTILIZATION.—Water used 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	Shiro Takabayashi	2.54	35	22.8
Sept. 26	do	2.76	42	27.5

Daily discharge, in million gallons, of Hanamaulu ditch near Lihue, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	24	26	20.0	19.5	16	21	23	20.0	14.6	10.8
2	.....	23	25	24	19.0	17	22	23	19.5	14.0	16.0
3	.....	23	28	24	18.2	18	20.0	24	19.5	13.3	16.0
4	.....	23	28	23	21	19	22	23	19.0	14.0	15.3
5	.....	22	29	19.0	19.5	20	23	25	28	16.0	14.6
6	.....	23	29	26	22	21	23	24	20.0	28	14.6
7	.....	23	28	19.0	19.5	22	22	25	19.0	7.6	21
8	.....	24	26	20.0	11.4	23	22	24	16.8	.....	14.6
9	.....	23	28	20.0	5.0	24	20.0	24	16.0	.....	14.0
10	.....	22	26	19.0	5.0	25	20.0	23	16.8	.....	19.0
11	.....	22	26	17.5	4.9	26	22	23	26	22	19.0
12	17.5	23	26	20.0	10.8	27	24	23	19.5	21	15.3
13	20.0	23	24	17.5	10.8	28	25	24	28	24	14.6
14	20.0	23	22	16.0	10.8	29	24	20.0	28	20.0	14.6
15	19.0	23	22	15.3	10.8	20	24	20.0	26	19.5	14.6
						31	26	19.5	.....	20.0	.....

NOTE.—July 1–11 observer sick and no gage readings. Discharge estimated at 19 million gallons per day. No flow Oct. 23–25.

Monthly discharge of Hanamaulu ditch near Lihue, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	26	.....	20.8	32.2	646	1,980
August	25	19.5	23.0	35.6	712	2,190
September	29	16.0	23.8	36.8	715	2,190
October (28 days)	28	7.6	19.1	29.6	534	1,640
November	22	4.9	14.7	22.7	442	1,350
The period	.....	.....	.....	.....	3,050	9,350

LIHUE DITCH NEAR LIHUE, KAUAI.

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

RECORDS AVAILABLE.—August 1, 1917, to November 30, 1919, when station was discontinued. Station was reestablished June 30, 1917, but there was no record until August 1. 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.—1910–1920: Maximum stage recorded, 2.06 feet at 2.15 p. m. September 20, 1919 (discharge, 15.0 million gallons per day, or 23 second-feet); ditch occasionally dry.

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

REGULATION.—By head gates.

OBJECT OF STATION.—To determine amount of water diverted by ditch.

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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	Shiro Takabayashi	1.88	19.6	12.7
Sept. 26	do	1.88	20.8	13.4

Daily discharge, in million gallons, of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	12.1	13.8	13.8	13.8	16	12.1	13.2	13.8	13.8	12.1
2	.....	12.1	13.8	14.3	13.8	17	12.6	12.6	13.2	13.8	14.3
3	.....	12.1	13.8	14.3	13.2	18	12.1	12.6	13.2	13.8	14.3
4	.....	12.1	13.2	14.3	13.8	19	12.6	12.6	13.2	13.8	14.3
5	.....	12.1	13.2	13 2	13.8	20	13.2	13.2	15.4	14.3	13.8
6	.....	12.1	14.3	14.3	14.3	21	13.2	13.2	13.2	14.3	13.8
7	.....	12.1	14.3	13.2	14.3	22	13.2	13.2	13.2	6.1	14.3
8	.....	12.6	14.3	13.2	13.2	23	12.6	13.2	13.8	6.1	14.3
9	.....	12.6	7.0	14.3	13.2	24	12.1	13.2	13.2	0.0	14.3
10	.....	12.6	10.5	14.3	13.2	25	12.1	13.2	13.2	0.0	13.8
11	.....	12.1	14.3	13.8	12.6	26	12.1	13.2	13.2	0.0	13.8
12	12.1	12.1	14.3	14.3	12.1	27	12.6	13.2	13.8	0.0	14.3
13	12.6	12.6	14.3	14.3	12.1	28	12.6	13.2	14.3	7.5	13.8
14	12.6	13.2	13.8	13.8	12.1	29	12.6	13.2	14.3	13.8	13.8
15	12.6	13.2	14.3	13.8	12.6	30	12.6	13.2	14.3	13.8	13.2
						31	12.1	13.2	.....	14.3	.....

NOTE.—July 1–11 observer sick, and no gage readings. Discharge estimated at 12 million gallons per day.

Monthly discharge of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	.....	12.3	19.0	382	1,170
August	13.2	12.1	12.7	19.6	395	1,210
September	15.4	7.0	13.5	20.9	404	1,240
October (27 days)	14.3	6.1	13.1	20.3	355	1,090
November	14.3	12.1	13.5	20.9	406	1,240
The period	.....	.....	.....	.....	1,940	5,950

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, 1920. 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 during year determined by levels to flood marks 8.30 feet January 16 (discharge, 1,780 million gallons per day, or 2,750 second feet); minimum stage recorded, 0.93 foot 6 p. m. May 7 (discharge, 12.9 million gallons per day, or 20.0 second-feet).

1914–1920: 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 20.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of diversion above or near this elevation. Territorial land and water. Important in relation to proposed homesteads.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 20 and 400 million gallons per day. Operation of water-stage recorder unsatisfactory. 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 8	Shiro Takabayashi	1.24	36	23.9
Aug. 30	do	1.20	29	18.3
Sept. 25	do	1.15	29	18.8
Nov. 16	do	1.29	32	20.5
Dec. 21	do	1.17	29	18.8
Jan. 17	J. E. Stewart	2.37	173	112
Feb. 17	Shiro Takabayashi	1.10	30	19.5
Mar. 25	do	2.12	192	124
May 20	do	1.46	57	37
June 25	M. H. Carson	1.24	34	22.1

Daily discharge, in million gallons, of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	106	.....	21	42	.....	.....	18.6	15.3	96	15.3	20.0
2	.....	67	.....	23	37	.....	.....	18.0	15.3	97	14.7	19.8
3	.....	42	.....	26	31	.....	.....	17.7	17.8	79	14.4	26
4	.....	41	.....	23	47	.....	.....	17.4	17.4	230	14.1	24
5	.....	34	.....	30	55	.....	.....	17.4	15.6	97	14.7	78
6	.....	30	.....	28	99	.....	.....	16.8	23	58	14.1	28
7	.....	28	.....	22	57	.....	.....	16.5	20.0	44	13.5	23
8	.....	28	.....	22	50	.....	.....	16.2	37	37	13.8	22
9	44	25	.....	26	71	.....	.....	15.9	29	33	15.0	19.8
10	35	26	.....	23	51	.....	.....	31	24	36	15.0	37
11	74	28	.....	42	46	.....	.....	144	53	28	16.2	40
12	31	25	.....	28	35	.....	.....	50	159	27	15.6	37
13	58	27	.....	24	31	.....	.....	26	73	31	15.3	36
14	53	42	.....	23	28	.....	.....	21	32	28	15.3	35
15	59	43	.....	22	26	.....	.....	19.8	28	30	15.3	28
16	35	57	.....	23	25	.....	.....	19.2	23	23	.....	58
17	30	32	.....	27	24	.....	.....	18.6	66	22	.....	50
18	28	26	.....	22	24	.....	76	18.0	284	63	.....	30
19	35	24	.....	32	23	.....	50	17.4	190	26	.....	32
20	58	52	.....	49	23	.....	41	16.8	76	24	.....	26
21	46	80	.....	31	23	.....	39	16.5	67	58	42	26
22	48	47	.....	27	.....	21	32	16.2	111	68	38	36
23	32	31	.....	45	.....	22	28	16.5	161	34	66	38
24	28	28	.....	46	.....	20.0	25	16.5	35	25	60	26
25	26	26	.....	33	.....	.....	23	19.3	101	21	49	.....
26	53	24	.....	28	.....	.....	23	21	70	19.8	59	.....
27	36	23	.....	55	.....	.....	21	15.9	68	18.9	30	.....
28	44	.....	34	88	.....	.....	20.0	15.6	49	18.3	24	.....
29	47	.....	26	50	.....	.....	19.8	15.6	51	17.1	23	.....
30	46	.....	26	40	.....	.....	19.5	.....	78	16.8	23	.....
31	61	.....	.....	51	.....	.....	18.9	.....	54	.....	21	.....

NOTE.—Recorder not working properly and no record for days when discharge is not given. Discharge May 16–20 and June 25–30 estimated at 35 million gallons per day.

Monthly discharge of North Fork of Wailua River, at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 9 to 31	74	26	43.8	67.8	1,010	3,090
August 1 to 27	106	23	38.6	59.7	1,040	3,200
October	88	21	33.2	51.4	1,030	3,160
November 1 to 21	99	23	40.4	62.5	848	2,600
January 18 to 31	76	18.9	31.2	48.3	436	1,340
February	144	15.6	23.8	36.8	689	2,120
March	284	15.3	65.9	102	2,040	6,270
April	230	16.8	46.9	72.5	1,410	4,320
May	66	13.5	26.8	41.5	832	2,550
June	78	19.8	33.5	51.8	1,010	3,080

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, 1920.

GAGE.—Vertical staff. New datum May 28, 1913. Read by S. Koike and K. Shimokawa.

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, 2.64 feet at 8.10 a. m. September 20 (discharge, 23 million gallons per day, or 36 second-feet); minimum stage recorded during year, 0.18 foot, 7.50 a. m. January 25 (discharge, 3.0 million gallons per day, or 4.6 second-feet).

1910–1920: Maximum stage recorded September, 1919; ditch occasionally dry.

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

REGULATION.—By head gates.

OBJECT OF STATION.—To determine discharge of ditch which diverts water from river and delivers it to fee simple and territorial lands leased to Lihue plantation. Territorial water. Important station relative to proposed North Wailua homesteads.

UTILIZATION.—Water used for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined between 5 and 20 million gallons per day used July 1–22, and between 5 and 17 million gallons per day used February 18 to June 30. Rating curve used September 25 to January 14, poorly defined. Shifting-control method used July 23 to September 24 and January 15 to February 17. Gage read to hundredths once daily. Records fair.

Discharge measurements of Kanaha ditch near Lihue, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 22	Shiro Takabayashi	2.42	29	18.9
Sept. 25	.....do	2.66	36.5	23.6
Nov. 16	.....do	2.26	28	18.2
Dec. 21	.....do	1.78	23.2	15.0
Jan. 14	J. E. Stewart	2.04	28	18.1
Feb. 17	Shiro Takabayashi	1.83	21.7	14.0
Mar. 27	.....do	1.52	17.3	11.2
June 25	M. H. Carson	1.90	21.1	13.6

Daily discharge, in million gallons, of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	20.0	22	20.0	21	20.0	8.3	11.1	11.8	11.8	11.8	15.0
2	.....	20.0	21	22	20.0	22	8.3	11.1	11.8	11.1	11.8	14.2
3	.....	19.5	22	23	21	20.0	8.3	11.1	11.1	14.2	11.1	15.0
4	.....	20.0	21	21	21	7.4	7.8	10.7	11.8	15.8	11.8	15.0
5	.....	19.5	22	20.0	22	6.5	15.5	10.7	12.6	15.8	12.6	15.0
6	.....	19.5	21	22	22	5.2	14.5	10.7	15.0	15.0	15.0	14.2
7	.....	19.5	21	21	22	4.9	14.5	11.8	14.2	14.2	14.2	14.2
8	.....	19.5	22	20.0	22	13.6	14.5	11.8	15.8	15.8	15.8	14.2
9	.....	19.5	22	21	18.2	13.6	14.5	12.6	15.8	16.6	15.8	14.2
10	.....	19.5	21	22	16.4	12.7	15.5	15.0	15.0	15.8	15.0	15.0
11	.....	19.5	20.0	21	16.4	11.8	14.5	15.8	15.8	15.0	15.8	15.0
12	17.9	19.5	22	22	15.5	11.8	16.4	14.2	15.8	14.2	15.8	15.0
13	18.7	19.5	21	22	15.5	11.8	17.3	12.6	15.8	14.2	15.8	15.0
14	18.7	19.5	21	21	15.5	10.9	17.3	15.0	15.0	13.4	15.0	15.0
15	17.9	20.0	21	21	20.0	13.6	17.4	14.2	15.0	13.4	15.0	15.0
16	18.7	20.0	21	22	20.0	13.6	8.4	14.2	14.2	13.4	15.0	15.8
17	18.7	20.0	22	22	20.0	12.7	7.0	14.2	15.8	13.4	13.4	15.0
18	17.9	19.5	20.0	20.0	20.0	12.7	4.8	13.4	15.8	13.4	13.4	15.0
19	18.7	20.0	22	22	20.0	12.7	4.6	12.6	13.4	13.4	15.0	15.8
20	19.5	21	23	22	20.0	15.5	4.4	12.6	11.1	13.4	15.0	15.0
21	18.7	21	21	22	20.0	15.5	4.0	12.6	10.7	13.4	15.0	15.0
22	18.7	20.0	20.0	19.1	20.0	14.5	3.7	12.6	10.3	13.4	15.8	15.0
23	18.7	20.0	20.0	15.5	20.0	14.5	3.3	11.8	11.1	12.6	16.6	15.8
24	18.7	20.0	19.5	14.5	20.0	14.5	3.1	11.8	10.7	14.2	15.8	15.0
25	18.7	20.0	21	14.5	20.0	14.5	3.0	15.0	10.3	13.4	15.0	15.0
26	18.7	20.0	22	14.5	19.1	14.5	5.4	12.6	10.3	12.6	15.0	15.8
27	18.7	20.0	20.0	14.5	20.0	13.6	5.4	11.8	11.8	14.2	15.0	16.6
28	18.7	20.0	22	14.5	20.0	13.6	5.4	11.8	11.1	13.4	14.2	15.8
29	19.5	19.5	23	21	19.1	13.6	6.2	11.1	11.1	13.4	14.2	15.8
30	19.5	19.5	22	20.0	18.2	12.7	11.1	.....	11.8	13.4	14.2	15.8
31	20.0	19.5	.....	21	.....	12.7	11.1	.....	11.1	.....	14.2	.....

NOTE.—July 1-11, observer sick and no gage readings; discharge estimated at 18 million gallons per day.

Monthly discharge of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	.....	18.5	28.6	573	1,760
August	21	19.5	19.8	30.6	614	1,880
September	23	19.5	21.3	33.0	638	1,960
October	23	14.5	19.9	30.8	618	1,890
November	22	15.5	19.5	30.2	585	1,800
December	22	4.9	13.1	20.3	407	1,250
January	17.4	3.0	9.53	14.7	296	907
February	15.8	10.7	12.6	19.5	366	1,120
March	15.8	10.3	13.0	20.1	403	1,240
April	16.6	11.1	13.9	21.5	417	1,280
May	16.6	11.1	14.5	22.4	449	1,380
June	16.6	14.2	15.1	23.4	453	1,390
The year	23	3.0	15.9	24.6	5,820	17,900

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 31, 1912, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder, December 31, 1914, to June 30, 1918; staff 800 feet below present site July 31, 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, 9.22 feet at 7 p. m. January 16 (discharge, approximately 2,660 million gallons per day, or 4,120 second-feet); minimum stage recorded, 1.60 feet 8 p. m. March 5 (discharge, 8.0 million gallons per day or 12.4 second-feet);

1912–1920: 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.

OBJECT OF STATION.—To determine feasibility of diversion above this point. Territorial land and water. Valuable for prospective homesteads of North Wailua.

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 not permanent due chiefly to growth of moss and grass on control. Rating curves fairly well defined as follows: July 1–8 between 15 and 100 million gallons per day, October 25 to January 16 between 10 and 250 million gallons per day, January 17 to May 25 between 10 and 500 million gallons per day, and May 26 to June 30 between 20 and 100 million gallons per day. Shifting-control method used July 9 to October 24. 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 8	Shiro Takabayashi	1.97	25.5	16.6
Sept. 25	do	1.99	15.5	10
Nov 16	do	1.99	19.7	12.7
Dec. 21	do	1.95	17.6	11.4
Jan. 14	do	2.35	52	33.5
14	J. E. Stewart	2.32	51	33
15	do	3.38	275	178
15	do	3.60	351	227
18	do	2.54	122	79
Feb. 14	Shiro Takabayashi	1.75	18.9	12.2
Mar. 25	do	2.42	116	75
May 20	do	1.97	35	22.5
June 24	M. H. Carson	1.86	24.1	15.6

Daily discharge, in million gallons, of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	.....	14.5	8.5	18.0	10.9	15.5	13.8	9.1	45	16.8	18.9
2	.....	.....	11.6	8.8	13.5	.....	26	13.8	8.8	62	15.7	17.8
3	.....	.....	13.5	9.2	12.4	.....	.....	13.8	8.8	44	14.6	18.4
4	.....	.....	21	9.0	.....	.....	.....	13.5	8.8	83	13.8	20.0
5	.....	.....	16.5	11.6	.....	.....	.....	13.1	8.6	61	13.5	35
6	.....	.....	14.5	10.9	.....	.....	.....	12.7	11.9	44	13.5	21
7	.....	.....	14.0	8.2	.....	.....	.....	11.9	10.8	36	13.8	17.2
8	.....	.....	16.0	10.6	.....	.....	.....	12.3	21	31	13.5	16.3
9	22	.....	50	19.2	.....	.....	.....	11.6	15.0	27	12.7	15.4
10	22	.....	19.8	11.2	.....	.....	.....	14.2	13.8	26	12.7	18.9
11	35	.....	15.0	9.2	.....	.....	.....	44	33	24	12.3	24
12	33	.....	14.0	8	.....	.....	.....	23	92	22	12.7	24
13	25	.....	12.3	7.2	.....	.....	.....	16.2	63	22	12.7	23
14	25	.....	12.3	6.8	.....	.....	34	13.1	24	21	11.9	21
15	26	.....	11.6	6.6	.....	.....	232	12.3	18.9	18.9	11.9	18.4
16	22	.....	11.6	6.6	.....	.....	512	11.9	15.7	18.9	11.9	25
17	20.0	.....	12.3	6.4	13.0	.....	202	11.6	41	17.3	12.3	26
18	19.8	.....	11.2	6.4	12.7	.....	74	10.8	161	24	39	21
19	22	.....	10.9	6	12.4	.....	48	10.8	128	18.9	.....	20.0
20	23	.....	15.0	9.8	12.1	.....	37	10.2	64	17.3	.....	17.2
21	23	.....	12.0	7.8	16.2	10.9	31	10.0	49	56	25	16.3
22	.....	.....	11.2	7.2	28	10.9	26	9.7	45	87	24	20.0
23	.....	.....	10.2	7.2	14.5	11.8	24	9.7	87	36	29	18.9
24	.....	.....	10.6	36	13.5	10.9	21	10.0	53	27	31	15.8
25	.....	.....	10.2	19.2	12.4	10.3	20.0	10.0	81	24	92	15.4
26	.....	.....	9.5	13.5	12.1	11.2	18.4	12.3	76	21	80	18.9
27	.....	.....	8.8	13.5	11.5	10.6	17.8	9.4	58	20	33	27
28	.....	.....	8.8	22	10.9	11.8	16.8	9.4	43	18.9	26	25
29	.....	.....	9.5	19.2	11.2	27	16.2	9.4	39	17.8	23	24
30	.....	.....	9.2	14.0	10.9	31	15.7	.....	111	17.3	24	18.9
31	.....	11.2	.....	16.5	.....	18.0	14.6	.....	49	.....	21	.....

NOTE.—Recorder not working properly and no record on days for which discharge is not given. Discharge not estimated except for May 19-20 for which it is estimated at 13 million gallons per day.

Monthly discharge of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
September	50	8.8	13.9	21.5	418	1,280
October	36	6.0	11.5	17.8	356	1,090
January	512	.....	.....	.....	.....	.....
February	44	9.4	13.3	20.6	384	1,180
March	161	8.6	46.7	72.3	1,450	4,440
April	87	17.3	32.9	50.9	988	3,030
May	92	11.9	22.6	35.0	699	2,150
June	35	15.4	20.6	31.9	619	1,900

KAPAA RIVER NEAR KEALIA, KAUAI.

LOCATION.—One-fourth mile below confluence of two main branches, 1½ miles above intake of Kapahi ditch, and 6 miles northwest of Kealia.

RECORDS AVAILABLE.—June 23, 1915, to April 18, 1920. July 23, 1910, to May 16, 1915, at old station about 1 mile downstream.

GAGE.—Stevens continuous water-stage recorder used March 4 to October 22, 1920. Friez recorder used June 23, 1915, to March 3, 1920. Vertical staff about 1 mile below present site, July 23, 1910, to May 16, 1915.

EXTREMES OF DISCHARGE.—1918–1919: Maximum stage recorded during year, 7.43 feet at 10 a. m. November 25 (discharge, 625 million gallons per day, or 967 second-feet). Minimum stage recorded, 1.81 feet December 28 (discharge, 12.3 million gallons per day or 19 second-feet).

1919–1920: Maximum stage recorded during year, 8.38 feet at 6 p. m. January 16 (discharge, 757 million gallons per day or 1,170 second-feet). Minimum stage recorded, 1.52 feet March 2; minimum flow at stage, 1.67 feet January 12 (discharge, 11.2 million gallons per day or 17.3 second-feet).

1915–1920: Maximum stage recorded, 9.2 feet at 1 a. m. March 4, 1916 (discharge, approximately 850 million gallons per day or 1,320 second-feet). Minimum stage recorded, 1.52 feet March 2; minimum flow at stage, 1.65 feet August 28–29, 1915 (discharge, 11 million gallons per day or 17 second-feet).

1910–1915: Maximum stage recorded, 13 feet December 3, 1914 (stage ascertained from flood marks and discharge roughly estimated by extension of rating curve as 1,200 million gallons per day or 1,860 second-feet). Minimum stage recorded, 1.35 feet February, March, and April, 1914 (discharge, 6.2 million gallons per day or 9.6 second-feet).

DIVERSIONS.—Very small irrigation ditch diverts from above station.

REGULATIONS.—Practically none.

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

ACCURACY.—Stage-discharge relation shifts during extremely high water. Two rating curves used are fairly well defined. Shifting boulder diversion dam built below the station renders records valueless after April 19, 1920.

Discharge measurements of Kapaa River near Kealia, Kauai, during the years ending June 30, 1919 and 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
1919.				
July 14	W. V. Hardy	2.44	36	23.3
Sept. 30	do	1.92	20.6	13.3
1920.				
July 9	Shiro Takabayashi	2.28	29.5	19.1
Jan. 19	J. E. Stewart	1.93	26	16.9
May 14	Shiro Takabayashi	2.17	9.3	6.0
June 16	M. H. Carson	2.34	19.8	12.8

Daily discharge, in million gallons, of Kapaa River near Kealia, Kauai, for the years ending June 30, 1919 and 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1918-19.												
1	17.2	18.5	15.1	13.5	17.2	13.9	15.8	18.3	17.4	14.6	16.0	15.2
2	17.6	16.7	14.6	13.5	17.0	26	15.6	18.3	25	14.4	14.8	15.5
3	19.9	17.4	14.2	13.5	16.0	67.0	15.8	17.4	19.4	14.4	14.3	38
4	18.3	18.5	14.1	13.5	15.0	15.3	16.1	17.8	17.8	14.6	15.5	15.3
5	35	26	13.9	13.6	16.3	25	16.5	17.4	17.7	15.0	18.1	14.7
6	19.9	17.6	13.9	13.5	15.3	48	16.9	16.9	29	15.3	15.3	14.3
7	33	18.7	17.1	13.7	15.1	48	15.6	16.7	22	14.7	16.5	14.1
8	21	21	23	13.9	14.3	40	15.5	18.4	17.8	14.3	16.3	19.4
9	24	17.2	16.0	13.6	14.1	24	15.2	41	18.3	14.3	16.5	15.3
10	49	17.2	15.3	13.6	15.3	88	16.7	16.9	17.2	15.6	16.0	14.4
11	24	18.5	15.2	14.3	38	17.9	16.3	18.3	16.3	15.0	19.4	14.2
12	19.9	18.5	18.5	15.5	16.3	14.7	25	18.3	19.8	15.6	17.6	14.3
13	22	71	16.3	27	14.3	13.9	36	16.9	17.2	14.4	16.5	14.3
14	26	31	15.0	54	14.7	13.9	19.6	16.9	16.0	15.3	16.0	14.4
15	21	17.2	15.0	18.8	14.2	13.5	17.2	16.3	15.6	24	14.4	13.9
16	23	20.0	15.0	20.0	13.3	13.3	17.0	16.3	15.6	62	32	13.9
17	18.3	52	15.5	14.8	13.3	15.3	16.9	16.3	15.8	70	37	14.6
18	30	19.9	16.0	14.6	13.7	14.6	16.9	16.7	16.0	124	17.0	16.0
19	36	18.9	15.6	15.0	13.2	13.1	16.9	17.2	15.8	134	15.8	14.8
20	24	18.3	14.6	14.3	13.1	14.1	16.5	19.6	45	104	17.4	16.3
21	22	40	14.6	19.4	13.0	13.1	29	64	30	32	17.2	14.4
22	27	25	14.4	16.1	13.0	12.8	36	27	39	19.6	15.6	14.3
23	18.5	34	14.3	17.0	12.9	12.7	21	17.8	17.2	19.2	16.1	14.1
24	33	18.3	14.2	15.3	22	13.2	18.7	17.0	15.6	15.3	16.0	15.6
25	19.6	28	14.7	14.4	183	12.7	18.1	17.4	15.5	15.8	16.1	15.5
26	35	17.2	14.2	23	30	12.5	18.5	16.5	15.2	16.5	16.0	18.7
27	22	15.3	14.1	17.1	15.2	12.4	20.0	16.3	15.1	15.5	15.2	18.9
28	17.8	15.1	14.8	14.3	14.2	36	18.7	15.8	15.1	14.7	15.6	16.1
29	24	14.7	13.6	23	16.5	19.4	20.0	.....	15.1	15.3	15.6	19.8
30	18.5	14.4	13.6	61	14.4	19.9	19.4	.....	14.8	32	15.1	15.3
31	24	15.5	.....	73	.....	17.2	18.5	.....	14.7	.....	15.2	.....
1919-20.												
1	15.8	51	17.0	.....	14.7	12.1	12.6	14.3	13.5	17.1	.....	.....
2	15.0	23	15.6	.....	13.6	63	25	14.2	13.4	17.7	.....	.....
3	14.6	17.8	16.7	.....	12.9	79	13.6	14.2	13.6	17.8	.....	.....
4	14.4	21	18.9	.....	13.3	25	12.0	14.2	14.0	43	.....	.....
5	14.3	17.4	16.9	23	14.3	13.6	11.4	14.2	13.8	21	.....	.....
6	14.2	16.1	16.0	19.4	24	12.6	13.3	14.2	15.6	16.3	.....	.....
7	15.5	16.3	16.0	19.7	14.8	12.2	15.5	14.2	15.8	15.4	.....	.....
8	17.5	18.1	16.5	19.9	16.1	11.7	12.3	14.3	21	14.9	.....	.....
9	19.6	19.6	51	26	15.5	15.5	12.9	14.2	16.7	14.6	.....	.....
10	16.0	19.6	17.6	18.3	14.2	12.6	12.5	15.5	16.2	15.0	.....	.....
11	42	18.7	16.5	16.7	15.0	11.8	11.4	18.0	37	14.8	.....	.....
12	15.6	18.3	18.3	16.3	13.9	11.6	11.2	14.9	54	14.4	.....	.....
13	23	18.5	17.8	15.6	13.2	11.6	11.3	14.5	29	14.9	.....	.....
14	21	19.9	17.6	15.3	12.8	11.5	17.6	14.2	15.4	15.2	.....	.....
15	22	28	17.2	15.0	12.5	11.6	103	14.0	14.8	14.6	.....	.....
16	16.5	32	16.5	14.8	12.3	11.5	196	13.8	14.2	14.4	.....	.....
17	16.5	17.4	17.0	14.8	12.3	11.5	83	13.8	21	14.3	.....	.....
18	16.7	16.1	16.3	14.8	12.3	11.5	23	13.7	100	16.4	.....	.....
19	19.6	21	16.5	14.8	12.2	11.5	17.0	13.7	55	.....	.....	.....
20	25	36	20.0	15.3	12.2	11.3	15.8	13.7	23	.....	.....	.....
21	21	24	17.0	15.3	32	11.3	15.4	13.6	17.7	.....	.....	.....
22	18.7	17.2	16.7	14.3	30	11.2	15.0	13.7	17.2	.....	.....	.....
23	16.1	16.0	16.0	14.7	13.5	12.0	14.8	13.8	21	.....	.....	.....
24	15.5	15.6	16.3	48	12.9	11.4	14.7	13.8	17.6	.....	.....	.....
25	16.0	14.8	17.0	14.3	12.7	11.4	14.5	14.8	23	.....	.....	.....
26	21	14.7	17.8	13.0	13.1	12.2	14.5	15.2	30	.....	.....	.....
27	23	14.7	.....	13.1	12.6	11.6	14.4	13.8	16.8	.....	.....	.....
28	40	14.6	.....	14.6	12.3	13.1	14.3	13.7	15.7	.....	.....	.....
29	19.4	14.6	.....	13.2	12.2	24	14.3	13.5	15.2	.....	.....	.....
30	21	14.7	.....	12.9	12.2	16.6	14.3	.....	36	.....	.....	.....
31	27	15.6	.....	18.5	.....	13.2	14.2	.....	18.0	.....	.....	.....

NOTE.—Recorder not operating Sept. 27 to Oct. 4, 1919. Discharge estimated from records for adjacent streams at 17 million gallons per day.

Monthly discharge of Kapaa River near Kealia, Kauai, for the years ending June 30, 1912 and 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1918–19.						
July	49	17.2	24.5	37.9	760	2,330
August	71	14.4	23.0	35.6	712	2,190
September	23	13.6	15.2	23.5	456	1,400
October	73	13.5	20.6	31.9	638	1,960
November	183	12.9	21.8	33.7	654	2,010
December	88	12.4	23.3	36.1	721	2,220
January	36	15.2	19.2	29.7	596	1,830
February	64	15.8	20.1	31.1	564	1,730
March	45	14.7	19.4	30.0	602	1,850
April	134	14.3	30.7	47.5	921	2,830
May	37	14.3	17.3	26.8	536	1,650
June	38	13.9	16.2	25.1	486	1,490
The year	183	12.4	20.9	32.3	7,650	23,500
1919–20.						
July	42	14.2	19.8	30.6	614	1,880
August	51	14.6	20.1	31.1	622	1,910
September	51	15.6	18.2	28.2	545	1,680
October	48	12.9	17.4	26.9	540	1,660
November	32	12.2	14.9	23.1	446	1,370
December	79	11.2	16.8	26.0	521	1,600
January	196	11.2	25.5	39.5	791	2,430
February	18	13.5	14.3	22.1	414	1,270
March	100	13.4	24.0	37.1	745	2,280
April 1–18	43	14.3	17.3	26.8	312	957
The period	.....	.....	.....	.....	5,550	17,000

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; May 10, 1915, to June 30, 1920.

GAGE.—Stevens continuous recorder installed March 4, 1920. Prior to this Stevens 8-day water-stage recorder, installed May 10, 1915, was used and replaced original Watson recorder.

DISCHARGE MEASUREMENTS.—Made by 20-foot sharp-crested 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, 2.33 feet 1.30 p. m. October 24 (discharge, 151 million gallons per day or 234 second-feet); minimum stage recorded, 0.10 foot 1 p. m. January 20 (discharge, 1.4 million gallons per day or 2.2 second-feet).

1915–1920: Maximum stage recorded during period of record October, 1919; minimum, water shut off November 23 and 24, 1916.

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

REGULATION.—Flow regulated by head gates.

OBJECT OF STATION.—To determine amount of water diverted by ditch. Water owned by Territory and part is leased to Makee Sugar Co. Homesteads entitled to part of water.

UTILIZATION.—Water used for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-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 head gates.

Discharge measurements of Kapahi ditch near Kealia, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 29	H. A. R. Austin	0.30	9.2	6.0
Jan. 19	Shiro Takabayashi	.20	5.4	3.5
Feb. 16	do	.31	11.1	7.2
Mar. 29	do	.43	19.6	12.7
May 14	do	.30	10.5	6.8

Daily discharge, in million gallons, of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	14.2	41	11.2	.....	15.6	7.4	12.1	8.5	6.7	10.4	10.4	9.3
2	12.5	19.0	9.3	.....	9.7	5.2	16.3	8.5	11.4	8.5	.....	9.3
3	11.7	13.4	10.2	.....	8.5	7.3	15.1	8.5	14.7	10.0	.....	12.5
4	14.7	17.0	14.3	.....	9.3	7.4	10.4	8.1	7.8	9.5	.....	17.3
5	10.2	12.5	10.8	12.6	12.1	6.7	8.5	8.5	7.4	12.6	.....	26.5
6	8.5	10.8	10.8	10.8	22.5	6.7	11.7	8.5	13.1	14.7	.....	13.4
7	11.2	9.3	10.4	11.0	15.8	6.4	14.2	8.5	12.8	13.8	.....	10.4
8	16.3	9.3	11.2	11.6	16.9	6.7	11.7	8.5	24.5	12.1	.....	10.0
9	23	11.7	42	18.8	17.1	6.7	11.7	8.5	15.3	10.8	.....	9.3
10	13.9	11.7	13.4	10.8	12.5	6.7	12.1	11.2	15.1	12.1	.....	13.2
11	37	11.2	10.4	8.1	14.7	7.0	8.9	17.5	41	11.7	.....	.....
12	13.0	10.8	9.3	7.4	11.2	7.0	7.8	10.4	50	9.7	.....	.....
13	23.5	10.4	9.3	7.0	9.7	6.8	8.9	9.7	26	8.4	.....	.....
14	21	13.4	8.9	7.0	8.1	5.4	13.4	8.5	13.4	13.0	6.7	.....
15	23	22.5	8.1	7.0	7.4	6.7	10.8	8.1	10.8	10.0	7.0	.....
16	13.4	27.5	7.8	6.7	7.4	7.8	7.3	7.4	9.3	9.7	8.1	.....
17	10.4	10.4	8.9	6.4	7.0	7.8	4.4	7.4	16.0	8.9	12.5	22
18	10.4	8.5	8.1	6.7	7.0	7.8	4.1	7.4	15.5	15.0	27	13.8
19	15.7	11.6	8.1	6.4	6.7	7.4	4.1	7.0	5.4	11.2	18.2	15.4
20	22	30.5	9.7	9.7	6.7	7.4	8.3	7.4	4.8	13.0	10.4	11.7
21	19.3	21.5	6.7	9.3	24	7.0	10.1	7.0	4.8	38	15.0	10.0
22	16.6	11.7	6.7	7.4	40	7.0	7.2	7.0	4.8	13.4	15.8	13.0
23	11.7	9.3	6.4	7.8	12.1	9.7	10.4	6.7	13.0	11.2	19.8	12.3
24	9.7	8.9	6.0	41	10.0	7.8	7.8	6.7	16.4	10.8	17.6	9.7
25	9.7	8.1	6.4	12.5	9.3	7.0	8.9	9.0	7.0	11.2	30.5	9.3
26	15.8	7.8	7.4	8.9	10.0	9.5	9.7	12.7	8.8	12.1	10.5	12.5
27	15.4	7.8	.....	8.1	8.5	7.8	8.1	7.4	12.1	11.7	14.7	16.2
28	30	7.4	.....	13.0	7.4	11.7	9.3	7.0	12.1	12.1	11.2	16.6
29	16.5	7.4	.....	9.7	7.0	27	8.9	6.7	12.5	11.7	10.8	16.1
30	15.1	7.0	.....	7.8	6.7	21.5	8.9	.....	8.8	10.8	13.4	10.4
31	20.5	8.5	.....	16.4	.....	13.4	8.9	.....	9.3	.....	10.8	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day by comparison with gage-height record on Kapaa River, as follows: Sept. 27–30, 7; Oct. 1–4, 7.5; May 2–8, 10; May 9–11, 6; May 12–13, 10; and June 11–16, 15.

Monthly discharge of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	37	8.5	16.3	25.2	506	1,550
August	41	7.0	13.5	20.9	418	1,280
September	42	6.0	9.99	15.5	300	920
October	41	6.4	10.3	15.9	320	980
November	40	6.7	12.0	18.6	361	1,100
December	27	5.2	8.64	13.4	268	822
January	16.3	4.1	9.68	15.0	300	921
February	17.5	6.7	8.56	13.2	248	762
March	50	4.8	13.9	21.5	431	1,320
April	38	8.4	12.3	19.0	368	1,130
May	30.5	.....	12.2	18.9	378	1,160
June	26.5	9.3	13.7	21.2	410	1,260
The year	50	4.1	11.8	18.3	4,310	13,200

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 30, 1912, to June 30, 1920. Fragmentary record December 15, 1910, to December 28, 1912, at dam a quarter of a mile below present site.

GAGE.—Stevens continuous water-stage recorder March 14, 1920, to June 30, 1920; Friez water-stage recorder used August 22 to November 2, 1910, and December 28, 1912, to March 7, 1920.

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, 7.53 feet at 7.30 p. m. January 16 (discharge, approximately 1,020 million gallons per day or 1,580 second-feet); minimum stage recorded, 1.91 feet 11 p. m. October 19 (discharge, 2.6 million gallons per day or 4.0 second-feet).

1910, 1912–1920: 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, approximately 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.

OBJECT OF STATION.—To determine feasibility of additional diversions for irrigation of sugar cane. Water owned by Territory and leased to Makee Sugar Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves were used; one effective July 1 to January 16 and the other January 17 to June 30. Both curves are fairly well defined below 15 million gallons per day but poorly defined above that point. Operation of water-stage recorder fairly satisfactory. Records fair when water-stage recorder was operating and discharge less than 15 million gallons per day.

Discharge measurements of Anahola River near Kealia, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 10	Shiro Takabayashi	2.02	7.5	4.8
Sept. 24	do	1.95	4.5	2.9
Nov. 15	do	2.03	6.2	4.0
Dec. 15	do	2.10	8.5	5.5
Jan. 30	J. E. Stewart	2.27	9.4	6.1
Feb. 16	Shiro Takabayashi	2.11	5.6	3.6
Apr. 17	do	2.15	5.8	3.7
May 14	do	2.17	6.4	4.2
June 18	M. H. Carson	2.25	10.7	6.9

Daily discharge, in million gallons, of Anahola River, near Kealia, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.5	6.5	5.5	3.2	8.9	4.2	8.9	6.0	3.3	5.8	8.5	4.6
2	3.3	3.6	4.4	3.3	4.8	70	30	5.8	3.2	6.0	7.9	4.3
3	3.2	3.3	3.6	3.5	4.2	116	13.2	5.8	3.2	6.2	7.6	4.6
4	3.0	3.0	5.1	3.0	3.6	86	6.8	5.2	3.3	81	7.6	4.4
5	3.0	3.0	5.3	2.9	4.4	22	5.6	5.0	3.4	22	6.6	8.0
6	2.9	2.9	4.0	4.0	11.0	16.4	6.6	5.0	3.7	10.0	6.2	5.2
7	3.6	2.8	3.8	3.2	11.5	14.0	10.4	4.9	.....	7.6	5.8	4.6
8	3.4	2.7	5.5	4.6	16.7	9.7	5.6	5.0	.....	6.4	5.4	4.3
9	5.6	3.0	23	3.5	18.2	15.2	7.6	4.7	.....	6.0	5.4	4.0
10	4.6	4.2	6.2	3.3	15.0	12.0	14.6	5.4	.....	6.0	5.2	4.6
11	14.3	3.0	4.2	3.2	12.1	7.6	6.2	9.8	.....	6.0	5.2	5.7
12	4.0	2.9	3.6	4.9	8.9	7.0	5.2	5.4	.....	4.9	5.0	6.0
13	6.5	2.9	3.5	3.5	7.6	6.8	5.5	4.3	.....	5.0	4.9	5.4
14	7.2	2.9	3.4	3.0	6.5	5.9	26	4.0	.....	4.9	4.7	4.6
15	4.4	3.5	3.3	2.9	6.5	5.6	110	3.9	4.6	4.7	4.6	4.3
16	3.6	10.0	3.3	2.8	6.5	5.4	312	3.7	4.6	4.4	4.3	6.2
17	3.4	3.6	3.6	2.8	5.9	5.4	.....	3.6	5.2	4.4	4.0	12.2
18	3.4	3.3	3.2	2.8	5.4	5.0	.....	3.6	38	12.9	4.7	6.2
19	3.4	3.5	3.3	2.8	5.4	4.8	.....	3.7	47	5.8	5.4	5.4
20	8.0	11.0	3.4	3.7	5.2	4.2	23	3.7	23	5.4	4.3	4.7
21	4.6	12.0	.....	3.3	51	4.4	18.5	3.7	12.4	147	4.6	4.6
22	4.4	5.4	.....	8.0	69	4.4	15.8	3.6	23	231	4.3	4.3
23	4.2	4.4	.....	6.0	15.9	11.1	13.2	3.6	14.3	47	5.4	4.4
24	4.2	4.2	.....	16.0	9.3	5.2	10.4	3.9	7.6	22	5.4	4.3
25	4.0	4.0	4.0	6.2	7.0	4.6	9.7	3.7	17.5	15.4	17.6	4.3
26	4.2	3.6	3.2	4.2	6.2	18.0	9.4	4.2	15.4	12.8	15.2	4.6
27	3.8	3.4	3.0	3.6	5.6	5.6	7.6	3.6	6.8	11.2	4.4	6.2
28	5.0	3.3	3.0	4.2	5.4	5.4	7.0	3.4	6.8	10.4	4.0	7.3
29	4.0	3.3	3.0	4.0	4.8	44	6.8	3.4	6.4	11.6	14.5	4.9
30	3.5	3.4	3.0	3.6	4.4	26	6.4	.....	13.3	9.1	19.5	4.3
31	3.5	3.5	.....	7.0	.....	7.9	6.4	.....	6.4	.....	5.8	.....

NOTE.—Sept. 20-24 and Jan. 17-19, recorder not working properly; Mar. 7-14, recorder removed during reconstruction of station. Discharge estimated in million gallons per day as follows: Sept. 20-24, 3.4; Jan. 17-19, 70; Mar. 7-14, 10.

Monthly discharge of Anahola River near Kealia, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	14.3	2.9	4.51	6.98	140	429
August	12.0	2.7	4.26	6.59	132	405
September	23	3.0	4.47	6.92	134	412
October	16.0	2.8	4.29	6.64	133	408
November	69	3.6	11.6	17.9	347	1,070
December	116	4.2	18.1	28.0	560	1,720
January	312	5.2	29.6	45.8	918	2,820
February	9.8	3.4	4.54	7.02	132	404
March	47	3.2	11.4	17.6	352	1,080
April	231	4.4	24.4	37.8	733	2,250
May	19.5	4.0	6.90	10.7	214	656
June	12.2	4.0	5.28	8.17	158	486
The year	312	2.7	10.8	16.7	3,950	12,100

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 29, 1915, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder installed April 10, 1920. Stevens 8-day recorder used June 26, 1915, to April 10, 1920, and Friez recorder used May 29 to June 26, 1915.

DISCHARGE MEASUREMENTS.—Made from wooden footbridge at gage above control and spillway.

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, 3.84 feet at 6 p. m. December 3 (discharge, 55 million gallons per day or 85 second-feet); minimum stage recorded, reservoir gates occasionally shut in November, December, and January.

1915–1920: Maximum stage recorded, 3.96 feet at 5 p. m. April 18, 1919 (discharge, 58 million gallons per day or 90 second-feet); minimum stage recorded, reservoir gates occasionally shut (discharge into reservoir, 0.0).

DIVERSIONS.—Diverts from Anahola River.

REGULATION.—By head gates. When Kaneha reservoir is full, water is turned out of ditch at spillway just below gage.

OBJECT OF STATION.—To determine amount of water diverted from Anahola River to Kaneha reservoir. Water owned by Territory leased to Makee Sugar Co.

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

ACCURACY.—Stage-discharge relation permanent when spillway is closed and reservoir gate opened. Effect of opening spillway on relation of stage to discharge into reservoir not determined, but is probably slight and has been neglected. Rating curve well defined below 10 and fairly well defined below 35 million gallons per day. Figures do not include discharge through spillway. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records good except when water was wasting or recorder not operating.

Discharge measurements of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 10	Shiro Takabayashi	1.46	7.6	49
Aug. 29	do	1.24	3.6	2.3
Sept. 24	do	1.15	2.9	1.85
Nov. 15	do	1.26	4.1	2.7
Dec. 22	do	1.06	2.2	1.4
Jan. 30	do	1.37	3.1	2.0
Feb. 16	do	1.12	2.1	1.4
Mar. 29	do	1.45	6.5	4.2
Apr 17	W. V. Hardy	1.22	3.9	2.5
May 14	Shiro Takabayashi	1.15	2.4	1.5
June 18	M. H. Carson	1.40	6.0	3.9

Daily discharge, in million gallons, of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.3	13.7	7.9	.....	.....	1.5	3.6	3.6	1.6	4.0	2.6	2.8
2	3.0	5.4	4.1	.....	.....	5.5	3.7	3.5	1.8	7.1	2.3	2.5
3	3.2	4.2	3.7	.....	.....	6.2	4.0	3.4	1.6	7.4	2.3	2.8
4	2.8	4.5	7.3	.....	.....	3.0	3.4	3.3	2.0	8.0	2.2	3.6
5	2.7	4.0	7.0	4.8	.....	2.3	2.8	3.3	1.9	.....	2.2	8.1
6	2.6	3.3	5.0	4.7	.....	1.8	3.6	3.2	3.8	.....	2.2	3.5
7	4.2	3.0	4.0	2.6	.....	1.2	4.4	3.5	5.4	.....	2.2	2.8
8	3.5	5.0	6.8	4.0	.....	2.1	3.6	3.7	11.7	.....	2.2	2.8
9	8.5	6.6	15.7	2.8	9.5	2.8	5.5	3.6	3.8	.....	2.2	2.4
10	4.7	7.4	5.0	2.4	8.4	.0	8.6	4.0	8.2	.....	2.2	3.4
11	13.2	3.9	3.6	2.4	8.5	2.0	6.7	5.2	.....	.....	2.2	5.6
12	3.7	3.7	3.2	2.3	6.2	2.1	3.6	2.9	.....	3.2	2.2	5.1
13	8.5	4.4	3.0	2.2	3.8	2.0	2.7	2.9	.....	3.1	2.1	4.6
14	8.0	4.6	2.7	2.1	3.0	2.0	3.6	2.2	.....	3.5	2.1	3.7
15	6.4	7.2	2.6	2.0	2.8	1.9	4.9	2.0	.....	3.0	2.0	3.0
16	4.0	12.4	2.6	1.9	2.7	1.8	.0	1.9	3.7	2.8	2.0	6.8
17	3.4	4.2	2.9	1.9	2.5	1.8	.0	1.9	6.4	2.8	1.9	7.8
18	4.0	3.6	1.9	1.9	2.5	1.8	.0	1.9	10.0	6.2	6.9	4.3
19	6.4	5.4	1.4	1.9	2.3	1.8	.0	1.8	5.6	3.6	4.2	3.8
20	15.0	16.4	2.8	2.0	2.3	1.8	1.4	1.8	4.2	5.2	2.3	3.0
21	7.5	12.9	1.3	2.0	4.0	1.6	3.3	1.7	3.6	14.7	2.5	2.6
22	8.3	5.7	1.9	2.3	3.3	1.8	3.3	1.7	8.2	12.8	2.6	2.5
23	5.4	4.3	1.9	2.0	2.7	2.9	4.1	1.6	9.3	7.0	3.6	2.5
24	5.1	3.7	2.2	9.0	2.5	1.8	5.1	1.7	9.3	6.0	3.3	2.2
25	3.8	3.3	2.3	2.7	2.5	1.7	4.7	1.8	9.3	5.0	10.3	2.3
26	6.0	3.0	2.2	2.2	1.6	2.8	4.7	2.9	5.9	4.6	8.4	2.8
27	5.0	2.9	2.1	2.0	.0	2.3	4.4	1.8	2.7	4.0	3.0	6.4
28	13.3	2.8	3.5	4.8	.0	2.7	4.1	1.6	2.5	4.0	2.4	6.6
29	6.2	2.7	.....	3.0	.0	3.8	3.9	1.6	5.0	3.6	4.6	3.4
30	5.6	2.5	.....	2.3	.0	3.9	3.7	.....	5.1	2.9	7.2	3.3
31	5.6	4.7	.....	.....	.0	3.6	3.7	.....	3.6	.....	3.5	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: Sept. 29 to Oct. 4, 2.5; Oct. 31, 5; Nov. 1–8, 5.5; Mar. 11–15, 8; Apr. 5–11, 6; June 30, 3.3; Jan. 17–18 and Feb. 14–16, part of hydrograph estimated.

Monthly discharge of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	15.0	2.6	5.93	9.18	184	564
August	16.4	2.5	5.53	8.56	171	526
September	15.7	1.3	3.85	5.96	116	354
October	9.0	1.9	2.88	4.46	89.2	274
November (25⅝ days)	.....	1.6	4.49	6.95	115	353
December (29 days)	6.2	1.2	2.56	3.96	74.3	228
January (26⅛ days)	8.6	1.4	4.25	6.58	111	341
February	5.2	1.6	2.62	4.05	76.0	233
March	.....	1.6	5.68	8.79	176	540
April	.....	2.8	5.55	8.59	166	511
May	10.3	1.9	3.29	5.09	102	313
June	8.1	2.2	3.90	6.03	117	359
The period (354¾ days)	.....	1.2	4.22	6.53	1,500	4,600

KALIHIWAI RIVER NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—March 13, 1914, to June 30, 1920.

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, 6.10 feet at 7 p. m. January 16 (discharge, approximately 1,100 million gallons per day, or 1,700

second-feet); minimum stage recorded, 0.58 foot 8 a. m. February 22 (discharge, 5.8 million gallons per day, or 9.0 second-feet).

1914–1920: 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 February, 1920.

Correction to extremes of discharge published in Water-Supply Paper 485: Maximum stage recorded during the year 1917–18 was 7.92 feet May 22, 1918 (discharge, 1,780 million gallons per day or 2,750 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of high-level diversion, in connection with Territorial project relative to Hanalei River.

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 satisfactory except as shown in footnote to table of daily discharge. Records good when water-stage recorder was operating satisfactorily.

Discharge measurements of Kalihiwai River near Hanalei, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 13	Shiro Takabayashi	1.54	94	61
Sept. 2	H. A. R. Austin	.83	18.6	12
Nov. 13	Shiro Takabayashi	.88	22	14.2
Dec. 17	do	.68	12.4	8.0
Jan. 12	do	.75	14.0	9.0
Feb. 13	do	.86	19.5	12.6
May 18	do	1.05	32.5	21
June 21	M. H. Carson	.80	17.5	11.3

Daily discharge, in million gallons, of Kalihiwai River near Hanalei, Kauai, for the year ending June 20, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	19.0	78	12.6	8.6	12.0	.....	22	7.8	6.0	43	11.0	9.2
2	11.4	48	11.8	11.4	8.0	.....	39	7.6	6.2	70	9.8	9.5
3	10.7	37	26	10.7	6.8	.....	23	7.4	8.8	66	9.8	10.1
4	10.1	37	28	8.6	7.6	.....	16.5	7.2	12.0	116	9.2	16.9
5	8.9	32	27	23	10.1	.....	13.0	7.0	7.6	62	8.6	39
6	9.2	28	21	16.6	22	.....	19.0	6.8	15.6	41	8.3	14.2
7	11.8	27	18.5	12.6	13.0	.....	26	7.6	18.6	32	7.8	11.0
8	10.4	34	23	17.5	53	.....	15.5	9.5	46	26	7.4	10.1
9	27	39	59	12.2	30	.....	19.0	7.6	25	22	7.4	9.2
10	15.5	36	27	10.4	20.0	.....	15.5	14.5	27	24	7.4	16.5
11	51	30	21	11.0	27	.....	12.2	74	73	19.0	8.0	20.0
12	16.5	25	18.5	10.1	19.5	.....	10.4	23	97	17.0	8.0	26
13	38	29	16.5	8.0	12.6	.....	12.7	13.8	67	18.0	7.2	20.0
14	32	25	15.5	7.8	.....	.....	42	9.8	27	18.5	7.2	20.0
15	34	42	15.0	7.4	.....	.....	139	8.0	21	15.5	7.2	15.0
16	20.0	50	14.6	7.4	.....	7.6	236	7.8	16.0	12.2	7.4	23
17	14.2	19.0	15.0	7.2	.....	7.4	95	7.2	49	11.8	31	34
18	13.8	10.4	13.4	6.8	.....	7.2	50	7.0	146	25	45	18.5
19	23	14.0	13.0	7.0	.....	6.8	31	6.6	139	13.4	17.0	18.5
20	39	45	18.7	7.6	.....	6.6	22	6.4	80	23	9.8	13.0
21	32	40	11.8	7.2	.....	6.6	17.5	6.0	57	199	14.6	11.4
22	22	21	10.4	6.6	.....	7.0	15.5	6.0	72	138	13.8	15.5
23	15.5	16.0	9.8	7.0	.....	9.2	13.8	6.0	105	52	11.8	11.0
24	12.6	14.2	8.6	19.0	.....	6.2	12.6	6.0	72	30	15.0	9.5
25	14.1	13.0	8.0	7.6	.....	6.0	11.0	6.9	105	24	82	9.5
26	25	12.2	7.6	6.4	.....	15.0	10.4	13.0	70	20.0	43	13.4
27	18.5	11.8	7.2	9.5	.....	7.2	9.5	6.6	44	17.0	16.5	18.6
28	48	11.0	10.5	22	.....	12.2	9.2	6.2	38	16.5	13.0	28
29	40	10.4	11.5	15.0	.....	75	8.6	6.2	36	13.8	12.6	22
30	37	10.4	11.4	8.0	.....	47	8.3	.....	54	12.6	14.2	12.6
31	47	10.7	.....	11.0	.....	26	8.3	.....	33	.....	10.7	.....

NOTE.—Nov. 13 to Dec. 16 paper torn and no record. Nov. 13 and Dec. 16 graph partly estimated. Nov. 14–30 discharge estimated at 16 million gallons per day and Dec. 1–15 at 19 million gallons per day, determined by multiplying discharge of Waioli Stream by 1½.

Monthly discharge of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	51	8.9	23.5	36.4	727	2,240
August	78	10.4	27.6	42.7	856	2,630
September	59	7.2	17.1	26.5	512	1,570
October	23	6.4	10.7	16.6	331	1,020
November	.....	.....	17.1	26.5	514	1,570
December	.....	.....	17.4	26.9	538	1,660
January	236	8.3	31.7	49.0	984	3,020
February	74	6.0	10.7	16.6	310	952
March	146	6.0	50.8	78.6	1,570	4,830
April	199	11.8	39.9	61.7	1,200	3,670
May	82	7.2	15.5	24.0	482	1,470
June	39	9.2	16.8	26.0	505	1,550
The year	236	6.0	23.3	36.1	8,530	26,200

HANALEI RIVER NEAR HANALEI, KAUAI.

LOCATION.—5 miles upstream from Hanalei.

RECORDS AVAILABLE.—December 28, 1911, to November 20, 1919, when station was discontinued.

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, 7.54 feet at 7.10 a. m. July 11 (discharge, 379 million gallons per day, or 586 second-feet); minimum stage recorded, 6.55 feet at 4.10 p. m. October 24 to 8.10 a. m. October 27, and 4.10 p. m. October 30 (discharge, 38 million gallons per day, or 59 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)[5].

DIVERSIONS.—China and Kuna ditches divert water above station.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water left in river, below China and Kuna ditch diversions. Water rises on territorial lands.

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.

[5] Maximum stage recorded for year ending June 30, 1918, was given erroneously in Water-Supply Paper 485. Corrected figures are 12.74 feet at 4.10 p. m. May 22, 1918 (discharge, 6,350 million gallons per day or 9,820 second-feet).

Discharge measurements of Hanalei River near Hanalei, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	Shiro Takabayashi	6.74	131	85
Oct. 1	do	6.59	64	41.5
Jan. 11	do	6.71	91	59

Daily discharge, in million gallons, of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	54	315	182	40	57	16	85	295	50	40	57
2	49	117	66	47	54	17	60	88	49	44	54
3	43	95	47	52	52	18	72	60	47	40	50
4	40	85	285	39	72	19	100	54	44	40	49
5	40	76	95	39	142	20	280	98	68	47	142
6	39	66	57	55	117	21	170	186	44	39	.....
7	39	22	52	44	170	22	95	100	42	39	.....
8	42	142	50	39	345	23	72	64	40	39	.....
9	102	126	23	39	219	24	64	57	39	39	.....
10	72	102	105	39	95	25	88	54	39	38	.....
11	255	82	76	39	206	26	78	50	39	38	.....
12	60	54	68	39	90	27	60	49	39	54	.....
13	44	66	60	39	80	28	285	47	39	260	.....
14	126	54	54	39	72	29	114	46	47	156	.....
15	132	57	52	42	64	30	206	46	55	39	.....
						31	210	46	.....	66	.....

Monthly discharge of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	285	39	102	158	3,180	9,700
August	315	22	90.3	140	2,800	8,590
September	285	23	65.1	101	1,950	5,990
October	260	38	53.2	82.3	1,650	5,060
November 1–20	345	49	109	169	2,180	6,700
The period	.....	.....	.....	.....	11,800	36,000

CHINA DITCH NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—March 17, 1914, to November 20, 1919, when station was discontinued. 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.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.09 feet at 7 a. m. August 1 and 7 a. m. September 9 (discharge, 37 million gallons per day, or 57 second-feet); minimum stage recorded during year, 1.43 feet 8 a. m. and 4 p. m. October 30 (discharge, 15.2 million gallons per day, or 24 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 head gates.

OBJECT OF STATION.—To determine amount of water diverted by ditch. Ditch serves fee simple land, but water all rises on Territorial land.

UTILIZATION.—Water used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation practically permanent July 1 until station was discontinued. Rating curve fairly well defined between 10 and 25 million gallons per day. Gage read to hundredths twice daily. Records fair.

Discharge measurements of China ditch near Hanalei, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	Shiro Takabayashi	1.78	38.5	24.9
Oct. 1	do	1.54	26.5	17.1

Daily discharge, in million gallons, of China ditch near Hanalei, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	21	35	29	17.9	16.7	16	25	37	19.1	15.6	16.7
2	21	29	22	19.1	16.7	17	24	27	19.1	16.7	16.7
3	22	27	19.1	19.1	15.6	18	24	22	19.1	15.6	16.7
4	24	27	35	17.9	16.7	19	25	22	17.9	15.6	16.7
5	21	25	22	16.7	21	20	33	27	21	16.7	21
6	19.1	24	22	19.1	21	21	31	29	17.9	15.6	.....
7	19.1	24	21	17.9	21	22	27	24	17.9	15.6	.....
8	22	29	21	16.7	27	23	25	22	17.9	15.6	.....
9	29	29	35	16.7	24	24	25	22	17.9	16.7	.....
10	25	29	24	17.9	21	25	27	22	17.9	15.6	.....
11	33	29	21	16.7	24	26	25	21	17.9	15.6	.....
12	24	22	19.1	17.9	21	27	24	21	17.9	16.7	.....
13	22	22	19.1	16.7	19.1	28	35	21	16.7	24	.....
14	31	21	19.1	16.7	19.1	29	27	19.1	19.1	22	.....
15	27	22	19.1	16.7	17.9	30	31	19.1	17.9	15.6	.....
						31	33	19.1	.....	17.9	.....

Monthly discharge of China ditch near Hanalei, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	35	19.1	25.8	39.9	801	2,45
August	37	19.1	24.8	38.4	768	2,360
September	35	16.7	20.8	32.2	623	1,910
October	24	15.6	17.3	26.8	535	1,650
November 1–20	27	15.6	19.5	30.2	390	1,200
The period	.....	.....	.....	.....	3,120	9,570

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 November 20, 1919, when station was discontinued. 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, 3.32 feet at 8.50 a. m. July 21 (discharge, 39 million gallons per day or 60 second-feet); minimum stage recorded, 1.13 feet from 4.30 p. m. October 24 to 8.30 a. m. October 27, (discharge, 7.0 million gallons per day or 10.8 second-feet). Water was occasionally higher than indicated by the maximum above, but observer was unable to reach the gage at higher stages.

1918–1919: Maximum stage recorded, 6.2 feet December 3, 1912, at old site and 3.32 feet at 8.50 a. m. July 21, 1919 (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 head gates.

OBJECT OF STATION.—To determine amount of water diverted from river by ditch, which serves fee simple land. Water all rises on Territorial lands.

UTILIZATION.—Water used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent July 1 until station was discontinued. Rating curve fairly well defined above and poorly defined below 15 million gallons per day. Gage read to hundredths twice daily. Records fair.

Discharge measurements of Kuna ditch near Hanalei, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	Shiro Takabayashi	2.66	44	28.5
Oct. 1	do	1.98	26	16.8

Daily discharge, in million gallons, of Kuna ditch near Hanalei, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	27	.....	.....	15.8	17.2	16	30	.....	19.3	7.2	10.2
2	27	30	27.	19.3	16.5	17	27	27	19.3	18.6	9.7
3	27	28	25	19.3	16.5	18	27	27	19.3	7.2	9.7
4	27	27	.....	7.2	17.2	19	30	27	18.6	7.2	9.7
5	25	27	30	7.2	21	20	.....	28	20.0	12.6	.....
6	25	27	27	13.2	19.3	21	35	.....	18.6	7.2	.....
7	25	27	27	12.6	.....	22	30	30	17.9	7.2	.....
8	27	.....	27	7.2	.....	23	28	28	17.2	7.2	.....
9	30	34	.....	7.2	.....	24	27	27	7.6	12.0	.....
10	30	30	23	7.2	12.0	25	28	27	7.2	7.2	.....
11	.....	28	21	7.2	.....	26	28	27	7.2	7.2	.....
12	28	27	20.0	7.2	11.4	27	27	27	7.2	13.2	.....
13	27	27	20.0	7.2	10.8	28	.....	27	7.2	.....	.....
14	35	27	19.3	7.2	10.8	29	30	27	19.3	20.0	.....
15	32	27	19.3	7.2	10.2	30	.....	27	19.3	7.2	.....
						31	.....	27	.....	19.3	.....

NOTE.—On account of high water, gage could not be reached by observer, at one or both daily trips and discharge has been estimated in million gallons per day as follows: July 11, 20, 28, 30, 31, and Aug. 1, 8, 16, and 21, at 35; Sept. 1, 4, and 9, at 30; Oct. 28 and Nov. 7, 8, 9, and 11, at 20; and Nov. 20 at 13.

Monthly discharge of Kuna ditch near Hanalei, Kauai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July		25	29.5	45.6	914	2,810
August		27	28.7	44.4	889	2,730
September		7.2	20.0	30.9	601	1,840
October		7.2	10.7	16.6	333	1,020
November 1-20		9.7	14.8	22.9	295	906
The period (July 1 to Nov. 20)					3,030	9,300

WAIOLI STREAM NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—July 1, 1914, to June 30, 1920. Data from December 19, 1916, to June 30, 1918, have been revised in Water-Supply Paper 515.

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, 4.50 feet at 6 p. m. March 25 (discharge, 470 million gallons per day or 727 second-feet); minimum stage recorded, 0.96 foot at 4.45 a. m. February 1, 6 p. m. March 3, and 7 a. m. May 9 (discharge, 5.7 million gallons per day or 8.8 second-feet).

1914–1920: 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[6] per day 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.

OBJECT OF STATION.—To determine feasibility of high-level diversions, in connection with Territorial Hanalei River project. Territorial land and water.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to August 8, well defined below 60 million gallons per day and rating curve used August 9 to June 30 well defined below 80 million gallons per day. Operation of water-stage recorder unsatisfactory. Records fair when water-stage recorder was operating.

Discharge measurements of Waioli Stream near Hanalei, Kauai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day
July 11	Shiro Takabayashi	1.65	46.5	30
Aug. 31	H. A. R. Austin	2.17	89	58
Sept. 29	Shiro Takabayashi	1.14	11.8	7.7
Nov. 12	do	1.60	34	22.1
Dec. 18	do	1.02	10.2	6.6
Jan. 10	do	1.15	12.9	8.4
Feb. 12	do	1.27	14.3	9.2
Mar. 20	do	2.20	74	47.5
20	do	3.48	470	304
May 16	do	1.00	8.4	5.4
June 19	M. H. Carson	1.10	12.1	7.8

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

Daily discharge, in million gallons, of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	13.5	26	28	12.1	.....	6.2	18.2	6.3	6.5	10.1	7.5	.....
2	14.8	17.0	13.5	9.7	.....	23	24	6.3	6.0	12.9	7.3	.....
3	13.1	14.1	16.4	7.6	.....	55	16.4	6.1	6.6	25	6.9	.....
4	12.7	14.3	15.0	.....	.....	15.7	12.6	6.1	6.9	31	6.6	.....
5	12.7	14.1	16.0	.....	.....	9.8	10.1	6.1	7.2	17.8	6.6	.....
6	13.2	14.1	11.8	.....	.....	8.6	17.9	6.1	17.4	12.0	6.6	.....
7	20.0	15.1	11.0	.....	.....	7.6	18.6	9.1	25	10.1	6.2	.....
8	13.3	46	13.2	.....	.....	7.2	11.8	12.4	64	8.4	6.1	.....
9	.....	30	45	.....	.....	10.2	9.8	8.0	17.1	7.5	6.0	.....
10	.....	19.2	13.5	.....	.....	8.6	9.6	9.4	47	10.2	6.2	.....
11	.....	15.4	10.3	.....	.....	7.3	7.3	29	56	8.8	6.1	.....
12	21	14.7	8.8	.....	.....	7.2	7.0	18.3	60	7.3	6.2	.....
13	34	18.8	8.2	.....	12.6	6.9	7.3	10.8	39	9.2	6.2	.....
14	33	19.4	7.6	.....	10.3	6.8	7.2	8.8	14.7	9.0	6.2	.....
15	28	32	7.5	.....	9.2	6.6	26	7.6	16.9	7.2	6.2	.....
16	21	35	7.3	.....	8.4	6.6	71	7.3	23	6.8	6.3	.....
17	17.0	18.5	7.2	.....	7.8	6.6	43	7.0	27	6.2	.....	.....
18	15.9	16.0	6.9	.....	7.5	6.6	31	7.0	80	14.6	.....	.....
19	25	24	6.8	.....	7.2	6.6	15.0	6.9	115	9.6	.....	7.8
20	36	33	9.7	.....	6.9	6.6	10.8	6.6	86	27	.....	7.8
21	25	24	7.2	.....	46	6.6	9.4	6.3	72	129	.....	7.9
22	21	16.4	6.9	.....	19.7	6.9	9.2	6.0	106	109	.....	8.4
23	15.4	12.3	6.9	.....	10.3	15.1	8.4	6.9	69	33	.....	7.8
24	14.1	8.8	7.2	.....	8.4	7.2	7.8	6.5	38	12.9	.....	6.8
25	14.6	8.4	7.2	.....	7.3	7.0	7.2	16.5	116	10.1	.....	7.0
26	16.5	8.4	7.0	.....	6.8	18.6	7.3	13.8	34	9.4	.....	7.2
27	14.8	8.4	7.3	.....	6.6	12.3	7.0	7.2	16.4	8.6	.....	9.0
28	34	8.0	7.6	.....	6.9	16.4	6.8	6.8	12.3	8.4	.....	11.3
29	18.5	8.0	8.6	.....	6.6	56	6.8	6.8	9.8	8.2	.....	9.4
30	16.2	9.4	8.4	.....	6.5	32	6.6	.....	8.8	8.0	.....	7.6
31	19.1	25	.....	.....	.....	26	6.2	.....	8.2	.....	.....	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: July 9–11, 21; Nov. 1–12, 13; May 17–31, 16; June 1–18, 12. Estimates are approximately two-thirds of discharge of Kalihiwai River.

Monthly discharge of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1920

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	36	12.7	19.9	30.8	616	1,890
August	46	8.0	18.5	28.6	574	1,760
September	45	6.8	11.3	17.5	338	1,040
October	.....	.....	7.13	11.0	[a] 221	678
November	46	6.5	11.7	18.1	351	1,080
December	56	6.2	13.7	21.2	424	1,300
January	71	6.2	14.8	22.9	457	1,410
February	29	6.0	9.03	14.0	262	804
March	116	6.0	39.1	60.5	1,210	3,720
April	129	6.2	19.6	30.3	587	1,800
May	.....	.....	11.1	17.2	343	1,060
June	.....	.....	10.4	16.1	313	957
The year	129	.....	15.6	24.1	5,700	17,500

[a] Estimated as two-thirds of discharge of Kalihiwai Stream.

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, 1920.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
Jan. 25	Main left branch of Koaie	Elevation 3,500 feet, near Waimea, Kauai		2.2	1.45
July 18	Waiahulu	Near Waimea, Kauai	2.44	27	17.5
Aug. 23	do	do	2.48	27	17.6
Sept. 3	do	do	2.44	25	16.2
Oct. 30	do	do	2.38	21.4	13.8
Dec. 31	do	do	3.39	80	52
Jan. 27	do	do	3.58	108	70
Mar. 12	do	do	5.36	626	405
Apr. 28	do	do	2.80	31	19.9
June 28	do	do	2.60	18.3	11.8
July 17	Koaie	do	2.16	25.5	16.4
Aug. 23	do	do	2.18	26.5	17.0
Oct. 30	do	do	2.24	32.5	20.9
Dec. 31	do	do	2.55	56	36.5
Jan. 27	do	do	2.43	42	27
Mar. 12	do	do	3.69	176	114
12	do	do	4.86	583	377
Apr. 27	do	do	2.10	24	15.5
May 24	do	do	2.28	35	22.6
June 28	do	do	2.12	20.6	13.3

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 6, 1913, to June 30, 1920.

GAGE.—Gurley 7-day water-stage recorder installed June 25, 1918. Friez recorder in use September 8 to November 22, 1913, and Gurley printing recorder 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.—Maximum stage recorded during year, 9.31 feet at 10.30 p. m. March 22 (discharge, 566 million gallons per day or 876 second-feet); minimum stage recorded during year, 2.80 feet several times between February 27 and March 5 (discharge, 0.5 million gallons per day, or 0.8 second-foot).

1913–1920: 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 discharge recorded during 1920.

DIVERSIONS.—Catholic Orphanage diverts water for domestic use into a 4-inch pipe (which is reduced by several stages to 1 inch at the outlet) at a dam about 300 feet above the station. Dam was installed May, 1920. Prior to this there were no diversions above station.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of using stream to augment water supply of city of Honolulu. Part of water rises on Territorial lands.

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

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

Discharge measurements of Kalihi Stream near Honolulu, Oahu, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 4	A. H. Wong	3.16	5.7	3.7
Sept. 1	J. E. Stewart	3.46	12.9	8.3
Nov. 21	do	2.87	.75	.5
Dec. 1	M. H. Carson	2.85	1.0	.65
Jan. 24	do	2.88	1.45	.95
Feb. 27	do	2.81	.85	.55
Mar. 19	do	4.38	57	37
May 7	do	2.96	2.8	1.8

Daily discharge, in million gallons, of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.1	4.0	13.3	1.5	1.1	0.7	1.0	0.8	0.5	4.9	2.1	1.
2	2.8	3.1	.....	1.5	1.6	.7	.9	.8	.5	4.4	2.0	1.8
3	2.7	2.8	.....	1.7	1.2	.7	.9	.8	.5	6.0	1.9	1.8
4	2.1	4.6	.....	1.6	1.2	.9	.8	.7	.5	4.4	1.9	1.7
5	1.9	2.8	.....	22	1.5	.8	.7	.7	.6	4.4	1.9	1.7
6	2.2	2.7	.....	5.3	1.3	.7	.7	.7	.6	3.8	1.8	1.4
7	2.2	11.4	.....	18.6	12.0	.7	.7	.7	.7	3.4	1.7	1.3
8	6.2	24	.....	3.9	1.7	.7	.7	.7	1.2	3.0	1.6	1.3
9	2.5	5.9	.....	2.5	1.5	.7	.7	.9	.7	2.9	2.2	1.2
10	2.2	4.7	.....	2.1	1.2	.7	2.5	.9	.7	2.7	1.8	1.3
11	2.7	3.4	.....	1.9	1.2	.8	1.2	1.1	2.2	2.4	1.8	1.1
12	2.1	3.0	.....	1.9	1.5	.8	.9	.9	2.8	2.8	1.8	1.3
13	3.4	3.3	.....	1.8	1.3	.7	1.0	.8	20.0	2.6	1.6	1.2
14	2.1	4.6	2.3	1.7	1.1	.7	.9	.7	2.5	2.4	1.6	1.1
15	1.9	3.6	2.4	1.7	1.0	.7	.8	.7	1.7	2.8	1.5	1.6
16	1.8	3.3	2.4	1.6	1.0	.8	.9	.7	1.9	2.2	1.5	1.2
17	1.7	2.9	2.2	1.6	1.0	.7	15.2	.6	1.5	2.4	1.9	1.4
18	1.7	2.7	2.1	1.6	1.0	.7	4.1	.6	40	2.4	1.7	1.2
19	1.7	2.6	2.0	1.6	.9	.7	1.7	.6	27	3.7	1.5	2.0
20	6.4	2.6	1.9	1.5	.9	.7	1.3	.7	12.7	8.6	1.6	1.3
21	3.3	3.6	1.8	1.5	.9	.7	1.1	.7	6.9	4.2	1.8	1.1
22	2.4	2.6	1.8	1.4	1.0	.7	1.0	.7	26	3.6	1.6	1.5
23	2.0	2.4	1.7	1.4	.9	.9	1.0	.7	34	3.0	1.6	1.4
24	1.8	2.3	1.7	1.6	1.0	.7	1.0	.6	12.6	2.7	1.6	1.2
25	10.6	2.3	1.6	1.3	.9	.8	1.0	.6	18.1	2.6	1.7	1.1
26	2.7	2.2	1.6	1.3	.9	.8	.9	.6	12.8	2.4	1.5	1.1
27	3.4	2.1	1.7	1.4	.9	.7	.9	.6	8.2	2.4	1.5	1.1
28	14.0	2.0	1.6	1.3	.8	.7	.8	.5	6.2	2.4	1.4	1.1
29	3.5	2.0	1.6	1.1	.9	2.8	.8	.5	6.0	2.3	1.4	1.0
30	7.3	2.1	1.6	1.5	.7	2.5	.8	.....	4.9	2.1	1.8	1.0
31	3.9	6.6	.....	1.1	.....	1.4	.8	.....	4.3	.....	1.6	.....

NOTE.—Sept. 2–13 float caught and record of no value; discharge estimated in million gallons per day as follows: Sept. 2–4, 10; Sept. 5–13, 2.5.

Monthly discharge of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	14.0	1.7	3.46	5.35	107	329
August	24	2.0	4.14	6.41	128	394
September	13.3	1.6	3.26	5.04	97.8	300
October	22	1.1	2.98	4.61	92.5	284
November	12.0	.7	1.47	2.27	44.1	135
December	2.8	.7	.88	1.36	27.3	84
January	15.2	.7	1.54	2.38	47.7	147
February	1.1	.5	.71	1.10	20.6	63
March	40	.5	8.35	12.9	259	794
April	8.6	2.1	3.33	5.15	99.9	307
May	2.2	1.4	1.71	2.65	52.9	163
June	2.0	1.0	1.34	2.07	40.2	123
The year	40	.5	2.78	4.30	1,020	3,120

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, 1920.

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 in 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, 2.09 feet at 4 p. m. September 3 (discharge, 41 million gallons per day, or 63 second-feet); minimum stage recorded 0.05 foot at 9 p. m. March 4 and 4 p. m. June 25 (discharge, 0.15 million gallons per day, or 0.25 second-foot).

1913-1920: Maximum stage recorded, 6.0 feet at 4 p. m. April 5, 1914, discharge, 610 million gallons per day, or 944 second-feet); minimum stage recorded in 1920.

DIVERSIONS.—Most of the flow at low and medium stages is diverted above station for domestic supply and for power development.

REGULATION.—Amount diverted above station varies.

OBJECT OF STATION.—To determine feasibility of using Nuuanu Stream at this point to augment water supply for city of Honolulu. Territorial land and water.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records excellent when water-stage recorder was operating. Records fair when estimated.

Discharge measurements of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	J. E. Stewart	0.19	0.7	0.45
Oct. 2	do	.21	.75	.5
Nov. 15	do	.12	.09	.06
Dec. 20	M. H. Carson	.08	.25	.15
27	do	.06	.25	.15
Feb. 14	do	.10	.35	.25
27	do	.15	.2	.06
Mar. 19	do	.53	2.6	1.65
19	do	.60	4.1	2.6
22	do	1.13	10.6	6.8
22	do	1.13	9.7	6.3
22	do	1.32	20.3	13.2
22	do	1.32	17.8	11.5
29	do	.71	3.7	2.4
Apr. 30	do	.15	.4	.25
May 21	J. E. Stewart	.15	.45	.3

Daily discharge, in million gallons, of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.8	0.6	1.5	.....	0.5	0.3	0.2	0.2	0.2	.....	0.5	0.2
2	.8	.6	.6	.....	.7	.3	.2	.2	.2	.....	.4	.2
3	.8	.6	8.1	0.8	.5	.3	.2	.2	.2	8.5	.4	.2
4	.7	.5	1.9	1.5	.5	.3	.2	.2	.2	3.6	.4	.2
5	.7	.5	1.1	2.1	.7	.....	.2	.3	.2	2.9	.4	.2
6	.7	.4	1.0	1.9	.6	.....	.2	.2	.2	2.3	.4	.2
7	.8	1.4	1.0	1.7	1.0	.....	.2	.2	.2	1.9	.4	.2
8	.9	1.9	.8	1.4	.6	.....	.2	.2	.2	1.3	.4	.2
9	.8	.6	.8	1.2	.5	.....	.2	.2	.2	1.2	.5	.2
10	.8	.6	.8	.8	.5	.....	.5	.4	.2	1.0	.4	.2
11	.9	.6	.7	.8	.5	.....	.3	1.0	.2	1.0	.4	.2
12	.9	.5	.6	.8	.5	.3	.2	.5	.5	.9	.4	.2
13	1.0	.5	.6	.7	.5	.2	.3	.3	.6	.8	.5	.2
14	.9	.7	.6	.6	.4	.2	.2	.2	.3	.8	.....	.2
15	.7	.6	.7	.6	.4	.2	.2	.2	.2	.8	.....	.3
16	.7	.6	.7	.6	.3	.2	.2	.2	.2	.9	.....	.2
17	.7	.6	.8	.6	.3	.2	2.1	.2	.2	1.9	.....	.2
18	.7	.5	2.1	.6	.2	.2	.7	.2	3.5	.8	.....	.2
19	.6	.5	1.5	.6	.2	.2	.4	.2	2.1	.8	.....	.5
20	1.0	.5	.8	.7	.2	.2	.3	.2	1.4	.8	.....	.2
21	.7	.5	1.1	.8	.2	.2	.3	.2	.9	.7	.....	.2
22	.7	.5	1.7	.9	.2	.2	.4	.2	6.0	.7	.....	.4
23	.6	.5	1.5	.8	.2	.2	.3	.2	5.1	.6	.....	.4
24	.6	.5	.8	.8	.2	.2	.3	.2	3.0	.6	.....	.2
25	.6	.5	.7	.6	.3	.2	.3	.2	4.4	.6	.....	.2
26	.6	.4	.7	.5	.3	.2	.3	.2	.....	.6	.....	.2
27	.6	.4	.9	.5	.2	.2	.3	.2	.....	.6	.....	.2
28	1.2	.4	.9	.5	.3	.2	.2	.2	.....	.6	.2	.2
29	.6	.4	.7	.4	.3	.3	.2	.2	.....	.5	.2	.2
30	.6	.5	.....	.5	.3	.3	.2	.....	.....	.5	.3	.2
31	.6	.6	.....	.5	.....	.2	.2	.....	.....	.....	.3	.....

NOTE.—Clock on recorder stopped and discharge estimated in million gallons per day as follows: Sept. 30, 0.7; Oct. 1–2, 0.6; Dec. 5–11, 0.3; May 14–20, 0.4; May 21–27, 0.3. Record lost Mar. 26 to Apr. 2 and discharge estimated at 4.0 million gallons per day. Parts of graph of Nov. 14, 15, and May 28 estimated.

Monthly discharge of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.2	0.6	0.75	1.16	23.3	71
August	1.9	.4	.60	.93	18.5	57
September	8.1	.6	1.21	1.87	36.4	111
October	2.1	.4	.84	1.30	26.0	80
November	1.0	.2	.40	.62	12.1	37
December	.....	.....	.25	.39	7.6	24
January	2.1	.2	.33	.51	10.2	31
February	1.0	.2	.25	.39	7.3	22
March	6.0	.2	1.76	2.72	54.6	167
April	8.5	.5	1.54	2.38	46.2	142
May	.....	.....	.37	.57	11.4	35
June	.5	.2	.23	.36	6.8	21
The year	8.5	.2	.71	1.10	260	798

MAOLE DITCH, MAUKA STATION, NEAR HONOLULU, OAHU.

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

RECORDS AVAILABLE.—October 6, 1917, to March 5, 1920, when station was discontinued.

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, and has an elliptical concrete control 15 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.67 feet at 8 p. m. October 5 (discharge, 35 million gallons per day, or 54 second-feet); minimum stage recorded during year, ditch dry.

1917–1920: Maximum stage recorded, 2.86 feet at 5.30 a. m. April 19, 1918 (discharge, estimated from extension of rating curve, 41 million gallons per day, or 63 second-feet [7]); minimum stage recorded, ditch occasionally dry.

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

REGULATION.—By head gates.

OBJECT OF STATION.—To determine amount of water diverted from Hillebrand Glen for reservoir No. 4 of water supply for city of Honolulu. Territorial water.

UTILIZATION.—City water supply and power development.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 10 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records good for low stages and poor for high stages.

The following discharge measurement was made by A. H. Wong.

July 31, 1919: Gage height, 0.39 foot; discharge, 0.85 second-foot, or 0.55 million gallons per day.

[7] 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, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
1	0.06	0.4	1.6	0.01	0.01	.....	0.02	.....
2	.15	.15	.15	.01	.05	.....	.01	.....
3	.06	.1	4.7	.02	.01	.....	.08	.....
4	.04	.15	.5	.01	.....	.....	.01	.....
5	.03	.08	.2	2.2	.2	.....	.01	.....
6	.06	.08	.15	.5	.06	.....	.....	.....
7	.08	1.3	.2	1.5	.6	.....	.....	.....
8	1.7	1.8	.09	.35	.09	.....	.....	.....
9	.3	.45	.1	.1	.05	.....	.....	.....
10	.15	.35	.09	.06	.01	.....	.09	0.04
11	.2	.2	.15	.03	.04	0.09	.06	.06
12	.1	.8	.05	.01	.07	.01	.01	.02
13	.2	.45	.04	.01	.06	.01	.03	.01
14	.06	.45	.06	.01	.01	.....	.01	.....
15	.06	.25	.06	.01	.01	.....	.....	.....
16	.03	.2	.07	.01	.01	.....	.....	.....
17	.04	.1	.06	.01	.01	.....	1.0	.....
18	.05	.07	.04	.01	.01	.....	.25	.....
19	.02	.06	.04	.01	.01	.....	.07	.....
20	.6	.06	.03	.01	.....	.....	.03	.....
21	.25	.2	.03	.01	.....	.....	.01	.....
22	.03	.09	.04	.01	.....	.....	.01	.....
23	.06	.08	.04	.01	.....	.02	.01	.....
24	.05	.09	.03	.01	.....	.....	.....	.....
25	.85	.08	.02	.....	.....	.....	.....	.....
26	.1	.07	.01	.....	.....	.....	.....	.....
27	.45	.05	.01	.....	.....	.....	.....	.....
28	1.4	.04	.02	.....	.....	.....	.....	.....
29	.25	.05	.01	.....	.....	.45	.....	.....
30	.85	.2	.01	.02	.....	.15	.....	.....
31	.5	1.5	.....	.01	.....	.15	.....	.....

NOTE.—No record and graph partly estimated Oct. 1, 2, and Jan. 15-17. No discharge for days for which discharge is not given.

Monthly discharge of Maole ditch, mauka station, near Honolulu, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.7	0.02	0.283	0.438	8.78	27
August	1.8	.04	.321	.497	9.95	31
September	4.7	.01	.287	.444	8.60	26
October	2.2	.....	.160	.248	4.95	15
November	.6	.00	.044	.068	1.31	4
December	.45	.00	.028	.043	.88	3
January	.....	.00	.081	.125	2.52	8
February	.06	.00	.004	.006	.13	0

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; 6½ miles from Honolulu post office.

RECORDS AVAILABLE.—October 5, 1917, to June 30, 1920.

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, 2.84 feet at 10.20 p. m. August 7 (discharge, 71 million gallons per day, or 110 second-feet); minimum stage recorded, ditch occasionally dry.

1917–1920: Maximum stage recorded, 3.45 feet at 4 a. m. April 19, 1918 (discharge, 108 million gallons per day, or 167 second-feet); minimum stage, ditch occasionally dry.

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

Regulations.—By head gates.

Object of station.—To determine amount of water diverted from Maole Stream in Hillebrand Glen to reservoir No. 4 of city of Honolulu.

Utilization.—City water supply and power development.

Accuracy.—Stage-discharge relation permanent, except during unusually high stages, when concrete control is not effective on account of large amount of silt carried. Rating curve is well defined below 10 million gallons per day. Operation of water-stage recorder unsatisfactory at times. 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 31	A. H. Wong	0.33	0.40	0.25
Aug. 30	J. E. Stewart	.39	.85	.55
Mar. 19	M. H. Carson	.32	.45	.3
Apr. 16	do	.07	.005	.005

Daily discharge, in million gallons, of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.01	0.4	1.6				0.04					0.05
2	.09	.08	.35				.02					.02
3	.01	.08	13.2				.05			0.6		.01
4		.1	.35				.01			.25		
5		.08	.1	3.1						.25		
6	.02	.05	.05	.1						.2		
7	.2	1.5	.06	2.5						.1		
8	1.7	1.7	.02	.25	0.07				0.08	.08		
9	.2	.4	.03	.06	.02				.01	.08	0.09	
10	.08	.2	.02	.02	.01		.8	0.02		.08	.01	
11	.1	.15	.06	.01	.02	0.15	.08	.02	.04	.08		
12	.05	.08	.02		.45	.01	.02		.5	.08		
13	.15	.15	.01		.02		.04		.85	.09		
14	.03	.6	.01				.01		.07	.04		
15	.01	.25	.01						.03	.03		.01
16	.01	.2	.01				.01		.03	.01		
17		.09	.01				1.8		.02	.02		
18	.05	.07	.01				.35		2.0	.04		.01
19	.01	.05	.01				.07		1.5	.7		.45
20	.6	.04	.01				.03		.65	1.6		.02
21	.25	.2	.01				.02		.2	.25		.01
22	.1	.08	.01				.01		1.3	.2		.15
23	.03	.04	.01			.01			1.7	.08	.02	.03
24	.02	.02	.01	.01					.35	.02	.15	
25	1.6	.02	.02						1.0	.01	.15	
26	.08	.02	.01						.75		.01	
27	1.3	.02										
28	2.0	.01	.01									
29	.2	.02				.5						
30	.7	.15		.02		.15					.03	
31	.4	.95		.01		.1					.01	

NOTE.—Clock stopped part of day and graph estimated Oct. 2, Nov. 8, Dec. 3, 11, Mar. 18, 19, 26, and May 14. Clock stopped and discharge estimated in million gallons per day as follows: Nov. 1–6, 0.01; Nov. 7, 1.0; Dec. 4–10, 0.00; Mar. 27 to Apr. 2, 0.05; May 15–21, 0.00. No discharge for other days for which discharge is not given.

nthly discharge of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.0	0.00	0.323	0.500	10.0	31
August	1.7	.01	.252	.390	7.80	24
September	13.2	.00	.534	.826	16.0	49
October	3.1	.00	.196	.303	6.08	19
November	.....	.00	.055	.085	1.65	5
December	.5	.00	.030	.046	.92	3
January	1.8	.00	.108	.167	3.36	10
February	.02	.00	.001	.002	.04	0
March	.....	.00	.365	.565	11.3	35
April	1.6	.00	.166	.257	4.99	15
May	.15	.00	.015	.023	.47	1
June	.45	.00	.025	.039	.76	2
The year	13.2	.00	.174	.269	63 4	195

WEST BRANCH OF MANOA STREAM NEAR HONOLULU, OAHU.

LOCATION.—At diversion dam at R. W. Shingles 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, 1920.

GAGE.—Friez 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; replaced August 15, 1917, by a Stevens continuous water-stage recorder; replaced April 13, 1920, by Friez 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, 3.75 feet at 9.20 p. m. October 5 (discharge, 245 million gallons per day or 379 second-feet); minimum stage recorded, 0.94 foot at 11.30 p. m. December 21 and 8.10 p. m. March 1 (discharge, 0.12 million gallons per day or 0.19 second-feet).

1913–1920: Maximum stage recorded, 4.65 feet at 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 by diversion for filling a swimming pool.

OBJECT OF STATION.—To determine feasibility of using stream to augment water supply of city of Honolulu. Part of water rises on Territorial lands. Records on West and East branches of Manoa Stream together show amount of surface water available in upper Manoa Valley, above nearly all diversions.

UTILIZATION.—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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	J. E. Stewart	1.10	0.9	0.6
31	A. H. Wong	1.26	4.8	3.1
Oct. 2	John Kaheaku	1.04	.2	.15
Nov. 10	J. E. Stewart	1.01	.15	.1
Feb. 14	M. H. Carson	1.00	.2	.15
20	do	.98	.15	.1
Apr. 2	do	1.38	8.0	5.2
16	do	1.10	1.55	1.0
May 14	Reid Jerman	1.02	.25	.15

Daily discharge, in million gallons, of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1920.

Day.	Aug.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.2	0.6	0.6	0.3	0.8	0.2	0.2	1.8	0.4	0.7
2	2.7	.6	.7	.2	.6	.2	.2	5.1	.3	.6
3	2.2	.6	.4	.2	.6	.2	.3	9.9	.4	.6
4	2.1	.5	.4	.6	.5	.3	.3	4.0	.4	.6
5	1.8	16.8	.5	.3	.3	.3	.2	2.9	.4	.....
6	1.5	5.2	.6	.3	.4	.3	.2	2.1	.4	.....
7	8.7	4.7	2.0	.2	.5	.3	.2	1.8	.4	.....
8	7.5	1.4	.6	.2	.5	.3	1.6	1.7	.4	.....
9	2.0	.9	.4	.3	.7	.3	.6	1.5	.9	.....
10	2.1	.7	.4	.6	2.3	.4	.4	1.5	.6	.....
11	1.5	.6	.6	.6	.8	.9	.5	1.2	.6	.....
12	1.7	.6	.8	.5	.6	.9	1.5	1.7	.6	.....
13	2.1	.5	.9	.3	.6	.6	1.4	1.6	.6	.....
14	4.8	.6	.7	.2	.5	.3	.6	1.1	.4	.....
15	1.8	.6	.8	.3	.6	.3	.4	1.1	.4	.....
16	1.6	.6	.7	.3	.6	.3	.6	1.0	.6	.....
17	1.2	.6	.6	.3	3.5	.3	.6	.9	.8	.....
18	1.2	.6	.6	.4	1.5	.3	15.8	.9	.6	.5
19	1.0	.5	.6	.4	.9	.3	11.4	1.2	.4	1.3
20	1.0	.6	.6	.3	.7	.3	5.7	2.2	.5	.4
21	1.1	.6	.6	.2	.7	.2	2.7	1.2	.5	.6
22	2.0	.6	.6	.2	.7	.2	14.8	1.0	.5	2.2
23	1.0	.6	.4	.5	.6	.2	12.6	.9	.4	1.0
24	1.0	.7	.3	.6	.4	.2	5.1	.7	.8	.8
25	.9	.6	.4	.6	.3	.2	9.4	.7	.9	.6
26	.9	.4	.4	.6	.3	.2	4.8	.6	.8	.6
27	.9	.4	.4	.4	.4	.3	3.1	.6	.6	.6
28	.8	.6	.3	.2	.3	.2	2.3	.6	.4	.7
29	.9	.5	.3	1.6	.3	.2	2.0	.6	.4	.6
30	2.1	.6	.3	1.1	.4	.....	1.8	.6	.5	.6
31	3.5	.6	.....	1.2	.3	.....	1.8	.....	.6	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day by comparison with flow of East Branch of Manoa Stream, as follows: Oct. 1, 0.6; June 5–10, 0.4; 11–15, 0.5; 16–17, 0.7. Graph partially estimated Oct. 2, Feb. 6, 7, and June 18.

Monthly discharge of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July			1.94	3.00	[a] 60.0	185
August	8.7	0.8	2.19	3.39	67.8	208
September			1.88	2.91	[a] 56.4	173
October	16.8	.4	1.42	2.20	44.0	135
November	2.0	.3	.58	.90	17.5	53
December	1.6	.2	.45	.70	14.0	43
January	3.5	.3	.72	1.11	22.2	68
February	.9	.2	.32	.50	9.2	28
March	15.8	.2	3.32	5.14	103.	316
April	9.9	.6	1.76	2.72	52.7	162
May	.9	.3	.53	.82	16.5	50
June	2.2		.64	.99	19.3	59
The year			1.32	2.04	482	1,480

[a] Estimated by comparison with flow of East Branch of Manoa Stream.

EAST MANOA STREAM NEAR HONOLULU, OAHU.

LOCATION.—At highway bridge 400 feet above confluence with West Branch of Manoa Stream, in upper Manoa Valley, and 4 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1920.

GAGE.—Friez water-stage recorder. Watson water-stage recorder used from May 5, 1913, to September 28, 1914; Stevens 8-day water-stage recorder used October 11, 1915, to August 15, 1917; and Stevens continuous water-stage recorder used August 15, 1917, to March 19, 1920. 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, 4.58 feet at 9.50 p. m. October 5 (discharge, 328 million gallons per day or 507 second-feet); minimum stage recorded, 1.18 feet at 1 p. m. June 8 and 3 a. m. June 9 (discharge, 0.54 million gallons per day or 0.84 second-foot).

1913–1920: 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 1920.,

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

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of using stream to augment water supply of city of Honolulu. Part of water rises on Territorial lands. Records on East and West branches of Manoa Stream together show amount of surface water available in upper Manoa Valley above nearly all diversions.

UTILIZATION.—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 1 and 80 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of East Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	J. E. Stewart	1.34	2.1	1.35
31	A. H. Wong	1.49	4.1	2.7
Oct. 2	John Kahesauku	1.32	1.8	1.15
Nov. 10	J. E. Stewart	1.27	1.5	.95
Jan. 24	M. H. Carson	1.23	1.3	.85
Feb. 27	....do	1.19	1.05	.7
Mar. 26	....do	1.43	3.7	2.4
Apr. 9	....do	1.28	1.75	1.15
9	....do	1.28	1.75	1.1
May 14	Reid Jerman	1.20	.8	.5

Daily discharge, in million gallons, of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.6	2.8	4.0	1.4	1.1	0.9	1.0	0.7	0.6	1.8	0.7	1.0
2	2.4	2.3	1.8	1.3	1.3	.9	1.0	.6	.7	2.2	.7	.9
3	1.7	2.1	21	1.6	1.2	.9	1.0	.6	.6	2.8	.8	.8
4	1.6	2.0	3.1	1.6	1.2	1.1	.9	.6	.6	1.8	.7	.7
5	1.5	2.2	2.1	19.5	1.1	.9	.9	.6	.6	1.6	.8	.7
6	1.7	2.0	2.1	6.0	1.6	.9	.9	.6	.5	1.5	.7	.7
7	2.0	4.1	2.1	4.0	3.2	1.0	.9	.6	.5	1.3	.6	.6
8	2.1	5.5	1.8	1.9	1.3	.8	.9	.8	1.7	1.3	.6	.5
9	1.9	2.0	1.8	1.5	1.3	.8	1.1	.7	.7	1.1	1.1	.6
10	1.8	2.1	1.9	1.4	1.1	1.1	1.9	.8	.7	1.1	.7	.6
11	1.8	1.8	1.9	1.4	1.1	.8	1.1	1.1	.7	1.0	.8	.6
12	1.7	1.8	1.7	1.3	1.2	.9	1.0	1.1	2.5	1.3	.8	.6
13	1.8	2.5	1.6	1.2	1.3	.8	.9	.8	1.8	1.2	.6	.7
14	1.6	3.3	1.6	1.2	1.2	.8	.9	.7	1.0	1.0	.6	.6
15	1.7	2.2	1.6	1.2	1.3	.7	.8	.6	.8	1.0	.7	.8
16	1.6	2.1	1.7	1.2	1.1	.7	.9	.6	1.0	1.0	.8	.6
17	1.6	1.8	1.6	1.2	1.1	.7	3.1	.6	.7	.9	.8	1.0
18	1.6	1.7	1.6	1.1	1.0	.7	1.1	.5	10.8	.8	.8	.7
19	1.7	1.7	1.6	1.1	1.0	.7	.9	.6	10.5	1.9	.7	1.2
20	4.8	1.7	1.6	1.2	1.0	.7	.8	.6	3.0	2.7	.7	.8
21	3.0	1.8	1.6	1.2	1.1	.7	.8	.6	1.9	1.6	.7	.8
22	2.2	2.2	1.6	1.3	1.0	.7	.8	.7	6.2	1.1	.7	2.2
23	1.8	1.7	1.6	1.2	1.0	.9	.8	.7	5.3	.9	.7	1.0
24	1.6	1.6	1.5	1.3	1.0	.8	.7	.7	2.8	.9	1.0	.8
25	2.7	1.6	1.6	1.1	1.0	.8	.7	.6	4.4	.9	1.1	.8
26	1.8	1.5	1.5	1.1	.9	.8	.7	.4	2.6	.8	.9	.9
27	3.0	1.7	1.5	1.2	.9	.8	.7	.6	1.9	.8	.7	.8
28	5.9	1.6	1.5	1.1	.9	.8	.7	.6	1.9	.7	.6	1.0
29	2.1	1.6	1.4	1.1	.9	2.5	.8	.6	1.9	.8	.6	.8
30	2.9	3.3	1.5	1.2	.9	1.3	.8	.....	1.7	.7	.8	.8
31	2.8	6.1	.....	1.1	.....	1.6	.7	.....	1.7	.....	.7	.....

Monthly discharge of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre feet.
	Maximum.	Minimum.	Mean.			
July	5.9	1.5	2.19	3.39	68.0	208
August	6.1	1.5	2.34	3.62	72.4	223
September	21	1.4	2.45	3.79	73.5	226
October	19.5	1.1	2.10	3.25	65.2	200
November	3.2	.9	1.18	1.83	35.3	109
December	2.5	.7	.92	1.42	28.5	88
January	3.1	.7	.97	1.50	30.2	92
February	1.1	.4	.67	1.04	19.3	60
March	10.8	.5	2.33	3.61	72.3	222
April	2.8	.7	1.28	1.98	38.5	118
May	1.1	.6	.75	1.16	23.2	71
June	2.2	.5	.82	1.27	24.6	76
The year	21	.4	1.51	2.34	551	1,690

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, 1920.

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 wading.

CHANNEL AND CONTROL.—Weir basin about 6 feet wide, 30 feet long, and 2 feet deep below weir crest. Ditch in earth cut. Control is 2.5-foot wooden sharp crested Cippoletti weir with metal crest.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 1.92 feet at 9.30 p. m. October 5 (discharge, 17.1 million gallons per day or 26.5 second-feet); minimum stage recorded during the year 0.04 foot at 2 p. m. May 9 (discharge, 0.06 million gallons per day or 0.09 second-foot).

1915–1920, 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-foot).

DIVERSION.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of using water to augment water supply of city of Honolulu.

UTILIZATION.—Water used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent except for short periods when water was leaking around weir. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records good.

Discharge measurements of East Manoa ditch near Honolulu, Oahu, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	J. E. Stewart	0.33	1.35	0.9
Feb. 14	M. H. Carson	.22	.75	.5
Mar. 12	do	.40	3.2	2.1
19	do	.56	3.8	2.5
19	do	.74	6.5	4.2
Apr. 9	do	.26	.85	.55
May 14	Reid Jerman	.21	.65	.4

Daily discharge, in million gallons, of East Manoa ditch near Honolulu, Oahu, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.1	1.7	2.2	0.8	0.8	0.7	0.7	0.6	0.5	0.9	0.6	0.7
2	1.8	1.4	1.3	.8	.9	.7	.6	.6	.4	1.0	.5	.6
3	1.2	1.2	3.6	.8	.8	.7	.7	.6	.4	1.2	.5	.5
4	1.0	1.2	1.7	.9	.8	.9	.7	.5	.4	1.0	.5	.4
5	1.0	1.3	1.3	2.0	.8	.7	.7	.5	.4	.9	.5	.4
6	1.0	1.0	1.2	.5	1.0	.7	.7	.5	.4	.8	.5	.4
7	1.2	1.6	1.4	.5	1.2	.6	.7	.5	.4	.7	.5	.4
8	1.3	2.3	1.2	.8	.8	.6	.7	.6	.9	.7	.5	.4
9	1.2	1.3	1.1	.9	.7	.7	.7	.5	.5	.7	.6	.4
10	1.2	1.2	1.2	8	.7	.8	1.1	.6	.4	.7	.5	.4
11	1.1	1.0	1.0	.8	.8	.7	.7	.7	.5	.6	.7	.4
12	1.0	1.1	.7	.8	.9	.7	.6	.7	1.1	.8	.6	.5
13	1.0	1.2	.8	.8	.9	.7	.6	.6	1.1	.8	.5	.5
14	.9	1.5	1.1	.8	.8	.6	.6	.6	.6	.7	.5	.4
15	.9	1.2	1.2	.8	.8	.6	.6	.....	.5	.7	.5	.5
16	.8	1.2	1.2	.8	.8	.6	.6	.....	.7	.6	.5	.4
17	.8	1.0	1.2	.8	.8	.6	1.7	.....	.6	.6	.5	.6
18	8.	1.0	1.2	.8	.8	.6	.8	.....	2.4	.6	.5	.5
19	1.0	1.1	1.2	.8	.7	.6	.6	.....	2.8	1.1	.5	.7
20	2.0	1.1	.9	.8	.7	.6	.6	.....	1.7	1.5	.5	.5
21	1.5	1.0	.9	.8	.7	.6	.7	.....	1.2	1.2	.5	.5
22	1.2	1.1	.9	.8	.7	.6	.7	.....	2.2	.8	.5	1.2
23	1.0	1.0	.8	.8	.7	.7	.6	.....	2.2	.6	.5	.8
24	1.0	.9	.8	.8	.7	.6	.6.	.....	1.5	.6	.6	.6
25	1.4	.8	1.0	.8	.7	.6	.6	.....	2.0	.6	.6	.5
26	1.0	.8	.8	.8	.7	.6	.6	.....	1.4	.5	.4	.4
27	1.5	1.0	.8	.8	.7	1.4	.6	.4	1.1	.5	.4	.4
28	2.2	.9	.8	.8	.7	.8	.6	.4	.9	.5	.4	.6
29	1.2	.8	.8	.8	.7	1.0	.6	.4	.8	.5	.4	.5
30	1.6	1.7	.8	.9	.7	.7	.6	.....	.8	.5	.5	.6
31	1.4	2.8	.....	.8	.....	.7	.6	.....	.8	.....	.5	.....

NOTE.—Graph partially estimated Dec. 19, 20, 26, 27, 31, Jan. 1, 2, 5–8, 31, Feb. 5–7, 14, and 27. Clock stopped and discharge estimated in millions gallons per day as follows: Feb. 15–20, 0.5, and Feb. 21–26, 0.6. Estimates made by comparison with records for East Branch of Manoa Stream.

Monthly discharge of East Manoa ditch near Honolulu, Oahu, for the year ending June, 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.2	0.8	1.20	1.86	37.3	114
August	2.8	.8	1.24	1.92	38.4	118
September	3.6	.7	1.17	1.81	35.1	108
October	2.0	.5	.83	1.28	25.7	79
November	1.2	.7	.78	1.21	23.5	72
December	1.4	.6	.70	1.08	21.7	67
January	1.7	.6	.69	1.07	21.5	66
February	.7	.4	.55	.85	15.9	49
March	2.8	.4	1.02	1.58	31.6	97
April	1.5	.5	.76	1.18	22.9	70
May	.7	.4	.51	.79	15.8	48
June	1.2	.4	.52	.80	15.7	48
One year	3.6	.4	.83	1.28	305	936

HAIKU STREAM NEAR HEEIA, OAHU.

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

RECORDS AVAILABLE.—January 29, 1914, to October 25, 1919, after which station was discontinued.

GAGE.—Gurley printing water-stage recorder installed June 14, 1919. Stevens continous water-stage recorder 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, 1.85 feet at 5.45 p. m. September 3 (discharge, 34 million gallons per day or 53 second-feet); minimum stage recorded 0.56 foot from 1 p. m. September 11 to 8 a. m. September 13 (discharge, 1.15 million gallons per day or 1.8 second-feet).

1914–1919.—Maximum stage recorded, 6.5 feet at 1 a. m., March 20, 1917 (discharge from extension of rating curve, about 550 million gallons [8] per day or 850 second-feet); minimum stage in September, 1919.

DIVERSION.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of water-supply projects for Army camp sites and proposed Army posts in vicinity.

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

ACCURACY.—Stage-discharge relation permanent July 1 until station was discontinued. Rating curve fairly well defined between 1 and 20 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Haiku Stream near Heeia, Oahu, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 28	A. H. Wong	0.76	4.3	2.8
Sept. 16	J. E. Stewart	.68	2.7	1.7
Dec. 2	M. H. Carson	.67	2.9	1.85
Feb. 18	do	.72	3.0	1.95

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

Daily discharge, in million gallons, of Haiku Stream near Heeia, Oahu, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	1.9	1.9	3.8	1.4	16	1.9	2.2	1.3	1.4
2	2.0	1.9	2.1	1.3	17	1.9	2.1	1.3	1.4
3	1.9	2.0	8.3	1.3	18	1.9	2.0	1.3	1.5
4	1.9	2.0	1.8	1.3	19	1.9	1.9	1.3	1.5
5	1.9	2.0	1.5	1.9	20	2.2	1.9	1.3	1.6
6	1.9	2.0	1.5	1.3	21	2.1	3.0	1.3	1.6
7	1.9	2.0	1.5	7.0	22	2.0	2.8	1.3	1.5
8	1.9	3.3	1.5	1.8	23	2.0	2.0	1.3	1.5
9	2.0	2.2	1.5	1.5	24	1.9	2.1	1.3	1.7
10	2.0	2.1	1.5	1.4	25	2.3	2.1	1.3	.....
11	2.1	1.9	1.3	1.4	26	2.3	2.2	1.3	.....
12	1.9	1.9	1.2	1.4	27	2.6	2.3	1.3	.....
13	1.9	2.0	1.2	1.3	28	2.5	2.3	1.3	.....
14	1.9	2.1	1.3	1.3	29	2.4	2.4	1.4	.....
15	2.0	2.1	1.3	1.3	30	2.2	2.4	1.4	.....
					31	2.2	2.8	.....	.....

NOTE.—July 28 discharge estimated.

Monthly discharge of Haiku Stream near Heeia, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	1.9	2.06	3.19	63.9	196
August	3.3	1.9	2.19	3.39	67.9	208
September	8.3	1.2	1.70	2.63	51.0	157
October 1-24	7.0	1.3	1.69	2.61	40.6	125
The period	.....	.....	.....	.....	223	686

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, 1920.

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 low-water stages.

EXTREMES OF DISCHARGE.—1913–1920: Maximum stage during period of record, 9.0 feet at 3 a. m. March 26, 1920 (by flood marks and comparison with record for Left Branch) (discharge, estimated by 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). Minimum discharge during year, 1.17 feet at 10 p. m. February 27 (discharge, 0.24 million gallons per day or 0.37 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water taken from Territorial lands by Wahiawa Water Co. Water rises on Territorial lands.

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 for irrigation in vicinity of Wahiawa. All water, except low flow, from North Fork is impounded in Wahiawa reservoir for irrigation of sugar cane on Waialua plantation.

ACCURACY.—Stage-discharge relation changed during the flood of March 25. Rating curves well defined between 1 and 200 million gallons per day, used July 1 to March 25 and March 26 to June 30. Operation of water-stage recorder unsatisfactory. Records good when water-stage recorder was operating and poor at other times.

Discharge measurements of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 1	A. H. Wong	1.68	9.1	5.9
Sept. 6	J. E. Stewart	1.58	6.9	4.4
Oct. 7	do	3.32	159	103
Nov. 17	do	1.34	1.7	1.1
Feb. 5	M. H. Carson	1.20	.5	.3
Mar. 1	do	1.19	.25	.15
Apr. 1	do	3.65	149	96
May 1	do	1.40	2.1	1.35
June 2	J. E. Stewart	1.46	2.2	1.4

Daily discharge, in million gallons of Right Branch of North Fork of Kaukonahua Stream, near Wahiawa, Oahu, for the year ending June 30, 1920.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Apr.	May.	June.
1			8.8	0.5	1.2		48	1.3	1.6
2			10.8	1.3	4.5		56	1.2	1.7
3			4.1	1.4	1.4		34	1.2	3.5
4			3.8	1.8	.8		16.7	1.1	1.8
5			5.2	.7	.6	0.3	12.0	1.1	4.5
6	4.1		5.1	.6	1.2	.4	9.4	1.0	1.6
7	3.8		3.2	.6	1.6	.3	7.0	1.0	1.4
8	4.2	31	2.4	.6	7	.3	5.9	.8	1.2
9	4.6	4.8	2.2	.5		.4	5.1	1.4	1.2
10	3.5	2.7	1.9	.5		7.3	6.4	1.2	1.1
11	2.9	2.1	2.4	.5		15.9	4.2	2.4	.9
12	2.5	1.7	3.9	.5		*1.9	4.3	1.2	1.2
13	2.3	1.5	2.3	.4		.8	6.6	1.0	1.8
14	2.1	1.3	1.7	.5		.6	3.6	.8	1.3
15	1.9	1.2	1.4	.6		.6	3.9	3.0	3.9
16	1.8	1.2	1.3	.5		.5	3.1	2.6	2.8
17	1.7	1.1	1.2	.4		.5	2.8	1.4	6.2
18	1.5	.9	1.2	.4		.5	3.8	4.5	4.0
19	1.4	.9	1.1	.4		.6	3.3	4.1	14.6
20	2.1	1.0	1.0	.4		.4	9.1	8.3	2.6
21	1.4	3 9	.9	.4		.4	4.5	9.0	3.1
22	1.2	1.9	.8	.4		.4	3.5	14.4	5.1
23	1.2	3.0	.8	.4		.4	2.8	2.4	2.4
24		28	.8	.4		.3	2.4	7.5	1.8
25		1.8	.7	.4		.3	2.1	9.9	1.5
26		1 2	.6	.3		.3	2.0	3.3	2.3
27		13.8	.6	.3		.3	1.9	5.4	1.5
28		4.2	.6	.3		.2	2.1	3.5	4.6
29		2.4	.6	13.3		.2	1.8	2.2	2.0
30		1.9	.6	8.3			1.4	4.9	1.4
31		51		2.2				2.6	

NOTE.—Recorder not working properly and discharge estimated in million gallons per day, by comparison with Left Branch of North Fork of Kaukonahua as follows: July 1–5, 4.7; 6–10, 3.4; 11–15, 6; 16–20, 4.7; 21–25, 18; 26–31, 16; Aug. 1–5, 8.5; 6–15, 11; 16–20, 7.5; 21–25, 6; 26–31, 4.8; Sept. 1–5, 25; 24–30, 1.1; Oct. 1–7, 8; Jan. 9–15, 0.9; 16–20, 2.3; 21–25, 0.7; Jan. 26 to Feb. 4, 0.4; Mar. 2–5, 0.2; 6–10, 1.9; 11–15, 1.4; 16–20, 21; 21–25, 50; and 26–31, 11. Sept. 6, 23, Jan. 8, Feb. 5, Mar. 1, and Apr. 1 graph partly estimated.

Monthly discharge of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July			9.03	14.0	280	859
August			8.03	12.4	249	764
September			5.90	9.13	177	543
October	51	0.9	7.11	11.0	220	676
November	10.8	.6	2.40	3.71	72.0	221
December	13.3	.3	1.28	1.98	39.8	122
January			1.15	1.78	35.7	109
February	15.9	.2	1.23	1.90	35.7	109
March			14.1	21.8	439.	1,340
April	56	1.4	8.99	13.9	270.	828
May	14.4	.8	3.41	5.28	106	324
June	14.6	.9	2.82	4.36	84.6	260
The year			5.49	8.49	2,010	6,160

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

LOCATION.—100 feet above 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 25, 1913, to June 30, 1920.

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 boulder; fairly permanent.

EXTREMES OF DISCHARGE.—1913–1920: Maximum stage recorded, 9.75 feet at 2.40 p. m. March 26, 1920 (discharge, 3,700 million gallons per day, or 5,720 second-feet); minimum discharge recorded, 4 a. m February 18 and 11.30 p. m. March 5, 1920 (discharge, 0.10 million gallons per day, or 0.16 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water diverted from Territorial land by Wahiawa Water Co. Water all rises on Territorial lands.

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 changed by flood of March 25. Rating curve used July 1 to March 25 well defined between 1 and 40 million gallons per day. Rating curve used March 26 to June 30 well defined between 0.2 and 200 million gallons per day. Operation of water-stage recorder satisfactory but silt sometimes filled bottom of well and stopped intake so that parts of the low-water records are not records of stream surface elevation. Flow for these periods have been estimated. Records good when well and intake were clean and poor for other times.

Discharge measurements of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 1	A. H. Wong	1.76	24.2	15.6
Sept. 6	J. E. Stewart	1.55	11.6	7.5
Nov. 17	do	1.19	1.9	1.25
Feb. 5	M. H. Carson	.96	.35	.2
Mar. 1	do	.94	.4	.25
Apr. 1	do	2.07	40.5	26
May 1	do	1.13	2.7	1.7

Daily discharge, in million gallons, of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	6.9	16.4	53	3.4	12.0	0.8	2.2	0.4	0.3	92	.....	2.2
2	11.8	11.3	6.5	3.4	10.3	1.2	6.7	.3	.3	111	.....	2.1
3	6.5	8.2	111	6.1	.....	2.6	2.4	.3	.2	41	.....	7.2
4	5.0	10.0	14.6	3.3	.....	3.0	1.3	.4	.2	16.4	.....	2.7
5	4.3	8.0	8.5	12.0	.....	1.2	.8	.3	.2	16.9	.....	12.1
6	4.3	6.7	7.4	5.3	.....	.8	.8	.3	.1	9.1	.....	2.6
7	5.2	70	9.2	64	.....	.8	2.1	.3	.2	7.1	.....	2.0
8	6.9	43	14.1	56	.....	.7	1.1	.3	9.9	.....	.....	1.7
9	4.6	10.3	11.0	.....	.....	.7	.7	.4	1.5	.....	.....	1.6
10	7.2	10.6	11.2	.....	.....	.6	3.4	6.4	.6	10.2	.....	1.6
11	14.2	8.8	6.5	.....	.....	.6	1.4	10.6	.3	.....	.....	1.2
12	6.2	6.3	5.0	.....	.....	.4	.6	2.3	3.0	.....	.....	3.2
13	10.8	14.4	4.8	.....	.....	.5	1.8	1.4	5.1	13.5	.....	6.0
14	7.1	28	4.6	.....	.....	.4	.9	1.2	2.3	.....	.....	3.2
15	4.0	13.9	4.3	.....	.....	.4	.6	.6	.6	.....	.....	17.8
16	3.6	24	4.3	.....	.....	.4	.4	.6	3.5	.....	.....	6.3
17	3.6	8.8	4.1	.....	1.7	.3	10.2	.2	15.4	.....	.....	9.6
18	3.6	6.9	4.1	.....	1.9	.4	2.4	.2	77	.....	.....	4.0
19	3.6	5.8	4.1	.....	1.8	.4	1.4	.3	57	.....	.....	22
20	18.7	5.6	4.1	27	1.8	.4	1.3	.3	11.7	14.9	.....	3.2
21	21	6.7	4.0	12.7	1.7	.4	1.2	.3	44	7.7	.....	3.7
22	10.3	21	4.0	.....	1.6	.4	1.6	.3	154	.....	17.0	5.0
23	4.6	5.8	3.3	.....	1.5	.4	.8	.2	73	.....	.....	2.7
24	4.5	4.8	3.3	28	1.4	.3	.7	.2	22	.....	.....	2.0
25	37	4.8	3.4	.....	1.3	.2	1.3	.3	231	.....	16.5	2.7
26	11.6	4.6	3.4	.....	1.1	.2	.4	.3	79	.....	.....	6.4
27	8.8	4.5	3.1	21	1.4	.2	.3	.3	14.5	.....	.....	3.2
28	36	4.3	3.6	.....	1.3	.3	.4	.3	10.7	.....	.....	6.4
29	7.7	6.0	3.3	.....	.8	21	.4	.3	8.4	.....	.....	3.3
30	17.4	8.0	3.3	.....	.9	12.2	.4	.....	6.1	.....	.....	2.4
31	30	14.2	.....	45	.....	5.0	.4	.....	19.1	.....	.....	.....

NOTE.—On account of plugged intake and mud in well affecting low-water flow, discharge partially estimated in million gallons per day as follows: Oct. 8–14, 4.0; 15–19, 1.7; 22–23, 2.3; 25–26, 2.8; 28–30, 4.8; Nov. 3–5, 7; 6–10, 5; 11–16, 3.2; Apr. 8–9, 6.5; 11–12, 5; 14–19, 5.5; 22–27, 3.4; 28–30, 2.3; May 1–10, 1.8; 11–15, 3.0; 16–21, 7.5; 23–24, 7.5; and 26–31, 6.5.

Monthly discharge of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	37	3.6	10.5	16.2	327	999
August	70	4.3	13.0	20.1	402	1,240
September	111	3.1	10.9	16.9	327	1,000
October	64	.....	11.1	17.2	344	1,060
November	12.0	.8	3.59	5.55	108	331
December	21	.2	1.85	2.86	57.2	176
January	10.2	.3	1.63	2.52	50.4	155
February	10.6	.2	1.02	1.58	29.6	91
March	231	.1	27.5	42.5	851	2,620
April	111	.....	14.1	21.8	423	1,300
May	17.0	.....	5.34	8.26	166	508
June	22	1.2	5.00	7.74	150	460
The year	231	.1	8.84	13.7	3,230	9,940

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, 1920.

Date.	Stream.	Locality.	Discharge in million gallons per day.
July 14	Paumalu	Below dam, near Pupukea, Oahu	0.01
14	.....do.	Above dam, near Pupukea, Oahu	.02
14	.....do.	Where pipe from right branch drops into tunnel, near Pupukea, Oahu.	.005
14	.....do.	Above intake to tunnel near Pupukea Oahu	.02
14	Water reserve "C" No. 1	.....do.	.005
14	Water reserve "C" No. 2	Just below large pool and fall near Pupukea Oahu	.01

ISLAND OF MAUI.

HONOKAHAU STREAM NEAR HONOKAHAU, MAUI.

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

RECORDS AVAILABLE.—March 12, 1913, to June 30, 1920, and staff readings at old site on diversion dam August 13 to December 31, 1911.

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, 5.64 feet at 2.45 a. m. September 3 (discharge, approximately 679 million gallons per day, or 1,050 second-feet; minimum stage recorded, 130 feet at 7 p. m. February 10 (discharge, 6.6 million gallons per day, or 10.2 second-feet).

1913–1920: Maximum stage recorded, 8.25 feet at 7.30 a. m. January 18, 1916 (discharge, computed from extension of rating curve, approximately 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.

OBJECT OF STATION.—To determine resources of stream.

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

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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 9	A. H. Wong	1.49	15.2	9.8
Aug. 7	J. E. Stewart	2.44	81	53
7	do	2.70	118	76
Jan. 1	do	1.54	17.7	11.4
Mar. 1	Reid Jerman	1.44	12.2	7.9
28	do	1.57	20.9	13.5
Apr. 20	do	1.46	15.2	.98

Daily discharge, in million gallons, of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	33	16.9	36	.....	12.7	9.6	12.7	7.9	9.4	49	8.8	17.2
2	29	20.0	19.6	.....	11.0	9.8	14.2	7.7	8.4	49	8.6	17.1
3	12.0	16.5	.....	.....	10.7	9.8	12.0	8.0	8.2	26	8.4	13.9
4	12.0	31	.....	13.3	11.2	15.4	10.2	8.0	8.2	16.9	8.4	11.2
5	11.2	53	.....	27	10.4	9.8	9.2	8.0	8.0	33	8.6	9.6
6	11.2	22	.....	63	10.0	10.0	9.2	7.9	8.2	39	8.4	9.4
7	11.0	82	.....	22	22	10.0	11.2	7.9	8.8	25	9.0	8.6
8	10.7	40	.....	14.6	10.2	9.4	9.8	7.2	9.6	13.3	8.6	8.6
9	10.2	18.0	26	12.4	12.7	9.6	9.6	7.2	10.0	12.0	8.4	8.4
10	17.2	28	30	12.0	11.7	9.8	8.6	7.6	9.4	11.0	8.2	11.0
11	12.7	19.5	17.3	11.2	26	9.0	11.0	23	9.0	11.7	8.4	13.8
12	74	28	16.2	11.0	14.9	9.0	9.8	9.8	14.5	11.2	8.4	9.4
13	14.9	59	15.8	10.7	22	9.4	9.8	8.0	130	12.7	8.2	15.0
14	42	24	15.5	11.2	12.2	9.0	9.2	7.9	.....	10.2	8.2	10.0
15	32	46	15.2	10.7	10.7	8.8	8.6	7.6	.....	10.2	8.4	18.0
16	14.9	26	15.5	10.2	10.2	9.6	8.8	7.4	.....	9.4	8.2	10.2
17	12.2	24	14.9	10.2	10.2	9.0	23	7.4	.....	9.2	8.2	18.3
18	12.0	16.9	14.6	10.2	10.4	9.0	24	10.2	.....	9.4	8.8	10.7
19	15.8	17.6	21	10.4	10.0	8.8	10.0	9.2	.....	9.2	10.8	9.6
20	21	15.8	18.4	11.7	9.8	8.2	8.4	8.6	.....	9.6	12.1	9.0
21	50	15.2	15.8	16.5	10.0	8.2	8.2	8.8	.....	9.4	9.8	8.6
22	22	14.9	15.8	12.0	9.8	8.2	41	15.3	.....	9.2	9.4	9.2
23	13.6	15.2	26	16.3	9.6	36	11.4	14.5	.....	12.0	9.0	8.4
24	12.2	15.5	.....	12.4	10.0	11.0	9.8	8.8	.....	11.2	9.0	8.0
25	51	14.6	.....	12.0	10.2	9.2	9.6	8.2	.....	9.2	9.0	8.2
26	15.8	24	.....	11.4	10.2	8.8	9.6	7.6	.....	9.0	9.2	7.9
27	60	16.5	.....	10.7	10.0	17.0	9.6	8.2	.....	9.2	8.4	7.9
28	48	15.5	.....	10.4	9.6	26	9.0	8.4	12.7	9.2	8.8	9.2
29	15.5	32	.....	11.0	10.0	120	7.7	9.4	13.3	9.2	8.8	8.0
30	26	33	.....	11.4	9.8	73	7.6	.....	15.2	8.6	8.6	9.8
31	18.0	105	.....	14.4	.....	66	7.7	.....	15.5	.....	9.4	.....

NOTE.—Float hung up Sept. 3–6 and Mar. 14–27. Clock stopped Sept. 6–8 and Sept. 24 to Oct. 3. Discharge estimated in million gallons per day by comparison with adjacent streams as follows: Sept. 3–8, 25; 24–30, 14; Oct. 1–3, 12; Mar. 14–17, 10; 18–25, 50; 26–27, 15. Graph partly estimated Mar. 13 and 28.

Monthly discharge of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	74	10.2	23.9	37.0	741	2,270
August	105	14.6	29.2	45.2	906	2,780
September	.....	.....	19.4	30.0	582	1,790
October	63	10.2	14.4	22.3	446	1,370
November	26	9.6	11.9	18.4	358	1,100
December	120	8.2	18.6	28.8	576	1,770
January	41	7.6	11.6	17.9	360	1,100
February	23	7.2	9.16	14.2	266	815
March	.....	8.0	24.8	38.4	768	2,360
April	49	8.6	15.8	24.4	473	1,450
May	12.1	8.2	8.85	13.7	274	842
June	18.3	7.9	10.8	16.7	324	994
The year	.....	7.2	16.6	25.7	6,070	18,600

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, 1920, at this location; and from July 1, 1912, to December 31, 1917, at old location about a mile upstream on former ditch line.

GAGE.—Gurley weekly water-stage recorder installed April 15, 1919. Stevens continuous water-stage recorder used November 14, 1918, to April 15, 1919. Staff gage used prior to that.

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 year, 5.88 feet at 6 a. m. September 3 (discharge, 33.5 million gallons per day, or 52 second-feet); minimum stage recorded, 3.78 feet at 11 a. m. October 22 (discharge, 2.1 million gallons per day, or 3.2 second-feet).

1912–1920: Maximum stage recorded in 1919. Minimum stage recorded, 0.22 foot at 9 p. m. November 14, 1918 (discharge, 0.32 million gallons per day or 0.5 second-foot).

DIVERSIONS.—Flood water diversion ditch station 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 head gates at ditch intake and by flood gates just below recorder well intake.

OBJECT OF STATION.—Most of drainage area in Territorial lands. Data valuable in relation to Territorial lease to Pioneer Mill Co.

UTILIZATION.—Water used for power development and irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 2 and 15 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

48298—24—WSP 516——6

Discharge measurements of Honokawai ditch near Lahaina, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 13	H. A. R. Austin	4.10	10.1	6.5
Oct. 13	R. D. Klise	3.85	4.6	3.0
Dec. 10	J. E. Stewart	3.90	5.1	3.3
Jan. 2	Reid Jerman	4.01	7.7	5.0
31	do	3.87	5.1	3.3
Mar. 27	B. F. Rush	3.96	6.9	4.4
Apr. 22	Reid Jerman	3.87	4.4	2.9

Daily discharge, in million gallons, of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	7.0	6.3	7.7	3.1	3.5	3.4	4.5	3.1	3.0	8.7	3.0	2.8
2	8.1	6.2	5.5	3.3	3.6	3.5	4.9	3.1	3.0	7.6	2.9	2.7
3	4.5	6.6	21	3.4	3.5	3.5	4.1	3.1	3.0	6.3	2.9	3.0
4	4.1	9.1	5.7	3.3	2.9	4.2	3.4	3.1	3.0	6.0	2.9	2.9
5	4.1	12.0	4.6	6.2	2.4	3.8	3.3	3.1	3.0	9.8	2.9	2.8
6	4.1	7.3	4.2	13.5	2.4	3.8	3.3	3.3	3.0	6.3	2.9	2.7
7	3.9	12.8	6.4	6.4	5.5	3.5	3.6	3.3	3.0	7.0	2.9	2.7
8	3.8	8.0	6.3	3.8	3.0	3.5	3.3	3.3	3.0	3.9	2.9	2.7
9	3.8	5.3	5.5	2.4	2.8	3.5	3.1	3.1	3.4	3.3	2.9	2.7
10	6.3	6.7	6.3	2.5	2.9	3.4	4.2	3.1	3.3	3.1	2.9	3.1
11	11.2	5.9	4.2	2.8	6.4	3.4	5.0	5.9	3.3	3.1	2.9	4.6
12	7.8	7.3	3.6	2.8	5.6	3.4	3.5	4.3	3.1	3.3	2.9	2.9
13	7.1	10.5	3.5	2.9	7.8	3.4	3.3	3.3	9.1	4.6	2.9	5.5
14	13.5	7.3	3.5	2.9	4.3	3.3	3.3	3.1	3.9	5.5	2.8	3.1
15	7.0	11.2	3.5	2.9	3.6	3.4	3.1	3.0	3.3	3.3	2.8	6.9
16	6.3	6.0	3.4	3.0	3.5	3.4	3.3	3.0	3.1	3.3	2.7	3.4
17	4.9	5.5	3.3	2.9	3.4	3.4	5.6	3.0	3.5	3.1	2.7	6.3
18	5.2	3.5	3.3	2.8	3.4	3.4	8.1	3.5	9.1	3.1	2.7	4.1
19	7.1	4.2	3.8	2.8	3.4	3.4	4.2	3.3	18.0	3.1	2.7	2.8
20	6.6	4.1	5.6	2.8	3.4	3.4	3.4	3.1	23	3.1	4.5	2.5
21	15.0	3.8	3.8	2.8	3.3	3.4	3.4	3.1	14.2	3.1	3.9	2.4
22	6.9	3.8	3.5	3.0	3.3	3.4	8.4	3.9	27	3.1	2.9	2.4
23	4.9	4.1	3.5	3.3	3.3	7.0	4.3	5.9	10.5	3.1	2.8	2.4
24	6.6	3.9	3.5	3.3	3.3	4.5	3.5	3.4	12.8	3.4	2.8	2.4
25	10.5	3.9	3.3	3.4	3.4	3.6	3.3	3.1	23	3.1	2.8	2.4
26	6.7	4.3	3.1	3.3	3.3	3.5	3.1	3.1	8.3	3.0	2.8	2.4
27	13.5	4.8	3.1	3.3	3.3	5.2	3.1	3.1	4.8	3.0	2.8	2.4
28	13.5	4.1	3.0	3.3	3.4	7.4	3.1	3.0	3.9	3.0	2.8	2.4
29	5.9	6.7	3.0	3.3	3.5	23	3.1	3.0	3.5	3.0	2.8	2.4
30	9.1	6.9	3.0	3.4	3.4	16.5	3.1	.....	3.4	3.0	2.7	2.5
31	6.9	16.5	.....	3.4	.....	13.5	3.1	.....	4.1	.....	2.7	.....

Monthly discharge of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	15.0	3.8	7.29	11.3	226	694
August	16.5	3.5	6.73	10.4	209	640
September	21	3.0	4.79	7.41	144	441
October	13.5	2.4	3.62	5.60	112	344
November	7.8	2.4	3.69	5.71	111	340
December	23	3.3	5.19	8.03	161	494
January	8.4	3.1	3.94	6.10	122	375
February	5.9	3.0	3.40	5.26	98.7	303
March	27	3.0	7.28	11.3	226	693
April	9.8	3.0	4.21	6.51	126	388
May	4.5	2.7	2.92	4.52	90.5	278
June	6.9	2.4	3.14	4.86	94.3	289
The year	27	2.4	4.70	7.27	1,720	5,280

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, 1920, at this station and from August 5, 1911, to Jan. 18, 1916, at a station about a mile downstream from present site.

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, 3.50 feet at midnight March 23 (discharge, approximately 262 million gallons per day, or 405 second-feet); minimum stage recorded, 0.94 foot 1.25 a. m. June 29 (discharge, 1.9 million gallons per day, or 2.9 second-feet).

1916–1920: Maximum stage recorded, 3.79 feet at 10.30 a. m. November 26, 1918 (discharge, 314 million gallons per day or 486 second-feet); minimum stage recorded, June, 1920.

DIVERSIONS.—None.

REGULATIONS.—None.

OBJECT OF STATION.—Data valuable in relation to Territorial agreement with Pioneer Mill Co. pertaining to division of water.

UTILIZATION.—Water used for domestic purposes, power development, and irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 2 and 10 million gallons per day. Operation of water-stage recorder unsatisfactory. Records good when water-stage recorder was operating and poor at other times.

Discharge measurements of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 8	A. H. Wong	1.04	4.7	3.1
Aug. 13	H. A. R. Austin	1.22	9.0	5.8
Sept. 30	R. D. Klise	1.04	4.3	2.8
Dec. 10	J. E. Stewart	1.03	3.7	2.4
Jan. 2	Reid Jerman	1.08	4.7	3.0
31	do	.99	3.7	2.4
Feb. 28	do	.98	3.2	2.0
Mar. 23	J. E. Stewart	1.04	4.2	2.7
Apr. 21	Reid Jerman	.98	3.2	2.1

Daily discharge, in million gallons, of Lahainaluna Stream above pipe-line intake near Lahaina, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.7	3.0	4.8	3.0	.....	2.3	2.7	2.2	2.5	7.0	2.2	2.4
2	3.7	3.0	3.9	.....	.....	2.3	2.9	2.2	2.3	4.3	2.1	2.5
3	2.8	3.3	26	.....	.....	2.3	2.7	2.2	2.2	2.7	2.1	2.4
4	2.8	5.1	5.5	.....	.....	3.7	2.5	2.2	2.2	2.4	2.2	2.2
5	2.8	4.8	3.3	.....	.....	2.4	2.4	.....	2.5	15.9	2.2	2.2
6	2.8	3.3	2.9	.....	.....	2.4	2.4	.....	2.4	4.5	2.2	2.2
7	2.8	7.9	4.1	.....	.....	2.4	2.4	.....	2.4	4.7	2.2	2.2
8	2.7	5.6	4.8	.....	.....	2.5	2.5	.....	4.8	2.2	2.2	2.2
9	2.7	2.9	4.3	.....	.....	2.4	2.5	.....	2.7	2.2	2.2	2.2
10	3.3	2.9	4.2	.....	.....	2.7	3.4	.....	2.4	2.2	2.2	2.6
11	3.0	3.1	3.0	.....	.....	2.5	3.1	.....	2.2	2.5	2.2	4.2
12	12.1	5.2	2.9	.....	.....	2.4	2.7	.....	2.2	2.7	2.1	2.1
13	5.2	10.5	2.9	.....	.....	2.4	2.5	.....	2.3	3.8	2.1	5.5
14	8.3	9.0	2.8	.....	2.8	2.3	2.4	.....	2.2	2.3	2.1	2.3
15	9.6	15.7	2.9	.....	.....	2.5	.....	2.2	2.1	2.2	2.1	9.2
16	3.5	6.2	.....	.....	.....	2.7	.....	2.2	2.1	2.2	2.1	2.3
17	3.0	4.0	.....	.....	.....	2.3	.....	2.2	2.1	2.1	2.1	3.2
18	3.0	3.4	.....	.....	.....	2.2	.....	4.5	7.8	2.1	2.1	2.5
19	3.3	3.1	.....	.....	.....	2.3	.....	2.2	16.7	2.2	2.2	2.2
20	3.4	2.8	.....	.....	.....	2.3	2.2	2.2	24	2.3	2.2	2.2
21	15.9	2.8	.....	.....	.....	2.3	2.2	2.5	7.0	2.2	2.2	2.2
22	6.1	2.7	.....	.....	.....	2.2	14.3	5.3	45	2.2	2.2	2.2
23	3.0	2.7	.....	.....	.....	2.7	.....	7.2	8.0	2.2	2.2	2.1
24	2.8	2.7	.....	.....	.....	2.4	.....	2.2	18.6	2.2	2.1	2.1
25	9.4	2.7	.....	.....	.....	2.2	.....	2.2	54	2.2	2.2	2.1
26	4.1	2.8	.....	.....	.....	2.2	.....	2.2	4.6	2.2	2.1	2.1
27	14.7	3.0	.....	.....	.....	2.2	.....	2.2	2.8	2.1	2.2	2.1
28	14.6	2.9	.....	.....	.....	2.8	.....	2.2	2.7	2.2	2.2	2.0
29	3.5	5.1	.....	.....	.....	11.7	.....	2.7	2.5	2.2	2.3	2.0
30	5.9	4.0	2.8	.....	.....	16.7	.....	.....	2.4	2.3	2.2	4.5
31	3.7	12.9	.....	.....	.....	20.0	.....	.....	2.3	.....	2.2	.....

NOTE.—Clock stopped and discharge estimated in million gallons per day by comparison with flow of adjacent streams as follows: Sept. 16–29, 3.0; Jan. 15–19, 3.0; Jan. 23–31, 2.3: and Feb. 5–14, 2.2.

Monthly discharge of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	15.9	2.7	5.43	8.40	168	517
August	15.7	2.7	4.81	7.44	149	458
September	26	.....	4.10	6.34	123	377
October	.....	.....	3.00	4.64	[a] 93.0	285
November	.....	.....	3.00	4.64	[a] 90.0	276
December	20.0	2.2	3.76	5.82	117	358
January	14.3	.....	2.95	4.56	91.5	281
February	7.2	.....	2.59	4.01	75.0	231
March	54	2.1	7.74	12.0	240	736
April	15.9	2.1	3.15	4.87	94.5	290
May	2.3	2.1	2.17	3.36	67.2	206
June	9.2	2.0	2.74	4.24	82.2	252
The year	54	.....	3.80	5.88	1,390	4,270

[a] Estimated by comparison with flow of adjacent streams.

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, 1920. Replaces old station in tail-race 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.—1916–1920: Maximum stage recorded 1.29 feet 6.30 p. m. November 7, 1919 (discharge, 12.8 million gallons per day, or 19.8 second-feet); minimum stage recorded, ditch dry January 18 to 20 and 22 to 24, 1920.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—Data valuable in relation to Territorial lease to Olowalu Co.

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 curves fairly well defined used as follows: July 1 to October 5, between 3 and 6 million gallons per day; October 6 to January 17, between 2 and 8 million gallons per day; January 18 to June 25, between 2 and 5 million gallons per day. Shifting-control method used in computing discharge June 26–30. Operation of water-stage recorder unsatisfactory at times. Records fair.

Discharge measurements of Olowalu ditch near Olowalu, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 7	A. H. Wong	0.50	4.1	2.6
8	do	.50	4.1	2.6
Aug. 2	H. A. R. Austin	.71	5.2	3.4
Sept. 30	R. D. Klise	.48	4.2	2.7
Oct. 28	B. F. Rush	.33	4.0	2.6
Dec. 31	J. E. Stewart	.85	12.2	7.9
Jan. 28	Reid Jerman	.26	6.0	3.8
Feb. 14	do	.19	5.1	3.3
16	do	.11	3.9	2.5
Mar. 2	do	.06	3.2	2.0
27	do	.25	5.9	3.8
Apr. 19	do	.29	6.0	3.9

Daily discharge, in million gallons, of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	4.6	10.0	2.7	3.1	2.6	6.3	3.1	2.2	6.0	3.1	3.6
2	.....	4.7	8.4	2.6	3.1	2.6	5.8	3.0	2.0	7.6	2.7	4.0
3	.....	4.7	10.0	2.4	3.0	2.6	5.1	2.8	2.0	6.0	2.7	2.9
4	.....	5.6	8.4	2.7	3.0	4.7	4.6	2.8	2.0	.....	.....	2.5
5	.....	7.4	6.0	3.2	2.9	2.5	4.0	2.7	2.1	.....	.....	2.2
6	.....	5.1	4.5	8.3	3.9	2.5	3.8	2.6	2.0	.....	2.6	2.2
7	.....	6.0	4.3	7.1	4.1	2.3	3.5	2.6	1.9	.....	2.5	2.1
8	.....	7.9	4.1	6.3	4.6	2.1	3.3	2.5	2.0	.....	2.4	2.0
9	2.6	5.6	3.8	5.1	3.7	2.2	3.2	3.5	2.0	.....	2.6	2.0
10	3.3	4.4	4.5	4.9	3.4	3.8	6.2	2.6	2.0	.....	2.6	1.9
11	2.9	5.1	4.5	4.4	5.0	3.2	5.4	4.0	2.0	.....	2.4	1.9
12	8.3	4.5	4.1	4.1	4.2	2.7	5.1	3.4	.....	.....	2.3	2.0
13	4.7	10.0	4.0	4.1	4.9	2.3	4.5	3.4	.....	.....	2.3	2.0
14	4.3	8.4	3.7	4.0	4.3	2.2	4.0	3.2	.....	.....	2.3	2.0
15	9.4	9.4	3.7	4.0	4.0	2.3	3.6	2.7	.....	.....	2.2	2.1
16	6.4	8.4	3.4	3.9	3.9	3.2	3.5	2.5	.....	.....	2.2	2.1
17	4.5	6.9	3.4	3.9	3.7	2.6	4.0	2.6	.....	.....	2.3	2.3
18	3.8	6.0	3.3	3.9	3.5	2.2	.1	2.8	.....	.....	2.3	2.2
19	3.6	5.1	3.5	3.9	3.4	2.2	.0	2.3	.....	.....	2.5	.....
20	3.7	4.5	3.4	3.5	3.4	2.2	1.6	2.3	.....	3.5	2.5	.....
21	5.3	4.1	3.4	3.3	3.3	2.1	4.4	2.3	.....	3.3	2.3	.....
22	6.0	3.9	3.2	3.3	3.2	2.1	.3	2.4	.....	3.2	2.3	.....
23	4.4	3.7	3.0	3.2	3.1	2.4	.0	2.7	.....	3.1	2.2	.....
24	3.7	3.5	3.0	3.4	3.1	2.5	1.3	2.4	.....	3.0	2.3	.....
25	4.9	3.4	.....	3.2	3.0	2.3	5.6	2.3	.....	2.9	2.2	.....
26	4.4	4.1	.....	3.1	3.0	2.3	4.8	2.3	.....	2.9	2.1	.....
27	6.3	3.7	.....	3.1	2.9	2.4	4.2	2.3	.....	2.9	2.2	2.2
28	9.4	3.4	.....	3.1	2.8	1.7	3.8	2.1	3.0	3.2	2.2	2.2
29	6.9	4.3	.....	3.1	2.8	8.7	3.6	2.2	5.2	2.9	2.4	2.1
30	6.0	6.4	.....	3.1	2.8	7.8	3.4	.....	7.0	2.8	2.8	2.2
31	5.6	9.4	.....	3.1	.....	7.8	3.2	.....	5.9	.....	2.5	.....

NOTE.—Clock stopped and discharge estimated in million gallons per day, by comparison with Honokawai ditch as follows: July 1–8, 3.0; Sept. 25–30, 2.8; Mar. 12–18, 2.2; Mar. 19–25, 8; Mar. 26–27, 4.0; Apr. 4–7, 7; Apr. 8–19, 3.5; May 4–5, 2.6; June 19–26, 2.2.

Monthly discharge of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	9.4	2.6	4.66	7.21	144	443
August	10.0	3.4	5.62	8.70	174	535
September	10.0	.....	4.35	6.73	130	400
October	8.3	2.4	3.87	5.99	120	368
November	5.0	2.8	3.50	5.42	105	322
December	8.7	1.7	3.07	4.75	95.1	292
January (29 days)	6.3	.1	3.84	5.94	112	344
February	4.0	2.1	2.70	4.18	78.4	240
March	.....	1.9	3.96	6.13	123	377
April	.....	2.8	4.11	6.36	123	378
May	3.1	2.1	2.43	3.76	75.2	231
June	4.0	1.9	2.28	3.53	68.3	210
The year (364 days)	.....	.1	3.71	5.74	1,350	4,140

UKUMEHAME STREAM NEAR OLOWALU, MAUI.

LOCATION.—Half a mile above upper ditch intake, 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 December 27, 1919, after which station was discontinued.

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, 2.02 feet at 5.15 p. m. November 7 (discharge, 43 million gallons per day, or 66 second-feet); minimum stage recorded, 0.72 foot 5.15 p. m. December 9 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

1911–1919: Maximum stage recorded, 9.0 feet estimated gage height of flood of January 18, 1916 (discharge not estimated); minimum discharge recorded in December, 1919.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine resources of stream in relation to Territorial lease to Olowalu Sugar Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent from July 1 to December 27. Rating curve well defined below and fairly well defined above 25 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Ukumehame Stream near Olowalu, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 7	A. H. Wong	0.93	4.8	3.1
Oct. 12	R. D. Klise	.90	4.5	2.9
Dec. 31	J. E. Stewart	1.50	4.6	16.0
Jan. 3	Reid Jerman	1.18	6.1	3.9
20	do	1.36	6.9	4.5
29	do	.98	5.4	3.5
Feb. 12	do	.98	5.0	3.2
13	do	.98	5.6	3.6
Mar. 2	do	.85	3.7	2.4
27	B. F. Rush	1.26	12.9	8.3
Apr. 19	Reid Jerman	1.12	5.4	3.5

Daily discharge, in million gallons, of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1....	4.6	4.7	8.4	3.1	2.4	2.0	16....	5.3	6.3	3.6	2.7	2.5	3.2
2....	5.2	4.7	6.1	3.1	2.3	2.0	17....	4.4	5.9	3.6	2.8	2.4	3.2
3....	3.7	4.4	15.3	3.0	2.3	2.1	18....	4.0	5.5	3.6	2.8	2.3	3.2
4....	3.4	5.2	8.1	3.1	2.3	7.6	19....	3.7	5.0	3.7	2.7	2.3	3.2
5....	3.3	7.3	6.5	3.4	2.4	4.0	20....	3.7	4.7	3.6	2.7	2.3	3.2
6....	3.2	5.5	5.7	4.8	4.2	3.5	21....	5.9	4.4	3.6	2.8	2.3	3.2
7....	3.1	7.6	5.3	3.1	14.4	3.1	22....	6.3	4.2	3.5	2.8	2.3	3.2
8....	3.2	9.2	5.0	3.0	4.4	2.4	23....	5.2	4.0	3.4	2.7	2.3	3.5
9....	3.1	6.3	4.8	2.9	3.0	1.8	24....	4.4	3.8	3.4	2.8	2.3	3.4
10....	3.5	5.7	4.7	2.8	2.7	2.2	25....	5.5	3.7	3.4	2.7	2.2	3.2
11....	3.3	5.2	4.2	2.8	3.1	2.2	26....	5.2	4.1	3.4	2.6	2.1	3.2
12....	4.8	5.2	4.1	2.8	3.2	2.0	27....	6.9	3.7	3.3	2.5	2.2	3.2
13....	3.6	8.9	4.0	2.8	3.1	1.9	28....	9.2	3.6	3.2	2.5	2.1	.....
14....	4.6	6.3	3.8	2.8	2.7	2.2	29....	6.5	4.2	3.2	2.4	2.1	.....
15....	9.2	6.9	3.7	2.8	2.6	2.8	30....	5.7	5.0	3.2	2.4	2.0	.....
							31....	5.2	11.5	.....	2.4	.....	.....

Monthly discharge of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	9.2	3.1	4.80	7.43	149	457
August	11.5	3.6	5.57	8.62	173	530
September	15.3	3.2	4.71	7.29	141	434
October	4.8	2.4	2.86	4.43	88.6	272
November	14.4	2.0	2.96	4.58	88.8	273
December 1–27	7.6	1.8	2.99	4.63	80.7	248
The period	.....	.....	.....	.....	721	2,210

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.—January 1, 1910, to December 31, 1912, and November 2, 1917, to June 30, 1920. 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.—Maximum stage recorded during year, 5.84 feet at 2.30 a. m. March 25 (discharge, 155 million gallons per day or 240 second-feet); minimum stage recorded, 0.90 foot at 10.40 p. m. June 28 (discharge, 8.2 million gallons per day or 12.7 second-feet).

1910–1912 and 1917–1920: Maximum stage recorded, 6.06 feet at 6 a. m. November 30, 1917 (discharge, 163 million gallons[9] per day, or 252 second-feet); minimum stage recorded, water occasionally shut off.

[9] Supersedes figures published in Water Supply Paper 485.

DIVERSION.—Ditch diverts water from all streams from Makapipi to Keanae inclusive.
REGULATION.—By gates at intervals.
OBJECT OF STATION.—To determine water diverted by ditch from Territorial lands.
UTILIZATION.—Water used for irrigation of sugar cane.
ACCURACY.—Stage-discharge relation affected for short periods by trash gathering on trash rack below gage; also affected 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 prior to October 12, water surface in well not the same as in ditch most of time. Staff gage readings twice daily used to determine discharge July 1 to October 11. Records fair July 1 to October 11 and good October 12 to June 30.

Discharge measurements of Koolau ditch near Keanae, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 5	R. D. Klise	4.90	192	124.
Jan. 12	Reid Jerman	1.56	34.5	22.4
Feb. 7	do	1.07	17.9	11.6
Apr. 6	do	4.55	171	111.

Daily discharge, in million gallons, of Koolau ditch near Keanae, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	63	54	126	28	20.0	13.2	72	12.8	16.1	96	25	18.0
2	63	51	86	45	21	12.8	60	12.8	12.4	102	25	27
3	28	48	126	39	19.0	12.6	42	12.0	11.4	96	23	34
4	22	93	109	33	19.0	16.0	33	12.0	11.0	93	23	17.0
5	22	126	93	109	16.0	13.0	29	11.6	10.8	105	22	13.6
6	21	116	83	126	16.0	12.2	26	11.4	10.8	116	22	13.4
7	18.0	105	79	109	17.0	11.4	24	11.8	11.2	112	21	12.2
8	16.0	116	93	86	16.0	11.0	22	11.8	22	99	19.0	12.0
9	15.0	93	79	60	15.0	11.0	21	11.8	24	86	19.0	12.8
10	22	79	102	51	15.0	11.0	20.0	11.2	18.0	76	18.0	15.0
11	21	69	72	42	74	11.0	26	11.2	13.2	76	18.0	17.0
12	112	66	60	36	32	10.8	24	11.2	54	66	17.0	13.0
13	66	105	54	33	33	10.8	20.0	11.0	59	79	17.0	36
14	99	72	54	30	30	10.8	18.0	11.4	26	63	16.0	20.0
15	126	126	51	29	30	10.8	17.0	12.2	20.0	57	16.0	33
16	102	116	42	27	23	10.8	17.0	11.8	18.0	51	15.0	17.0
17	48	112	42	25	20.0	10.6	19.0	12.2	33	48	15.0	16.0
18	42	89	39	24	19.0	10.6	30	18.0	101	42	14.0	15.0
19	39	89	42	26	18.0	9.8	19.0	12.0	93	42	14.0	13.8
20	34	69	39	25	17.0	9.3	15.0	11.2	72	39	13.8	13.0
21	48	66	33	27	17.0	9.3	12.6	11.0	72	34	13.4	12.6
22	72	57	30	23	16.0	9.1	34	14.5	76	33	13.8	12.2
23	45	57	29	22	16.0	55	25	30	79	42	13.6	11.8
24	36	48	28	23	15.0	19.0	17.0	14.0	109	39	12.8	11.6
25	76	33	27	20.0	15.0	12.4	16.0	11.8	79	34	12.6	11.4
26	51	39	25	20.0	14.0	11.2	15.0	11.4	89	32	12.2	10.4
27	86	39	24	23	14.0	32	15	12.4	109	29	12.0	10.0
28	119	42	24	21	14.0	80	14.0	11.6	89	28	11.8	10.4
29	89	79	25	21	13.8	122	14.0	17.7	79	27	11.6	10.0
30	72	112	26	19.0	13.4	117	13.6	.....	112	26	11.2	12.0
31	66	126	.....	19.0	.....	102	13.2	.....	89	.....	12.0	.....

Monthly discharge of Koolau ditch near Keane, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	126	15.0	56.1	86.8	1,740	5,340
August	126	33	80.4	124	2,490	7,650
September	126	24	58.1	89.9	1,740	5,350
October	126	19.0	39.4	61.0	1,220	3,750
November	74	13.4	20.6	31.9	618	1,900
December	122	9.1	25.8	39.9	798	2,450
January	72	12.6	24.0	37.1	743	2,280
February	30	11.0	13.0	20.1	376	1,160
March	112	10.8	52.2	80.8	1,620	4,970
April	116	26	62.3	96.4	1,870	5,740
May	25	11.2	16.4	25.4	510	1,560
June	36	10.0	16.0	24.8	481	1,470
The year	126	9.1	38.8	60.0	14,200	43,600

HONOMANU STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—At end of Haiku-uka boundary line trail about 8 miles east of Kailiili.

RECORDS AVAILABLE.—October 9, 1919, to June 30, 1920.

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 50 feet above and below the station; narrows into a gorge below station. Control composed of 2-man boulders, subject to shifts.

EXTREMES OF DISCHARGE.—1919–1920: Maximum stage recorded, 5.11 feet at 3 p. m. March 19, 1920 (discharge, 640 million gallons per day or 990 second-feet). Stage on March 22, 1920, was undoubtedly higher than this but recorder was not operating properly. Minimum stage recorded, 0.28 foot at 10 a. m. April 3, 1920, and noon April 5, 1920 (discharge, 0.03 million gallons per day or 0.05 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial land below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co's. ditches for the irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 100 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records good when water-stage recorder was operating.

Discharge measurements of Honomanu Stream at Haiku-uka boundary near Kailiili, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet)	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 9	R. D. Klise	0.71	1.25	0.8
Jan. 15	Reid Jerman	.65	.7	.45
Apr. 14	do	.76	1.4	.9
16	do	.83	1.85	1.2

Daily discharge, in million gallons, of Honomanu Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	0.2	0.1	2.7	0.2	1.4	9.0	0.4	0.6
2	.....	.2	.1	2.1	.2	.5	10.1	.4	.4
3	.....	.2	.1	2.9	.2	.3	7.5	.4	.....
4	.....	.2	.2	1.0	.2	.2	6.7	.4	.....
5	.....	.2	.3	.8	.2	.2	.....	.4	.....
6	.....	.2	.2	.8	.2	.2	.....	.4	.....
7	.....	.6	.2	.6	.2	.3	.....	.3	.....
8	.....	.7	.1	.5	.2	2.3	.....	.3	.....
9	0.7	.4	.1	.4	.2	1.6	.....	.3	.....
10	.6	.5	.1	.4	.2	.9	.....	.3	.....
11	.5	11.0	.1	1.0	2.0	.7	.....	.4	.....
12	.4	1.6	.1	1.6	.8	2.9	.....	.3	.....
13	.4	1.0	.1	1.0	.4	1.5	.....	.3	.....
14	.4	3.3	.1	.6	.3	.6	.....	.3	.....
15	.3	2.1	.1	.5	.4	.8	.....	.3	.....
16	.3	1.1	.1	.4	.3	.6	1.6	.3	.....
17	.3	.5	.1	3.9	.3	9.1	1.1	.3	.....
18	.3	.4	.1	4.2	1.0	17.0	.8	.3	.....
19	.3	.3	.1	.8	.5	117	.9	.3	.....
20	.2	.2	.1	.6	.3	.....	1.0	.2	.....
21	.2	.2	.1	.4	.3	.....	.8	.2	.....
22	.2	.2	.1	13.3	1.2	.....	.6	.2	.....
23	.2	.2	7.8	1.8	9.1	.....	4.4	.2	.....
24	.2	.2	1.1	.7	.7	.....	3.2	.2	.....
25	.2	.2	.4	.5	.4	.....	1.9	.2	.....
26	.2	.1	.2	.4	.3	.....	1.1	.2	.....
27	.2	.1	9.0	.4	.4	7.3	.8	.2	.....
28	.2	.1	11.6	.3	.4	6.9	.7	.3	.2
29	.2	.1	36	.3	2.4	6.9	.6	.3	.2
30	.2	.1	32	.3	.....	10.3	.5	.2	.2
31	.2	.....	100	.3	.....	7.8	.....	.2	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day by comparison with Haipuaena Stream at Haiku-uka boundary and other adjacent streams as follows: Mar. 20–26, 75; Apr. 5–10, 8; 11–15, 1.5; June 3–5, 3.1; 6–10, 0.2; 11–15, 1.7; 16–20, 0.3; and 21–27, 0.2.

Monthly discharge of Honomanu Stream at Haiku-uka boundary near Kailiili, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
October 9–31	0.7	0.2	0.30	0.46	6.9	21
November	11.0	.1	.88	1.36	26.4	81
December	110	.1	6.80	10.5	211	647
January	13.3	.3	1.47	2.27	45.5	140
February	9.1	.2	.81	1.25	23.5	72
March	.....	.2	23.3	36.1	722	2,220
April	.....	.5	3.63	5.62	109	334
May	.4	.2	.29	.45	9.0	28
June	.....	.....	.78	1.21	23.3	72
The period	.....	.....	4.42	6.84	1,180	3,620

HONOMANU STREAM NEAR KEANAE, MAUI.

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

RECORDS AVAILABLE.—November 15, 1913, to June 30, 1920.

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, 8.34 feet at 11 a. m. March 25 (discharge, 1,030 million gallons per day or 1,590 second-feet); minimum stage recorded, 1.84 feet between January 12 and February 17 (discharge, 0.3 million gallons per day or 0.5 second-foot). Recorder did not indicate stages below 1.84 feet, although the stage was probably lower than that during the period noted.

1913–1920: 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);[10] minimum stage recorded, 1.78 feet at 7 p. m. June 25, 1919 (discharge, 0.2 million gallons per day or 0.3 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—Data valuable in relation to Territorial water licenses to ditch company.

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 and poorly defined above and below these limits. Operation of water-stage recorder satisfactory from July 18 to May 7 except February 4–11; but no record July 1–17 and instrument not recording true elevation of water surface in stream, February 4–11 and May 8 to June 30. Discharge for these periods estimated. Records fair except for estimated periods for which they are poor.

Discharge measurements of Honomanu Stream near Keanae, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 12	A. H. Wong	2.27	4.5	2.9
Jan. 12	Reid Jerman	2.27	6.0	3.9
Feb. 20	do	1.90	1.2	.75
Mar. 30	B. F. Rush	2.62	10.9	7.0
Apr. 28	Reid Jerman	2.14	2.3	1.5

[10] Revised data.

Daily discharge, in million gallons, of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	.....	2.3	27	2.0	0.8	0.7	6.4	0.7	2.0	11.3	1.3
2	.....	1.9	9.7	3.8	.7	.6	3.3	.7	.8	13.5	1.2
3	.....	2.3	74	2.1	.7	.7	5.6	.6	.5	7.8	1.2
4	.....	10.2	9.9	2.7	.7	.7	2.5	.....	.4	4.9	1.4
5	.....	48	4.6	21	.8	.7	2.2	.....	.4	34	1.2
6	.....	11.3	3.7	89	.7	.7	1.8	.....	.5	23	1.3
7	.....	67	3.1	6.7	.9	.7	1.6	.....	.7	16.6	1.2
8	.....	15.5	4.0	3.2	1.5	.7	1.4	.....	3.4	5.5	.....
9	.....	4.5	3.9	2.3	.9	.7	1.7	.....	3.8	3.7	.....
10	.....	3.0	7.8	1.9	1.8	.6	1.9	.....	2.0	3.1	.....
11	.....	2.5	3.8	1.8	18.1	.6	2.1	1.5	2.3	3.8	.....
12	.....	2.8	2.7	1.4	2.6	.6	3.5	1.4	9.8	3.3	.....
13	.....	7.6	2.4	1.4	1.9	.6	2.2	.6	5.1	4.7	.....
14	.....	3.0	3.2	1.2	4.1	.6	1.4	.8	1.9	3.1	.....
15	.....	25	2.9	1.2	3.2	.7	.9	.8	1.4	2.6	.....
16	.....	14.6	1.8	1.1	1.9	.6	.8	.7	1.8	2.9	.....
17	.....	9.2	1.7	1.0	1.0	.7	5.7	.6	9.6	2.8	.....
18	2.9	8.5	1.7	1.0	.9	.7	6.1	1.9	41	2.2	.....
19	3.1	6.2	1.5	.9	.7	.7	1.6	1.0	168	2.1	.....
20	2.9	3.4	1.5	1.0	.7	.6	1.1	.5	239	2.5	.....
21	8.5	2.6	1.3	.9	.7	.7	1.0	.5	159	1.9	.....
22	9.1	2.6	1.2	.9	.7	.7	18.0	3.9	280	1.7	.....
23	4.3	3.3	1.0	.9	.7	15.6	3.1	10.0	106	9.0	.....
24	3.4	2.7	1.0	.8	.7	2.0	1.4	1.1	146	5.8	.....
25	8.3	2.2	1.0	.8	.7	1.0	1.2	.6	471	3.0	.....
26	4.8	2.4	1.0	.8	.7	.9	1.0	.4	75	2.4	.....
27	41	3.4	.9	.8	.6	16.4	1.0	.6	14.7	2.0	.....
28	24	2.3	.8	.9	.7	17.9	.9	.7	7.3	1.8	.....
29	5.2	8.5	.7	.8	.7	73	.8	4.1	5.0	1.6	.....
30	3.5	13.3	1.1	.9	.6	65	.7	.....	12.1	1.4	.....
31	3.4	74	.....	.8	.....	126	.8	.....	8.6	.....	.....

NOTE.—Feb. 4-10 float resting on intake pipe. Discharge estimated 0.5 million gallons per day. Feb. 11 graph partly estimated.

Monthly discharge of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	.....	8.06	12.5	[a] 250	767
August	74	1.9	11.8	18.3	366	1,120
September	74	.7	6.03	9.33	181	555
October	89	.8	5.03	7.78	156	479
November	18.1	.6	1.71	2.65	51.4	157
December	126	.6	10.7	16.6	332	1,020
January	18.0	.7	2.70	4.18	83.7	257
February	10.0	.....	1.28	1.98	37.2	114
March	471	.4	57.4	88.8	1,780	5,460
April	34	1.4	6.13	9.48	184	564
May	.....	.....	.81	1.25	[a] 25.0	77
June	.....	.....	1.67	2.58	[a] 50.0	154
The year	471	.....	9.55	14.8	3,500	10,700

[a] Estimated by comparison with flow of adjacent streams.

HAIPUAENA STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—300 feet upstream from Haiku-uka boundary line trail crossing and 7½ miles by trail east of Kailiili.

RECORDS AVAILABLE.—May 27, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

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

CHANNEL AND CONTROL.—Channel is pool at base of 60-foot falls. Control is solid rock ledge at lower end of pool. Permanent and the same for all stages.

EXTREMES OF DISCHARGE.—Maximum stage occurred on March 22, 1920. Record torn and exact height not determined but was higher than 3.65 feet (discharge more than 265 million gallons per day or 410 second-feet); minimum stage recorded, 0.15 foot at 1.30 p. m. May 27, 1920 (discharge, 0.02 million gallons per day or 0.03 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 1 and 2 million gallons per day, used July 1 to March 22 and March 23 to June 30. Operation of water-stage recorder satisfactory. Records fair.

Discharge measurements of Haipuaena Stream at Haiku-uka boundary, near Kailiili, Maui, from May 27, 1919, to June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
May 26	H. A. R. Austin	0.50	0.65	0.4
July 11	A. H. Wong	.53	1.0	.65
Oct. 9	R. D. Klise	.49	.75	.5
Jan. 15	Reid Jerman	.46	.80	.50
Apr. 15	do	.45	1.0	.65
16	do	.50	1.35	.85

Daily discharge, in million gallons, of Haipuaena Stream at Haiku-uka boundary, near Kailiili, Maui, from May 27, 1919, to June 30, 1920.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1919.			1919.			1919.		
1		1.2	11		0.4	21		
2		.7	12		.4	22		
3		.6	13		.4	23		
4		.6	14		.4	24		
5		.5	15		.4	25		
6		.5	16		.5	26		
7		.4	17		1.6	27	0.7	0.7
8		.4	18		2.5	28	.6	
9		.4	19		.9	29	.6	
10		.4	20		.6	30	.6	
						31	2.8	

Daily discharge, in million gallons, of Haipuaena Stream at Haiku-uka boundary, near Kailiili, Maui, from May 27, 1919, to June 30, 1920—Continued.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1919-20.												
1	.....	0.8	7.8	1.1	0.3	0.3	0.4	.....	0.8	3.6	0.4	0.5
2	.....	.8	1.4	1.3	.3	.3	.3	.....	.4	4.1	.4	.8
3	.....	.9	15.6	.6	.3	.3	.4	.....	.4	2.2	.4	3.2
4	.....	4.6	2.3	.5	.3	.4	.4	0.3	.4	1.2	.4	1.2
5	.....	15.3	1.3	3.3	.3	.4	.4	.3	.3	10.2	.4	.4
6	.....	3.3	1.1	26	.3	.3	.4	.3	.4	4.8	.4	.3
7	.....	19.2	.8	1.4	.7	.3	.3	.3	.4	4.6	.3	.2
8	.....	4.9	1.4	.7	.5	.3	.4	.3	1.5	1.4	.3	.1
9	.....	1.6	1.1	.5	.4	.3	.4	.3	1.3	1.0	.3	.2
10	1.7	1.0	1.9	.5	.4	.3	.4	.3	.8	1.0	.3	.2
11	.8	.9	1.0	.4	5.8	.3	.4	1.8	.5	1.2	.4	.7
12	7.3	1.0	.7	.4	.8	.2	.4	.6	.6	1.1	.3	.4
13	2.6	1.7	.6	.4	.7	.2	.4	.4	1.0	1.0	.2	2.1
14	6.2	.9	.9	.4	2.2	.2	.4	.4	.6	.8	.2	.7
15	11.0	8.2	.7	.4	1.1	.2	.4	.4	.4	.8	.2	1.3
16	1.8	4.2	.5	.4	.6	.3	.4	.4	.4	1.3	.2	.5
17	.9	2.4	.4	.4	.4	.3	3.5	.4	3.1	.9	.3	.3
18	.8	2.1	.4	.4	.4	.3	1.8	.8	9.9	.7	.2	.3
19	.9	1.9	.4	.4	.4	.3	.4	.5	.....	.8	.2	.2
20	.8	.9	.4	.4	.3	.3	.4	.4	.....	.7	.1	.2
21	3.1	.8	.4	.4	.3	.2	.4	.4	.....	.6	.1	.2
22	2.3	.8	.4	.4	.3	.2	.....	1.3	.....	.5	.1	.2
23	1.1	.8	.4	.4	.3	5.5	.....	4.4	.....	3.7	.1	.2
24	.8	.8	.4	.4	.3	.8	.....	.6	.....	1.8	.1	.2
25	2.2	.6	.4	.4	.3	.4	.....	.5	.....	1.2	.1	.2
26	1.1	.8	.4	.4	.3	.3	.....	.4	.....	.8	.1	.1
27	13.8	1.0	.4	.4	.3	6.6	.....	.5	3.4	.7	.1	.1
28	6.2	.6	.4	.4	.3	6.9	.....	.4	2.3	.5	.2	.1
29	1.6	2.5	.4	.4	.3	14.8	.....	1.9	1.8	.5	.2	.1
30	1.2	3.2	.4	.3	.3	.....	.....	.....	4.0	.5	.1	.2
31	1.1	23	.....	.3	.....	.....	.....	.....	2.5	.....	.1	.....

NOTE.—Clock stopped and discharge estimated by comparison with East and West branches of Puohakamoa Stream as follows: June 21–26, 1919, 0.4 million gallons per day; June 28–30, 1919, 0.7 million gallons per day. Clock stopped July 1–9, 1919. Record paper torn for all other periods of no record. Discharge estimated in million gallons per day by comparison with West Branch of Puohakamoa Stream as follows: July 1–5, 2.8; 6–9, 0.4; Dec. 30–31, 19.3; Jan. 22–25, 2.5; 26–31, 0.4; Feb. 1–3, 0.3; Mar. 19–26, 30. Graph partly estimated Dec. 29 and Jan. 1.

Monthly discharge of Haipuaena Stream at Haiku-uka boundary, near Kailiili, Maui, for the years ending June 30, 1919 and 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1919						
June	2.5	.....	0.63	0.98	19.0	58
1920.						
July	13.8	.....	2.74	4.24	84.9	261
August	23	.6	3.60	5.57	112	342
September	15.6	.4	14.9	2.31	44.7	137
October	26	.3	1.42	2.20	44.1	135
November	5.8	.3	.65	1.01	19.5	60
December	.....	.2	2.58	3.99	80.1	245
January	3.5	.3	.81	1.25	25.1	77
February	4.4	.....	.67	1.04	19.5	60
March	.....	.3	8.94	13.8	277	851
April	10.2	.5	1.81	2.80	54.2	167
May	.4	.1	.23	.36	7.2	22
June	3.2	.1	.51	.79	15.4	47
The year	.....	.1	2.14	3.31	784	2,400

HAIPUAENA STREAM NEAR HUELO, MAUI.

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

RECORDS AVAILABLE.—October 19, 1913, to June 30, 1920; 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.—1913–1920: Maximum stage recorded 5.32 feet at 3 a. m. March 25, 1920 (discharge, 473 million gallons per day or 732 second-feet); minimum stage recorded, 0.20 foot, occurred frequently during December, 1919 (discharge, 0.3 million gallons per day or 0.5 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—Data valuable in relation to water valuation appraisal under Territorial lease to ditch company.

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

ACCURACY.—Stage-discharge relation changed by flood of October 5 and 6. Rating curve used July 1 to October 5 fairly well defined between 2 and 200 million gallons per day. Rating curve used October 6 to June 30 fairly well defined between 1 and 150 million gallons per day. Operation of water-stage recorder satisfactory except 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 25	H. A. R. Austin	1.015	12.4	8.0
25	do	1.38	25	16.2
Oct. 6	R. D. Klise	2.36	117	75
Dec. 30	Reid Jerman	1.66	41	26.5
Jan. 26	do	.42	1.4	.9
Mar. 30	do	.95	9.8	6.3
Apr. 26	do	.64	4.2	2.7

Daily discharge, in million gallons, of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	17.5	4.3	19.0	2.2	0.7	0.4	5.8	.....	2.1	10.1	1.8	1.6
2	12.0	4.0	11.5	4.1	.7	.4	4.8	.....	.9	8.3	1.7	4.6
3	3.4	4.0	58	2.9	.8	.4	4.4	.....	.7	5.3	1.6	5.8
4	2.8	10.8	9.7	2.7	.6	.8	3.2	.....	.6	4.2	1.6	3.0
5	2.4	33	6.2	17.5	.4	.7	2.8	.....	.5	15.6	1.6	1.4
6	2.0	12.9	5.2	56	.4	.5	2.4	0.5	.5	10.2	1.4	1.1
7	1.7	41	4.5	6.4	1.1	.4	2.1	.5	.7	9.6	1.4	.8
8	1.6	14.7	5.6	3.6	1.6	.4	1.8	.5	2.2	4.9	1.4	.7
9	1.4	6.6	5.2	2.8	.7	.3	1.6	.6	3.0	4.1	1.0	.6
10	2.4	5.2	7.8	2.4	.6	.3	1.6	.6	1.8	3.6	1.0	.7
11	2.6	4.5	4.8	2.1	10.0	.3	2.2	1.1	2.5	4.0	.9	2.3
12	16.0	4.4	3.5	1.9	2.4	.3	2.8	1.2	12.0	3.6	1.1	1.3
13	6.4	9.1	3.3	1.7	.....	.3	2.0	.5	4.6	4.6	.9	4.3
14	13.8	5.3	3.1	1.6	.....	.3	1.4	.7	2.3	3.4	.9	2.7
15	22	22	3.1	1.4	.....	.3	1.3	1.0	1.7	3.0	.9	3.9
16	6.2	12.7	2.7	1.3	.....	.4	1.2	.7	1.6	3.1	.8	2.1
17	4.0	9.4	2.5	1.2	.....	.3	3.6	.8	4.6	3.0	.8	1.6
18	3.7	7.7	2.4	1.1	.....	.3	3.9	2.2	22	2.6	.9	1.3
19	3.9	7.1	2.3	1.0	.....	.3	1.6	1.2	78	2.4	.7	1.1
20	3.5	4.6	2.2	1.0	.....	.3	1.2	.7	111	2.4	.7	1.0
21	7.5	3.9	2.1	1.0	.....	.3	1.0	.7	92	2.1	.6	.8
22	8.1	3.7	1.9	.9	.....	.3	7.6	.8	158	2.0	.5	.8
23	4.5	3.7	1.8	.8	.....	9.4	2.5	5.9	45	6.6	.5	.8
24	3.5	3.2	1.7	1.0	.....	2.5	1.5	1.1	74	4.7	.5	.7
25	8.2	2.8	1.7	.9	.....	.9	1.3	.8	193	2.8	.4	.7
26	5.2	3.1	1.9	.8	.....	.6	1.1	.6	29	2.8	.4	.6
27	24	3.5	2.4	1.0	.....	8.4	1.1	.7	9.0	2.3	.4	.5
28	19.4	2.6	2.0	.9	.....	11.6	1.0	.7	6.1	2.1	.4	.6
29	8.4	6.9	1.4	.8	.....	51	1.0	2.0	5.0	2.0	.7	.5
30	6.4	13.9	1.6	.7	.....	43	.9	.....	8.2	1.8	.5	.7
31	5.6	44	.....	.7	.....	62	.7	.....	5.8	.....	.5	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day by comparison with records of adjacent streams as follows: Nov. 13-17, 2.0; Nov. 18-30, 0.4; and Feb. 1-5, 0.6. Graph partly estimated Nov. 12, Jan. 31, and Feb. 6.

Monthly discharge of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	24	1.4	7.42	11.5	230	706
August	44	2.6	10.1	15.6	315	961
September	58	1.4	6.04	9.35	181	556
October	56	.7	4.01	6.20	124	381
November	10.0	.....	1.17	1.81	35.2	108
December	62	.3	6.38	9.87	198	607
January	7.6	.7	2.30	3.56	71.4	219
February	5.9	.5	1.00	1.55	29.1	89
March	193	.5	28.3	43.8	878	2,690
April	15.6	1.8	4.57	7.07	137	421
May	1.8	.4	.92	1.42	28.5	88
June	5.8	.5	1.62	2.51	48.6	149
The year	193	.3	6.22	9.62	2,280	6,980

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

LOCATION.—On left bank of stream 200 yards downstream from trail crossing and 7 miles by trail southeast of Kailiili.

RECORDS AVAILABLE.—October 10, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 5 feet below gage.

CHANNEL AND CONTROL.—Channel high steep banks with boulder-strewn bed. Pool at station 20 feet wide by 35 feet long, clear and smooth. Control large boulders; likely to shift during floods.

EXTREMES OF DISCHARGE.—Maximum stage estimated by comparison with West and Middle branches of the same stream, 3.27 feet old datum March 22, 1920 (discharge about 102 million gallons per day or 158 second-feet); minimum stage recorded, 0.31 foot at 9 p. m. December 20, 1919 (discharge, 0.0).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 0.5 and 5 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records fair when recorder was operating.

Discharge measurements of East Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 9	R. D. Klise	0.58	0.4	0.25
Mar. 26	B. F. Rush	.93	4.5	2.9
Apr. 14	Reid Jerman	.60	.35	.2
15	do	.59	.3	.2

Daily discharge, in million gallons, of East Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1				1.1	0.05	0.2	0.9	0.2	0.1
2				.8	.05	.1	.9	.2	.3
3				1.0	.05	.05	.6	.1	1.1
4					.05	.05	.6	.1	.2
5		0.05			.05	.05	2.6	.2	.1
6		.1			.05	.05	1.2	.2	.1
7		.2			.05		1.4	.2	.1
8		.1			.05		.7	.1	.1
9		.1			.05		.5	.1	.1
10	0.3	.1	0.00		.05		.4	.1	.1
11	.3	1.7	.00		.05		.5	.2	.2
12	.2	.4	.00		.05		.4	.2	.1
13	.2	.5	.00		.05		.5	.1	.8
14	.2	.6	.05		.1		.3	.1	.2
15		.3	.00	.1	.1		.3	.1	.5
16		.2	.00	.1	.1		.3	.1	.1
17		.1	.00	.5	.1		.3	.1	.1
18		.1	.00	.3	.3		.2	.1	.1
19		.1	.00	.2	.1		.3	.1	.1
20		.1	.00	.1	.1		.3	.1	.1
21		.1	.00	.1	.1		.2	.1	.1
22		.1	.00	1.1	.3		.2	.1	.1
23		.1	1.6	.2	.5		1.1	.1	.1
24	.1	.1	.2	.1	.1		.4	.1	.1
25	.1	.05		.1	.1		.3	.1	.1
26	.1	.05		.1	.1		.2	.05	.1
27	.1	.05		.1	.1	1.6	.2	.05	.05
28	.05			.1	.05	1.2	.2	.1	.1
29	.1		7.2	.1	.6	.9	.2	.1	.1
30			7.3	.05		1.4	.2	.1	.1
31			11.2	.05		.9		.05	

NOTE.—Recorder not working properly and discharge estimated in million gallons per day, as follows: Oct. 15–20 at 0.2; Oct. 21–23, Oct. 30 to Nov. 4, Nov. 28 to Dec. 9 at 0.1; Dec. 25–28 at 0.7; Jan. 4–14 at 0.2; Mar. 7–10 at 0.3; 11–15 at 0.2; 16–20 at 4.4; and 21–26 at 10. Estimates by comparison with records for other branches of Puohakamoa Stream.

Monthly discharge of East Branch of Puohakamoa Stream at Haiku-uka boundary near Kailiili, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
October 10-31	.....	0.05	0.157	0.243	3.45	11
November	1.7	.05	.200	.309	6.00	18
December	11.2	.00	1.01	1.56	31.2	96
January	1.1	.05	.274	.424	8.50	26
February	.6	.05	.121	.187	3.50	11
March	.....	.05	2.93	4.53	90.7	279
April	2.6	.2	.55	.85	16.4	51
May	.2	.05	.118	.183	3.65	11
June	1.1	.05	.185	.286	5.55	17
The period	.....	.....	.....	.....	169	520

MIDDLE BRANCH OF PUOHAKAMOA STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—At trail crossing 200 feet above Haiku-uka boundary line and 3¾ miles southeast of Kailiili.

RECORDS AVAILABLE.—November 22, 1918, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—By wading or from suspension bridge just above gage.

CHANNEL AND CONTROL.—One channel at all stages; channel straight 25 feet above and below control; right bank vertical; left bank 1½ on 1 slope; stream bed composed of gravel and boulders; control probably shifting.

EXTREMES OF DISCHARGE.—1918-1920: Maximum stages recorded, 8.47 feet at 5 p. m. March 22, 1920 (discharge, 207 million gallons per day or 320 second-feet); minimum stage recorded, 3.91 feet at noon December 22, 1919 (discharge, 0.06 million gallons per day or 0.09 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co.'s ditches for the irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 22 fairly well defined between 1 and 2 million gallons per day. Curve used March 23 to June 30 fairly well defined between 1 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 Middle Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 11	A. H. Wong	4.24	0.95	0.6
Oct. 9	R. D. Klise	4.28	1.15	.75
Jan. 16	Reid Jerman	4.14	.4	.25
Mar. 26	do	4.87	10.7	6.9
Apr. 14	do	4.36	1.05	.7
15	do	4.34	1.0	.65

Daily discharge, in million gallons, of Middle Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	0.8	4.4	0.6	0.2	0.1	1.4	0.2	0.7	2.7	0.6	0.5
2	.....	.6	1.4	1.2	.2	.1	1.1	.2	.3	2.5	.6	.6
3	.....	.9	9.0	.4	.2	.1	1.5	.2	.2	1.9	.5	2.2
4	.....	2.2	2.1	.3	.2	.4	.8	.2	.2	1.5	.5	1.4
5	.....	7.2	1.4	2.4	.1	.2	.7	.2	.1	5.8	.5	.6
6	.....	2.3	1.1	11.3	.2	.1	.7	.2	.2	3.3	.5	.4
7	.....	10.0	.9	1.3	.6	.1	.5	.2	.2	3.2	.4	.3
8	.....	2.8	1.3	.7	.4	.1	.4	.1	1.1	1.7	.4	.3
9	.....	1.4	1.0	.6	.2	.1	.4	.2	1.0	1.4	.4	.3
10	.....	1.0	1.7	.5	.3	.1	.4	.2	.6	1.2	.4	.3
11	.....	.8	1.1	.5	3.0	.1	.6	.7	.4	1.3	.5	.8
12	.....	.9	.8	.4	.8	.1	.7	.7	.7	1.2	.4	.5
13	.....	1.4	.6	.4	.6	.1	.5	.3	.7	1.5	.4	1.8
14	.....	.8	.8	.4	1.4	.05	.4	.3	.4	1.1	.3	.9
15	.....	4.8	.7	.4	.8	.05	.4	.3	.3	1.1	.3	1.5
16	.....	2.8	.5	.3	4	.1	.3	.3	.3	1.4	.3	.7
17	.....	2.0	.4	3	.3	.05	1.5	.2	1.7	1.2	.5	.5
18	.....	1.9	4	.3	.2	.05	1.6	.7	5.3	1.0	.3	.3
19	.....	1.8	.3	.3	.2	.05	.6	.3	21	.9	.3	.3
20	.....	1.0	.3	.3	.2	.05	.4	.2	26	.9	.3	.2
21	.....	.8	.3	.3	.2	.05	.3	.2	16.7	.8	.3	.2
22	.....	.8	.2	.2	.2	.05	2.6	.7	34	.8	.3	.3
23	.....	.7	.2	.3	.1	2.4	.7	2.4	13.3	2.8	.2	.3
24	.....	.6	.1	.3	.1	.7	.4	.4	19.2	1.9	.2	.2
25	.....	.6	.1	.2	.1	.2	.4	.3	46	1.4	.2	.2
26	.....	.7	.1	.2	.1	.1	.3	.2	7.5	1.1	.2	.2
27	.....	1.0	.1	.2	.1	2.9	.3	.3	3.2	.9	.2	.2
28	.....	.5	.1	.2	.1	4.1	.3	.2	2.2	.8	.3	.2
29	.....	1.5	.1	.2	.1	9.4	.3	.7	1.9	.8	.3	.2
30	.....	2.4	.1	.2	.1	9.2	.2	.....	2.9	.7	.2	.2
31	1.1	11.5	.....	.2	.....	16.1	.2	.....	2.4	.....	.2	.....

Monthly discharge of Middle Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	.....	1.77	2.74	[a] 55.0	168
August	11.5	0.5	2.21	3.42	68.5	210
September	9.0	.1	1.05	1.62	31.6	97
October	11.3	.2	.82	1.27	25.4	78
November	3.0	.1	.39	.60	11.7	36
December	16.1	.05	1.53	2.37	47.3	146
January	2.6	.2	.67	1.04	20.9	64
February	2.4	.1	.39	.60	11.3	35
March	46	.1	6.80	10.5	211	647
April	5.8	.7	1.63	2.52	48.8	150
May	.6	.2	.35	.54	11.0	33
June	2.2	.2	.55	.85	16.6	51
The year	46	.05	1.53	2.37	559	1,720

[a] Estimated by comparison with flow of adjacent streams.

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

LOCATION.—At trail crossing 500 feet above Haiku-uka boundary line and 3½ miles by horse trail southeast of Kailiili.

RECORDS AVAILABLE.—March 14, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—By wading or from suspension bridge 200 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; channel straight 30 feet above and 50 feet below gage; right bank vertical; left bank 1 on 1½ slope; stream bed, rock and gravel; control composed of large boulders; occasionally shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 5.78 feet at 1.40 a. m. December 31, 1919 (discharge, 79 million gallons per day or 122 second-feet). Stages on March 22 and 25 were considerably in excess of this, but the float stuck and the instrument failed to record anything above 5.62 feet. Minimum stage recorded during period of record 3.48 feet at 8.30 a. m. December 22 and 2 a. m. December 23, 1919 (discharge, 0.08 million gallons per day or 0.12 second-foot).

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

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and Territorial lands below.

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

ACCURACY.—Stage-discharge relation shifts slightly. Rating curve used March 14 to October 5 well defined between 0.4 and 2.5 million gallons per day. Curve used October 6 to March 22 is a revision of the preceding curve and not due to a shift and is fairly well defined up to 10 million gallons per day. Data prior to October 6 not revised as it is mostly within the limits of coincidence of the two curves. Curve used March 23 to June 30 fairly well defined below 10 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of West Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 11	A. H. Wong	3.72	1.05	0.65
Oct. 9	R. D. Klise	3.71	1.15	.75
Jan. 16	Reid Jerman	3.63	.55	.35
Mar. 26	do	4.30	14.8	9.6
Apr. 13	do	3.79	3.0	1.95
14	do	3.70	1.25	.8

Daily discharge, in million gallons, of West Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	7.1	1.1	6.8	0.5	0.3	0.2	1.5	0.4	1.0	3.2	0.6	0.5
2	3.8	.9	2.1	1.0	.3	.2	1.0	.4	.6	3.6	.6	.8
3	1.6	1.0	16.5	.5	.3	.2	1.0	.4	.5	2.8	.6	2.5
4	1.0	3.0	3.3	.2	.3	.7	.6	.4	.4	2.1	.6	1.1
5	.6	12.9	2.2	4.4	.3	.4	.8	.3	.4	8.2	.6	.5
6	.2	3.9	1.8	15.0	.3	.3	.6	.3	.5	4.5	.5	.5
7	.2	17.3	1.5	1.9	.9	.3	.6	.4	.6	4.8	.5	.4
8	.2	5.1	1.8	1.3	.6	.2	.7	.4	1.6	2.3	.5	.4
9	.2	2.3	1.3	1.1	.4	.2	.7	.3	1.4	1.9	.5	.4
10	1.1	1.8	2.6	.9	.4	.1	.6	.3	.9	1.6	.5	.4
11	.7	1.6	1.6	.7	3.3	.1	.9	.5	.8	1.7	.5	1.0
12	6.3	1.4	1.1	.7	.9	.1	.9	.5	1.6	1.6	.5	.6
13	2.7	2.4	.9	.6	1.0	.1	.8	.4	1.3	2.2	.5	2.4
14	5.5	1.4	.9	.6	1.5	.1	.7	.4	.8	1.3	.5	1.0
15	9.1	8.6	.9	.6	1.1	.1	.6	.5	.7	1.2	.5	1.8
16	2.2	4.5	.5	.5	.7	.1	.5	.4	.7	1.7	.4	.7
17	1.4	2.6	.4	.5	.5	.1	2.8	.4	2.6	1.3	.5	.5
18	1.2	2.9	.3	.5	.4	.1	2.1	1.1	7.5	1.0	.5	.5
19	1.3	2.4	.2	.5	.4	.1	.9	.6	23.	1.0	.5	.5
20	1.1	1.6	.3	.5	.4	.1	.7	.5	33.	.8	.4	.4
21	2.6	1.2	.2	.4	.3	.1	.6	.5	23.	.8	.4	.4
22	2.3	1.2	.2	.5	.3	.1	5.0	1.6	41.	.7	.4	.4
23	1 3	1.1	.2	.4	.3	3.4	1.5	2.4	13.9	3.9	.4	.4
24	.9	1.0	.2	.5	.3	1.6	.8	.7	22.	2.2	.4	.4
25	2.1	.8	.2	.4	.3	.2	.6	.6	61.	1.5	.4	.4
26	1.4	.9	.2	.4	.3	.1	.6	.5	9.8	1.1	.4	.4
27	10.2	1.2	.2	.4	.3	3.9	.6	.6	3.9	1.0	.4	.4
28	5.2	.8	.2	.4	.2	3.9	.5	.6	2.8	.8	.4	.4
29	1.9	2.5	.2	.4	.3	11.3	.5	1.6	2.3	.7	.4	.3
30	1.5	5.0	.2	.4	.3	11.4	.4	.....	3.6	.7	.4	.4
31	1.5	18.2	.....	.4	.....	18.3	.5	.....	2.6	.....	.4	.....

Monthly discharge of West Branch of Puohakamoa Stream at Haiku-uka boundary near Kailiili, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	10.2	0.2	2.53	3.91	78.4	241
August	18.2	.8	3.63	5.62	113	345
September	16.5	.2	1.63	2.52	49.0	150
October	15.0	.2	1.20	1.86	37.1	114
November	3.3	.2	.57	.88	17.2	52
December	18.3	.1	1.87	2.89	58.1	178
January	5.0	.4	.99	1.53	30.6	94
February	2.4	.3	.62	.96	18.0	55
March	61.	.4	8.57	13.3	266	815
April	8.2	.7	2.07	3.20	62.2	191
May	.6	.4	.47	.73	14.7	45
June	2.5	.3	.69	1.07	20.8	64
The year	61.	.1	2.09	3.23	765	2,340

PUOHAKAMOA STREAM NEAR HUELO, MAUI.

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

RECORDS AVAILABLE.—June 13, 1913, to June 30, 1920 (new station); December 18, 1910, to June 18, 1913 (old station).

GAGE.—Stevens continuous water-stage recorder installed November 23, 1917, replacing Barrett and 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 very rough and steep. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.72 feet at 5.30 p. m. March 22 and 3 a. m. March 25 (discharge, 795 million gallons per day, or 1,230 second-feet); minimum stage recorded, 0.30 foot at 12.30 a. m. December 16 (discharge, 0.4 million gallons per day or 0.6 second-foot).

1910–1920: 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).

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

REGULATION.—None.

OBJECT OF STATION.—To furnish data for water valuation appraisal in connection with Territorial water license to ditch company.

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

ACCURACY.—Stage-discharge relation changed by flood of October 5 and 6. Curve used July 1 to October 5 well defined between 1 and 50 million gallons per day. Curve used October 6 to June 30 well defined between 1 and 80 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 12	A. H. Wong	1.30	8.3	5.4
Dec. 29	Reid Jerman	3.47	145.	94.
Feb. 6	do	.62	1.9	1.2
Apr. 6	do	2.36	26.5	17.0
8	do	2.05	17.6	11.4

Daily discharge, in million gallons, of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	42	7.2	37	2.7	2.2	1.0	10.9	2.0	4.0	21	4.0	3.0
2	35	6.7	15.3	5.3	1.9	.9	10.9	1.8	1.7	19.4	4.0	4.9
3	8.2	6.7	152	3.6	1.6	.8	8.6	1.6	1.1	11.4	3.7	11.0
4	7.2	17.6	21	4.0	1.6	2.1	6.4	1.5	1.0	10.4	3.7	6.2
5	5.8	70	12.4	35	1.6	1.5	6.0	1.5	.9	29.	3.5	3.1
6	4.8	25	9.8	130	1.5	.8	5.3	1.4	.9	19.9	3.4	2.4
7	3.9	65	8.8	13.8	2.7	.7	4.7	1.2	1.2	22	3.1	1.8
8	3.3	57	10.6	7.8	3.4	.7	4.4	1.2	3.6	11.4	2.8	1.4
9	2.8	13.3	10.2	6.7	2.1	.6	3.9	1.4	5.3	9.4	2.7	1.3
10	5.4	9.8	17.2	5.6	1.8	.6	3.6	1.6	3.8	8.6	2.5	2.0
11	5.7	8.2	9.3	5.3	17.0	.6	5.0	1.3	3.8	9.0	2.8	4.1
12	48	8.7	6.7	4.7	5.3	.6	5.0	2.5	26	8.6	2.9	2.7
13	13.3	18.2	6.2	4.7	5.3	.5	4.4	1.4	8.0	10.9	2.3	8.5
14	36	9.5	5.8	4.4	5.6	.5	3.6	1.5	4.1	8.2	2.2	5.6
15	46	52	5.8	4.1	6.0	.4	3.3	2.9	3.2	7.0	2.2	7.8
16	12.0	28	4.5	4.0	3.8	.5	2.9	1.8	2.7	7.4	2.2	4.4
17	7.2	16.0	4.2	3.7	3.1	.6	6.6	1.8	5.2	7.0	2.1	3.6
18	6.7	16.0	4.0	3.5	2.5	.5	7.4	4.7	36	6.4	2.4	3.0
19	6.7	13.7	3.8	3.5	2.5	.5	4.0	2.4	158	6.0	1.7	2.4
20	5.8	8.8	3.7	3.3	2.1	.5	3.3	1.4	216	5.6	1.7	2.0
21	16.0	7.2	3.0	3.4	1.8	.4	2.7	1.3	197	5.3	1.5	1.7
22	14.5	7.2	2.8	3.0	1.6	.5	12.9	1.5	348	5.0	1.5	1.5
23	7.2	6.7	2.5	2.9	1.5	15.5	5.3	9.2	102	17.4	1.2	1.5
24	5.8	5.3	2.3	3.0	1.5	4.5	3.7	2.6	146	9.6	1.1	1.4
25	16.4	4.9	2.2	2.8	1.3	1.3	3.1	1.5	379	6.4	1.0	1.2
26	8.2	5.3	2.1	2.5	1.3	.8	2.7	1.2	58	5.6	1.0	1.0
27	48	5.8	1.9	2.9	1.1	13.8	2.7	1.3	18.0	5.0	1.0	1.0
28	40	4.3	1.8	2.5	1.1	19.7	2.6	1.4	13.6	5.0	1.0	1.0
29	15.2	13.0	1.8	2.5	1.0	125	2.4	2.6	12.8	4.7	1.8	1.0
30	10.4	29	2.2	2.1	1.0	92	2.3	.....	19.1	4.4	1.0	1.2
31	9.3	96	.....	2.0	.....	118	2.2	.....	14.6	.....	1.0	.....

Monthly discharge of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	48	2.8	16.0	24.8	497	1,520
August	96	4.3	20.7	32.0	642	1,970
September	152	1.8	12.4	19.2	371	1,140
October	130	2.0	9.20	14.2	285	875
November	17.0	1.0	2.89	4.47	86.8	266
December	125	.4	13.1	20.3	406	1,250
January	12.9	2.2	4.93	7.63	153	469
February	9.2	1.2	2.05	3.17	59.5	182
March	379	.9	57.9	89.6	1,790	5,510
April	29	4.4	10.2	15.8	307	939
May	4.0	1.0	2.23	3.45	69.0	212
June	11.0	1.0	3.12	4.83	93.7	287
The year	379	.4	13.0	20.1	4,760	14,600

ALO STREAM NEAR HUELO, MAUI.

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

RECORDS AVAILABLE.—December 18, 1910, to June 30, 1920.

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; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.15 feet at 11.45 a. m. March 22 (discharge, 568 million gallons per day or 879 second-feet); minimum stage recorded, 0.33 foot at 3 a. m. December 23 (discharge, 0.3 million gallons per day or 0.45 second-foot).

1910–1920: Maximum stage recorded, 4.35 feet at 7 p. m. December 9, 1916 (discharge, computed from extension of rating curve, approximately 638 million gallons[11] per day or 987 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.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

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 0.5 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 25	H. A. R. Austin	1.09	16.4	10.6
29	do	.86	6.7	4.4
Nov. 12	A. H. Wong	.66	2.8	1.8
Dec. 29	Reid Jerman	1.15	15.3	9.9
Jan. 25	do	.49	1.1	.7
Apr. 5	do	.98	8.8	5.7

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

Daily discharge, in million gallons, of Alo Stream near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	8.0	2.3	6.8	0.7	0.6	0.4	3.1	0.6	0.6	8.8	0.7	1.2
2	3.9	2.2	10.3	1.2	.5	.4	5.0	.6	.4	3.3	.7	1.8
3	1.4	2.0	47	.9	.4	.4	2.6	.5	.4	3.3	.7	2.2
4	1.0	6.0	4.9	1.7	.4	.5	2.0	.5	.4	3.2	.7	.7
5	1.0	10.0	3.4	15.6	.4	.5	2.1	.5	.4	8.5	.6	.6
6	.9	6.3	2.7	43	.4	.4	1.7	.4	.3	4.5	.6	.5
7	.8	14.4	2.4	7.4	.6	.4	1.4	.4	.3	6.0	.6	.5
8	.8	5.1	3.0	2.7	.5	.4	1.2	.5	.9	3.2	.6	.4
9	.8	3.3	2.6	2.0	.5	.4	1.1	.6	.8	2.7	.6	.5
10	1.0	2.7	3.2	1.7	.7	.4	1.4	.7	.7	2.4	.5	.6
11	.8	2.5	2.1	1.4	11.0	.4	1.4	.6	2.1	2.3	.5	1.0
12	7.0	2.3	1.9	1.2	1.8	.4	1.5	.4	12.6	2.1	.5	.7
13	3.3	5.6	1.7	1.2	2.0	.3	1.2	.4	3.1	1.3	.5	2.3
14	8.8	3.3	1.7	1.0	1.6	.3	.9	.4	1.2	.8	.5	1.2
15	7.4	11.3	1.4	.9	1.9	.3	.9	.6	.9	.....	.5	2.9
16	2.4	4.5	1.2	.9	1.0	.4	.8	.6	.8	.....	.6	1.1
17	1.7	4.8	1.2	.8	.8	.3	1.3	.6	2.4	.....	.5	.9
18	1.5	3.8	1.2	.8	.7	.3	1.2	1.7	9.7	.....	.5	.9
19	1.2	3.2	1.2	.7	.6	.3	.8	.6	21	.....	.5	.7
20	1.1	2.5	1.0	.7	.6	.3	.8	.4	57	.....	.4	.7
21	3.2	2.4	.9	.8	.6	.3	.7	.4	75	.....	.4	.7
22	2.7	2.0	.8	.6	.5	.3	2.2	.5	151	.....	.4	.6
23	1.5	1.8	.8	.6	.5	5.1	1.0	.6	34	.....	.4	.6
24	1.4	1.4	.7	.7	.5	.7	.8	.4	36	.....	.4	.6
25	5.5	1.2	.7	.6	.5	.5	.7	.4	70	.....	.4	.6
26	2.3	1.4	.7	.5	.5	.4	.7	.4	11.0	1.2	.4	.6
27	8.7	1.2	.6	.8	.5	2.4	.7	.4	3.6	1.1	.4	.6
28	9.4	1.1	.6	.6	.4	3.9	.6	.4	2.4	1.0	.4	.6
29	3.9	1.5	.6	.6	.4	36	.6	.9	1.8	.9	.4	.5
30	3.4	6.6	.6	.5	.4	9.0	.6	.....	6.6	.8	.4	.6
31	2.7	18.9	.....	.5	.....	12.8	.6	.....	2.6	.....	.4	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day by comparison with adjacent streams as follows: Apr. 15–20, 0.8, and 16–25, 2.2.

Monthly discharge of Alo Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	9.4	0.8	3.21	4.97	99.5	305
August	18.9	1.1	4.44	6.87	138	422
September	47	.6	3.60	5.57	108	331
October	43	.5	3.01	4.66	93.3	286
November	11.0	.4	1.06	1.64	31.8	98
December	36	.3	2.55	3.95	78.9	243
January	5.0	.6	1.34	2.07	41.6	127
February	1.7	.4	.55	.85	16.0	49
March	151	.3	16.5	25.5	510	1,570
April	8.8	.....	2.44	3.78	73.2	225
May	.7	.4	.51	.79	15.7	48
June	2.9	.4	.91	1.41	27.4	84
The year	151	.3	3.37	5.21	1,230	3,790

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

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

RECORDS AVAILABLE.—May 28, 1918, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge just above control.

CHANNEL AND CONTROL.—Channel has gravel and boulder bed with steep high banks of hardpan. Control is composed of large boulders and gravel and may shift during large floods.

EXTREMES OF DISCHARGE.—1918–1920: Maximum stage recorded during period of record, 7.92 feet at 5.20 p. m. March 22, 1920 (discharge, 230 million gallons per day or 356 second-feet); minimum stage recorded, 3.77 feet April 15, 1919 (discharge, 0.07 million gallons per day or 0.11 second-foot or less).

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

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and Territorial lands below.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 22 fairly well defined between 1 and 5 million gallons per day. Rating curve used March 23 to noon June 23 fairly well defined between 1 and 40 million gallons per day. Rating curve used June 23 noon to June 30 fairly well defined between 1 and 5 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records fair.

Discharge measurements of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 11	A. H. Wong	4.16	3.4	2.2
Aug. 5	H. A. R. Austin	4.59	11.6	7.5
Oct. 10	R. D. Klise	3.90	1.0	.65
Jan. 16	Reid Jerman	3.85	.55	.35
Mar. 25	B. F. Rush	5.40	36	23.2
Apr. 13	Reid Jerman	4.63	2.3	1.5
14	do	4.54	1.5	.95

Daily discharge, in million gallons, of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	5.2	0.7	4.3	0.5	0.4	0.5	1.5	0.4	0.7	2.3	0.5	0.4
2	2.2	.6	1.0	.8	.4	.5	1.3	.4	.5	2.2	.5	.6
3	.8	.8	12.1	.4	.4	.5	1.6	.4	.5	1.4	.5	1.9
4	.5	2.5	1.5	.3	.....	.8	.9	.4	.4	1.2	.4	.8
5	.4	8.5	1.0	3.9	.....	.5	1.1	.4	.4	6.4	.4	.4
6	.4	1.8	.9	14.1	.....	.5	.8	.....	.4	2.6	.4	.4
7	.2	11.8	.6	.7	1.0	.4	.7	.....	.5	3.1	.4	.3
8	.2	2.2	1.0	.4	.6	.4	.6	.....	1.4	1.3	.4	.3
9	.2	1.0	.9	.4	.4	.....	.6	.4	1.6	1.1	.4	.3
10	.8	.8	1.8	.6	.5	.....	.6	.4	.9	1.0	.4	.3
11	.5	.7	.8	.6	3.3	.4	.8	.4	.6	1.2	.4	.8
12	5.0	.8	.6	.5	1.1	.....	.9	.6	.9	1.2	.4	.6
13	1.5	1.4	.5	.5	1.0	.....	.8	.5	1.0	1.5	.4	2.2
14	4.6	.7	.5	.5	1.8	.....	.7	.5	.6	1.0	.4	.8
15	4.9	6.4	.5	.4	1.1	.....	.5	.5	.5	1.0	.3	1.6
16	1.0	3.3	.4	.4	.7	.4	.4	.5	.5	1.2	.3	.7
17	.6	1.6	.4	.4	.5	.4	2.3	.4	2.3	9.5	.4	.5
18	.7	2.0	.3	.4	.5	.....	1.6	1.0	7.4	.8	.4	.4
19	.8	1.4	.4	.4	.5	.....	.8	.5	25	.7	.3	.4
20	.7	.8	.3	.4	.5	.....	.6	.5	30	.7	.3	.3
21	2.3	.7	.3	.4	.4	.....	.5	.5	22	.7	.3	.3
22	1.5	.7	.2	.4	.4	.....	3.9	2.0	42	.6	.3	.4
23	.8	.6	.2	.4	.4	4.8	.9	1.5	10.1	3.4	.3	.3
24	.6	.5	.2	.4	.4	.8	.6	.5	16.2	1.3	.3	.2
25	1.7	.5	.2	.4	.5	.5	.5	.5	46	1.0	.3	.3
26	.8	.5	.2	.4	.5	.5	.5	.4	6.0	.8	.3	.2
27	7.8	.7	.2	.5	.5	6.2	.5	.5	2.6	.7	.3	.2
28	3.5	.5	.2	.4	.5	4.9	.4	.4	1.9	.6	.3	.2
29	1.1	1.8	.2	.4	.5	16.9	.4	1.3	1.5	.5	.3	.2
30	.8	4.1	.2	.4	.5	13.0	.4	.....	2.7	.6	.3	.2
31	.9	12.9	.....	.4	.....	19.7	.4	.....	2.0	.....	.3	.....

NOTE.—Float resting on intake pipe and discharge estimated at 0.4 million gallons per day Nov. 4–6, Dec. 9–10, 12–15, 18–22, and Feb. 6–8.

Monthly discharge of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.8	0.2	1.71	2.65	53.0	163
August	12.9	.5	2.36	3.65	73.3	225
September	12.1	.2	1.06	1.64	31.9	98
October	14.1	.3	1.00	1.55	31.1	95
November	3.3	.....	.68	1.05	20.5	63
December	19.7	.....	2.48	3.84	77.0	236
January	3.9	.4	.91	1.41	28.1	87
February	2.0	.....	.59	.91	17.0	52
March	46	.4	7.39	11.4	229	703
April	9.5	.5	1.72	2.66	51.6	158
May	.5	.3	.36	.56	11.2	34
June	2.2	.2	.55	.85	16.5	51
The year	46	.2	1.75	2.71	640	1,960

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 east of Kailiili.

RECORDS AVAILABLE.—May 28, 1918, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 35 feet above gage.

CHANNEL AND CONTROL.—Channel is solid rock with steep rock and hardpan banks. Control is solid-rock ledge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.08 feet at 9.40 a. m. March 25 (discharge, 645 million gallons per day or 998 second-feet); minimum stage recorded during year, 0.33 foot at 8.30 p. m. December 22 (discharge, 0.1 million gallons per day or 0.16 second-foot).

1918–1920: Maximum stage recorded during period of record, 9.85 feet at noon December 6, 1918 (discharge, 2,020 million gallons per day or 3,130 second-feet); minimum stage recorded in 1919.

DIVERSIONS.—A small amount of water is diverted by Kula pipe line above station at elevation 4,300 feet.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and Territorial lands below.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 150 million gallons per day. Operation of water-stage recorder unsatisfactory prior to September 18, 1919. Records good when water-stage recorder was working.

Discharge measurements of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 10	A. H. Wong	0.52	0.75	0.5
Oct. 10	R. D. Klise	.52	1.7	1.1
Jan. 17	Reid Jerman	.46	.65	.40
Mar. 25	B. F. Rush	2.56	239	154
Apr. 13	Reid Jerman	.60	2.7	1.75

Daily discharge, in million gallons, of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1902.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	1.4	.....	0.8	0.5	0.2	3.3	0.4	0.9	5.1	0.6	0.6
2	.....	1.3	.....	1.1	.5	.2	2.0	.4	.5	6.9	.7	.7
3	.....	1.8	.....	.8	.5	.2	2.3	.4	.4	4.2	.6	2.0
4	.....	5.2	.....	2.0	.5	.8	1.5	.4	.3	2.5	.6	1.3
5	.....	30	.....	14.5	.4	.5	1.6	.3	.3	11.3	.6	.7
6	.....	6.6	.....	35	.4	.3	1.4	.3	.3	9.7	.6	.7
7	.....	35	.....	2.0	1.1	.2	1.1	.3	.5	7.5	.5	.5
8	.....	11.5	.....	1.3	1.2	.2	.9	.3	1.6	2.8	.6	.4
9	.....	.....	.....	1.1	.7	.2	.8	.2	1.6	1.6	.5	.4
10	.....	.....	.....	1.0	.6	.2	.7	.3	.....	1.4	.5	.5
11	1.5	.....	.....	.9	5.9	.1	1.1	.3	.....	1.3	.6	.9
12	.....	.....	.....	.8	1.6	.1	1.2	.6	.....	1.1	.6	.7
13	.....	.....	.....	.7	1.2	.1	1.0	.5	1.2	1.6	.5	2.6
14	.....	.....	.....	.7	2.0	.1	1.0	.4	1.1	1.4	.4	1.1
15	.....	.....	.....	.6	2.3	.1	.7	.6	1.0	1.3	.4	2.0
16	.....	.....	.....	.6	1.1	.2	.6	.5	1.0	1.4	.4	.9
17	.....	.....	.....	.6	.7	.2	6.5	.4	3.2	1.2	.6	.7
18	.....	.....	0.7	.5	.5	.1	6.2	1.0	15.2	.9	.6	.6
19	.....	.....	.7	.5	.4	.1	1.5	.6	59	.8	.4	.5
20	.....	.....	.5	.5	.4	.1	.8	.4	101	.7	.5	.4
21	.....	.....	.5	.5	.3	.1	.6	.4	60	.7	.5	.3
22	.....	.....	.6	.5	.3	.1	15.8	2.1	93	.6	.5	.3
23	.....	.....	.5	.5	.3	5.9	3.0	4.3	32	4.6	.4	.4
24	.....	.....	.4	.6	.2	1.7	1.2	1.1	62	3.5	.4	.3
25	.....	.....	.5	.5	.2	.6	.7	.6	233	1.5	.4	.3
26	.....	.....	.3	.4	.2	.3	.7	.5	27	1.0	.3	.2
27	.....	.....	.2	.4	.2	9.8	.6	.6	7.2	.7	.4	.2
28	.....	.....	.2	.4	.2	12.8	.6	.6	3.5	.7	.4	.2
29	.....	.....	.2	.5	.2	28	.6	.8	2.8	.7	.6	.2
30	.....	.....	.3	.5	.3	36	.5	.....	4.3	.6	.4	.2
31	1.6	.....	.....	.5	.....	66	.5	.....	4.8	.....	.4	.....

NOTE.—Mar. 10–12, clock stopped; discharge estimated at 1.5 millions gallons per day.

Monthly discharge of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
October	35	0.4	2.30	3.56	71.3	219
November	5.9	.2	.83	1.28	24.9	76
December	66	.1	5.34	8.26	166	508
January	15.8	.5	1.97	3.05	61	187
February	4.3	.2	.68	1.05	19.6	60
March	233	.3	23.3	36.1	723	2,220
April	11.3	.6	2.64	4.08	79.3	243
May	.7	.3	.50	.77	15.5	48
June	2.6	.2	.69	1.07	20.8	64

WAIKAMOI STREAM NEAR HUELO, MAUI.

LOCATION.—500 feet above Spreckels ditch intake and 5 miles by trail east of Huelo post office.

RECORDS AVAILABLE.—December 18, 1910, to June 30, 1920. Data have been revised in this report from January 16, 1916.

GAGE.—Stevens continuous water-stage recorder installed April 20, 1920. Friez water-stage recorder October 14, 1913, to April 20, 1920, prior to which original staff gage at different datum was read twice daily.

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

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; banks high and covered with vegetation. Water drops over a fall at control, which is rock ledge and boulders and fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.62 feet at 8.20 a. m. March 25 (discharge, approximately 1,590 million gallons per day or 2,460 second-feet); minimum stage recorded, -0.25 foot at 11 a. m. May 28 (discharge, 0.4 million gallons per day or 0.6 second-foot).

1910–1920: Maximum stage recorded, 7.57 feet at 5 a. m. January 18, 1916 (discharge, computed from extension of rating curve, approximately 1,800 million gallons per day or 2,780 second-feet); minimum stage recorded, 1.08 feet, old datum September 28, 1912 (discharge, 0.3 million gallons per day or 0.5 second-foot).

DIVERSIONS.—A small amount of water is diverted by Kula pipe line above station at elevation 4,300 feet.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of additional diversions or flood storage. Also to assist valuation appraisers in relation to Territorial water license to ditch company.

UTILIZATION.—Low water is all diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined and used as follows: First curve July 1, 1915, to January 15, 1916; second curve January 16, 1916, to March 14, 1916, and noon March 19, 1917, to November 6, 1917; third curve March 15, 1916, to September 6, 1916, and September 3, 1919, to March 24, 1920; fourth curve September 7, 1916, to noon March 19, 1917, and December 7, 1918, to March 22, 1919; fifth curve November 7, 1917, to December 6, 1918, and March 23, 1919, to September 2, 1919; sixth curve March 25, 1920, to June 30, 1920. Curves from January 16, 1916, have been revised on basis of all measurements made since that time. Operation of water-stage recorder unsatisfactory at times and discharges for such periods have been estimated. Records good when water-stage recorder was operating and fair for other times. At medium and high stages, and especially while it is raining, water spills into the stream above the station from New Hamakua ditch. Except for low flow, therefore, the flow at this station is not the true flow of the stream.

Discharge measurements of Waikamoi Stream near Huelo, Maui, during the year ending June 30, 1920.

Date	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 3	R. D. Klise	0.57	3.6	2.3
Dec. 29	J. E. Stewart	1.48	73	47.5
Jan. 25	Reid Jerman	.50	2.6	1.7
Feb. 17	J. E. Stewart	.41	1.7	1.1
Apr. 3	Reid Jerman	1.00	33.5	21.7
27	do	.27	3.5	2.2

Daily discharge, in million gallons, of Waikamoi Stream near Huelo, Maui, for the years ending June 30, 1916–1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1915–16.												
1	31	2.0	2.0	39	160	3.2	6.0	4.0	26	1.5	840	51
2	14.0	1.6	2.3	39	190	4.8	4.8	3.1	27	2.0	320	37
3	7.1	2.8	35	44	292	6.0	4.0	3.0	10.6	1.4	194	94
4	9.6	12.0	20.0	17.0	141	14.0	4.0	3.0	14.9	1.2	391	39
5	23	2.3	7.1	12.0	48	6.0	74	32	24	1.1	217	28
6	48	2.8	3.2	9.6	27	74	35	49	10.0	1.0	341	16.1
7	31	2.0	6.0	9.6	14.0	27	23	13.6	26	1.0	145	8.8
8	14.0	1.6	3.2	6.0	53	9.6	535	8.7	18.1	1.1	160	10.6
9	20.0	1.3	2.8	17.0	80	6.0	470	6.7	8.2	1.7	85	6.6
10	12.0	1.0	6.0	23	86	4.8	160	5.4	30	9.3	33	4.2
11	7.1	1.3	39	23	53	4.0	48	4.3	12.4	2.5	26	6.1
12	6.0	9.6	27	100	17.0	4.0	14.0	3.3	7.2	1.4	36	10.2
13	4.8	4.8	9.6	86	17.0	3.2	9.6	2.8	36	1.2	19.9	11.7
14	4.0	3.2	9.6	80	27	2.8	6.0	2.7	160	2.0	8.8	50
15	4.0	3.2	7.1	31	39	2.8	3.2	2.4	142	16.1	4.6	22
16	27	2.8	6.0	14.0	12.0	6.0	5.4	2.3	29	8.2	2.8	13.8
17	123	2.8	4.8	7.1	9.6	4.0	50	1.9	12.2	5.8	7.4	18.0
18	27	4.0	4.0	23	27	6.0	278	1.8	5.8	24	9.5	19.0
19	12.0	6.0	4.0	31	93	48	131	2.1	4.2	33	10.2	13.8
20	7.1	7.1	4.0	100	44	23.0	32	3.7	2.9	51	30	14.7
21	4.8	4.8	3.2	74	44	17.0	16.4	3.6	5.8	72	32	30
22	4.0	3.2	23	39	31	53	11.0	2.6	32	9.8	36	36
23	3.2	2.8	9.6	44	14.0	12.0	8.7	2.1	24	53	29	14.7
24	2.8	4.8	48	23	9.6	7.1	7.2	2.0	6.6	39	15.1	7.4
25	4.0	14.0	44	27	7.1	17.0	6.2	1.9	5.8	15.8	8.1	6.9
26	4.0	6.0	100	44	6.0	68	5.8	2.6	4.0	7.8	4.4	47
27	4.8	4.0	86	48	6.0	68	6.4	34	3.3	14.6	2.6	66
28	4.0	2.8	115	107	6.0	17.0	5.8	9.5	2.6	36	3.9	127
29	2.8	2.3	58	123	4.8	12.0	4.3	5.2	2.4	11.1	37	32
30	2.3	2.3	48	86	3.2	9.6	4.0	.....	2.6	48	12.2	28
31	2.0	2.0	.....	80	.....	6.0	5.8	.....	2.1	.....	23	.....
1916–17.												
1	14.7	52	21	15.6	16.0	.....	7.1	1.7	7.8	14.8	53	4.2
2	10.2	61	34	16.4	59	.....	6.4	1.6	3.1	10.8	21	40
3	10.2	58	11.7	7.8	55	60	7.8	1.6	27	5.2	18.7	9.3
4	6.9	21	6.4	5.4	23	29	58	1.6	31	14.1	11.7	8.7
5	9.5	12.2	19.6	4.6	174	12.1	37	1.5	11.8	17.7	7.4	17.2
6	4.8	8.8	17.7	3.9	88	8.8	45	1.4	6.4	7.2	7.9	14.4
7	2.5	6.1	76	3.6	22	7.6	30	1.3	3.8	6.2	6.0	9.7
8	1.5	4.0	31	3.6	16.0	6.9	12.1	1.2	6.1	5.0	5.2	16.4
9	1.2	4.2	24	3.7	11.8	51	8.8	1.2	7.1	4.3	4.6	13.2
10	2.5	5.2	21	2.7	9.8	199	7.1	1.1	4.3	4.2	4.3	8.2
11	25	17.1	15.3	2.4	9.6	42	9.8	1.0	2.7	18.1	4.6	13.4
12	9.2	43	11.8	4.7	6.2	.....	16.4	1.0	3.3	6.0	6.7	7.2
13	18.7	42	9.8	2.7	4.6	.....	7.8	1.0	4.6	4.4	7.4	5.6
14	15.3	56	7.1	2.2	4.4	.....	5.3	12.5	4.4	5.8	14.9	4.6
15	23	22	12.8	2.7	5.0	.....	4.0	5.0	7.3	6.7	11.7	4.0
16	36	7.8	11.0	3.5	114	.....	3.3	2.1	5.1	5.8	11.8	3.8
17	51	11.3	5.8	15.7	65	89	2.9	1.6	2.7	8.7	51	3.7
18	17.1	14.0	7.1	10.4	16.4	55	2.5	1.4	2.7	7.2	62	.....
19	10.6	27	65	7.1	10.4	65	2.3	4.7	2.9	4.8	12.4	.....
20	5.6	30	17.8	4.1	8.3	50	2.2	5.3	2.9	8.3	10.4	.....
21	3.3	21	11.5	2.5	6.7	229	2.0	7.8	2.4	6.0	10.4	.....
22	2.0	13.4	19.6	2.5	5.1	303	1.9	3.0	2.1	8.2	9.7	.....
23	1.5	10.7	28	4.7	4.3	520	1.8	1.7	2.6	6.0	17.8	.....
24	1.2	11.3	26	4.4	8.3	85	1.8	1.3	2.6	4.4	15.6	3.7
25	1.0	5.3	23	3.1	9.6	26	4.1	1.2	3.4	3.8	11.0	3.2
26	1.9	6.0	12.4	11.2	21	16.9	35	1.2	5.0	3.8	7.4	2.9
27	10.4	4.4	10.1	28	26	16.0	6.7	3.1	3.6	3.3	6.7	11.6
28	9.2	4.8	9.3	13.8	.....	33	3.7	52	3.7	24	9.3	9.0
29	5.2	4.6	6.5	15.1	.....	15.7	2.5	.....	9.7	215	6.4	6.4
30	26	2.4	5.3	40	.....	10.1	2.4	.....	8.5	104	5.0	4.2
31	100	23	.....	25	.....	8.0	2.0	.....	7.2	.....	4.4	.....

Daily discharge, in million gallons, of Waikamoi Stream near Huelo, Maui, for the year ending June 30, 1916–1920—Continued.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1917–18.												
1	4.2	3.1	1.2	1.4	1.9	22	3.5	9.8	30	23	10.6	8.4
2	3.9	5.0	1.1	.4	8.1	10.9	2.2	5.2	159	341	6.3	8.9
3	4.2	4.3	1.0	.2	5.0	7.5	3.8	4.1	189	403	11.9	6.5
4	5.8	2.6	.8	.2	25	7.3	3.7	3.4	102	30	34	5.0
5	13.5	1.7	.8	.2	10.0	4.6	3.0	2.9	24	64	12.0	4.3
6	6.7	1.5	.6	.2	6.9	3.8	2.4	3.0	10.9	118	6.1	4.0
7	4.2	1.9	.7	.4	46	3.4	2.0	2.7	17.1	38	5.0	3.7
8	3.7	1.8	.7	.4	24	3.2	11.9	10.8	16.6	43	4.3	3.6
9	4.3	3.0	.5	.2	21	3.0	19.4	225	17.5	302	4.2	4.3
10	6.4	2.7	.5	.4	5.0	2.7	5.3	85	24	509	19.7	13.7
11	4.0	3.2	.3	3.0	3.3	2.4	104	65	122	53	8.4	26
12	3.3	3.6	.9	.9	2.7	3.0	10.9	75	36	25	33	73
13	2.8	6.6	2.0	.3	2.1	5.6	6.1	16.2	7.2	14.6	59	16.7
14	2.5	4.4	1.2	4.6	1.8	6.1	4.2	8.9	8.3	39	13.4	8.9
15	2.5	2.6	.6	7.2	1.6	7.6	7.1	5.9	3.1	27	18.0	76
16	2.6	1.9	.3	4.8	1.5	3.4	22	4.6	32	11.2	22	43
17	2.1	1.6	.2	2.1	1.4	2.8	6.1	71	26	8.1	12.6	33
18	1.8	1.4	.2	.8	1.2	2.4	5.0	8.7	8.4	6.3	7.5	10.2
19	1.6	1.2	.2	.6	2.0	2.3	6.1	52	6.1	5.9	5.9	7.0
20	1.6	1.8	.2	.4	1.2	3.6	8.1	347	5.2	7.5	5.0	6.5
21	1.9	1.9	.2	.4	1.1	.....	5.4	59	4.6	9.8	4.6	8.1
22	5.0	36	.2	.4	21	.....	13.6	14.2	4.3	12.3	5.0	12.7
23	11.5	10.5	.2	.5	27	.....	7.3	9.5	4.2	7.0	8.0	8.1
24	4.3	4.3	.2	.5	29	.....	8.1	6.7	26	5.4	50	6.5
25	2.9	3.0	.5	.5	14.9	.....	7.8	5.2	178	4.8	.....	7.5
26	2.2	2.7	1.9	.5	8.9	.....	4.8	5.0	35	4.8	.....	7.3
27	3.0	2.1	1.9	.5	6.1	3.0	5.0	7.6	13.4	8.7	29	7.5
28	7.6	1.8	1.6	.4	6.1	2.8	4.3	55	8.9	8.7	92	6.3
29	3.3	1.7	2.4	1.6	71	2.6	3.5	.....	6.1	15.9	20.0	6.7
30	2.9	1.6	3.3	4.3	113	2.2	37	.....	8.3	40	11.2	8.9
31	2.5	1.5	.....	2.1	.....	2.0	13.4	.....	18.2	.....	8.9	.....
1918–19.												
1	18.7	32	17.8	3.3	79	3.7	9.3	22	4.4	1.5	35	.....
2	32	18.0	12.0	2.7	45	39	5.6	15.7	4.0	1.1	6.7	.....
3	48	17.5	7.0	2.3	17.5	475	8.6	11.0	3.9	1.0	3.8	.....
4	18.7	9.8	5.9	2.6	48	46	27	6.4	2.7	.9	5.0	.....
5	25	11.6	5.4	2.3	35	108	8.8	4.7	34	.9	59	.....
6	10.6	13.4	4.8	2.8	16.3	532	7.8	3.7	95	.8	29	.....
7	11.6	11.2	4.6	2.3	6.3	97	5.8	3.0	80	.8	8.7	.....
8	19.7	13.0	5.6	2.0	4.6	80	4.3	2.6	41	.7	6.5	.....
9	36	7.8	4.3	1.9	4.3	21	3.6	62	84	.8	26	.....
10	260	6.7	4.2	2.3	4.1	25	3.4	18.1	142	.7	8.1	.....
11	28	7.0	4.0	2.3	64	39	3.0	10.0	70	.7	6.3	.....
12	14.6	15.5	3.6	3.1	141	13.1	2.8	21	60	1.0	3.7	.....
13	19.0	50	3.6	5.0	63	8.3	2.5	10.7	34	.8	2.8	.....
14	15.8	32	3.2	3.1	26	33	2.2	7.3	21	.4	2.2	.....
15	18.5	12.0	3.0	2.5	12.3	40	2.2	5.4	14.9	.3	1.6	.....
16	11.2	189	3.2	2.0	6.7	22	2.2	4.6	26	12.6	1.4	.....
17	7.8	108	3.0	1.7	5.4	36	1.9	3.4	38	18.7	8.9	.....
18	6.3	66	4.6	1.6	4.2	22	1.7	2.9	15.3	2.7	49	.....
19	5.9	32	28	2.0	3.7	32	1.6	2.5	10.7	2.6	6.2	.....
20	9.3	91	7.0	7.5	3.3	22	1.4	44	7.3	3.6	3.2	.....
21	30	42	4.2	2.8	3.1	40	1.3	12.1	5.0	8.4	9.5	.....
22	21	23	3.3	2.7	2.8	14.6	1.8	15.3	119	38	7.5	.....
23	104	14.6	8.9	2.3	2.7	12.7	44	9.6	68	43	8.7	.....
24	56	11.6	5.9	2.0	2.6	14.9	39	11.0	35	32	8.7	.....
25	126	9.5	6.5	2.0	2.4	11.8	23	13.2	16.2	27	5.4	.....
26	32	8.7	3.7	30	2.8	7.8	7.7	5.6	8.9	23	3.7	.....
27	28	8.7	2.9	13.0	3.8	7.1	34	4.6	4.2	19.0	.....	.....
28	68	35	2.5	9.2	14.2	5.6	47	3.8	2.9	8.4	.....	.....
29	46	20.0	7.7	7.3	39	4.7	44	.....	2.3	4.5	.....	.....
30	19.5	10.2	9.9	55	6.1	17.4	17.3	.....	1.8	5.6	.....	.....
31	36	13.2	.....	17.5	.....	31	48	.....	1.6	.....	.....	.....

Daily discharge, in million gallons, of Waikamoi Stream near Huelo, Maui, for the years ending June 30, 1916–1920—Continued.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1919–20.												
1	.....	.....	.....	.....	1.4	0.8	14.4	1.0	2.0	28	1.4	1.4
2	.....	.....	.....	.....	1.4	.8	9.5	1.0	1.2	29	1.4	3.7
3	.....	.....	.....	.....	1.2	.8	6.4	.9	.9	20.0	1.3	5.0
4	.....	.....	.....	2.6	1.1	1.9	4.2	.9	.8	15.6	1.3	2.6
5	.....	.....	.....	34	1.0	2.1	4.2	.9	.8	37	1.3	1.1
6	.....	.....	.....	112	1.0	1.2	3.5	.9	.7	36	1.2	.8
7	.....	.....	.....	27	1.4	.9	2.9	.8	.9	33	1.1	.6
8	.....	.....	.....	11.7	2.6	.7	2.5	.8	2.1	17.3	1.0	.5
9	.....	.....	.....	4.2	2.5	.6	2.2	1.0	3.5	10.4	.9	.6
10	.....	.....	.....	3.7	1.7	.5	1.9	1.4	2.0	6.0	.9	.7
11	.....	.....	.....	3.3	28	.5	2.8	1.4	1.9	8.5	.9	1.7
12	.....	.....	.....	2.8	6.4	.5	3.5	1.2	16.0	4.8	1.0	1.4
13	.....	.....	.....	2.6	5.8	.7	2.8	1.1	7.4	11.8	.8	7.0
14	.....	.....	.....	2.6	6.9	.8	2.1	1.0	2.4	3.7	.7	2.8
15	.....	.....	.....	2.5	6.6	.8	1.6	1.4	1.6	2.7	.7	4.9
16	.....	.....	.....	2.5	3.8	.9	1.5	1.2	1.5	3.2	.7	1.7
17	.....	.....	.....	2.4	2.9	1.0	6.9	1.1	3.9	3.1	.7	1.3
18	.....	.....	.....	1.9	2.0	1.0	10.2	4.5	40	2.3	.9	1.0
19	.....	.....	.....	1.7	1.5	.9	3.1	2.5	111	2.0	.7	.8
20	.....	.....	.....	1.7	1.5	.8	1.9	1.1	196	1.9	.7	.7
21	.....	.....	.....	2.0	1.4	.8	1.4	.9	139	1.7	.6	.6
22	.....	.....	.....	1.9	1.3	.8	22	2.3	287	1.6	.6	.6
23	.....	.....	.....	1.6	1.2	21	5.2	8.8	66	17.1	.5	.7
24	.....	.....	.....	1.7	1.1	6.1	2.4	1.9	104	10.0	.5	.6
25	.....	.....	.....	1.6	1.1	2.6	1.6	1.2	378	4.0	.5	.5
26	.....	.....	.....	1.4	1.0	1.7	1.4	1.0	65	3.1	.5	.....
27	.....	.....	.....	1.6	.9	18.3	1.4	1.1	36	2.3	.4	.....
28	.....	.....	.....	1.7	.9	32	1.3	1.1	23	2.0	.5	.....
29	.....	.....	.....	1.7	.8	90	1.2	1.4	14.4	1.8	.6	.5
30	.....	.....	.....	1.4	.8	79	1.1	.....	31	1.6	.5	.6
31	.....	.....	.....	1.2	.....	123	1.0	.....	23	.....	.6	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: Nov. 28–30, 1916, 30; Dec. 1–2, 25; Dec. 12–16, 35; June 18–23, 1917, 4.0, and May 27–31, 1919, 2.5. Discharge estimated in million gallons per day by comparison with records of adjacent streams as follows: Dec. 21–26, 1917, 5, and May 25–26, 1918, 40. Discharge estimated in million gallons per day by comparison with Puohakamoa Stream near Huelo as follows: Oct. 1–3, 1919, 2.0, and June 26–28, 1920, 0.5.

Monthly discharge of Waikamoi Stream near Huelo, Maui, for the years ending June 30, 1916–1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1915–16.						
July	123	2.0	15.2	23.5	470	1,450
August	14.0	1.0	3.97	6.14	123	378
September	115	2.0	24.6	38.1	738	2,260
October	123	6.0	45.4	70.2	1,410	4,320
November	292	3.2	52.0	80.5	1,560	4,790
December	74	2.8	17.5	27.1	543	1,660
January	535	3.2	63.7	98.6	1,970	6,060
February	49	1.8	7.56	11.7	219	673
March	160	2.1	22.5	34.8	698	2,140
April	72	1.0	15.8	24.4	474	1,450
May	840	2.6	99.5	154	3,080	9,470
June	127	4.2	29.0	44.9	870	2,670
The year	840	1.0	33.2	51.4	12,200	37,300
1916–17.						
July	100	1.0	14.1	21.8	437	1,340
August	61	2.4	19.7	30.5	610	1,870
September	76	5.3	19.3	29.9	578	1,780
October	40	2.2	8.81	13.6	273	838
November	174	4.3	29.6	45.8	890	2,730
December	520	6.9	69.8	108	2,160	6,640
January	58	1.8	11.0	17.0	340	1,050
February	52	1.0	4.32	6.68	121	371
March	31	2.1	6.38	9.87	198	607
April	215	3.3	18.1	28.0	544	1,670
May	62	4.3	14.1	21.8	436	1,340
June	40	2.9	8.29	12.8	249	763
The year	520	1.0	18.7	28.9	6,840	21,000
1917–18.						
July	13.5	1.6	4.15	6.42	129	395
August	36	1.2	3.97	6.14	123	378
September	3.3	.2	.88	1.36	26.4	81
October	7.2	.2	1.30	2.01	40.4	124
November	113	1.1	15.7	24.3	470	1,450
December	22	2.0	4.85	7.50	150	461
January	104	2.0	11.2	17.3	347	1,070
February	347	2.7	41.7	64.5	1,170	3,580
March	189	3.1	37.1	57.4	1,150	3,530
April	509	4.8	72.9	113	2,190	6,710
May	92	4.2	19.6	30.3	608	1,860
June	76	3.6	14.7	22.7	442	1,350
The year	509	.2	18.8	29.1	6,850	21,000
1918–19.						
July	260	5.9	38.2	59.1	1,180	3,630
August	189	6.7	30.3	46.9	940	2,880
September	28	2.5	6.34	9.81	190	584
October	55	1.6	6.42	9.93	199	611
November	141	2.4	22.3	34.5	669	2,050
December	532	3.7	60.1	93.0	1,860	5,720
January	48	1.3	13.3	20.6	413	1,270
February	62	2.5	12.0	18.6	336	1,030
March	142	1.6	34.0	52.6	1,050	3,230
April	43	.3	8.72	13.5	262	803
May	59	1.4	10.6	16.4	329	1,010
June	.....	.....	2.50	3.87	[a] 75.0	230
The year	532	.....	20.6	31.9	7,500	23,000
1919–20.						
July	.....	.....	15.2	23.5	[a] 470	1,450
August	.....	.....	19.7	30.5	[a] 610	1,870
September	.....	.....	11.7	18.1	[a] 350	1,080
October	112	1.2	7.84	12.1	243	746
November	28	.8	3.04	4.70	91.2	280
December	123	.5	12.7	19.6	394	1,210
January	22	1.0	4.13	6.39	128	393
February	8.8	.8	1.58	2.44	45.8	141
March	378	.7	50.4	78.0	1,560	4,790
April	37	1.6	10.7	16.6	322	985
May	1.4	.4	.82	1.27	25.4	78
June	7.0	.....	1.53	2.37	45.9	141
The year	378	.4	11.7	18.1	4,290	13,200

[a] Estimated by comparison with Puohakamoa Stream near Huelo.

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, 1920.

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, 4.77 feet at 3.30 a. m. October 6 (discharge, 82 million gallons per day or 127 second-feet); minimum stage recorded, 0.20 foot 11.40 p. m. October 25 (discharge, 0.1 million gallons per day or 0.16 second-foot).

1917–1920: Maximum stage recorded, 4.63 feet at 3. p. m. April 2, 1918 (discharge, 87 million [12] gallons per day 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.

OBJECT OF STATION.—To determine discharge of ditch at boundary between Territorial lands above and fee simple lands below.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed by flood of October 5 and 6. Rating curve used July 1 to October 5 well defined between 3 and 50 million gallons per day. Rating curve used October 6 to June 30 well defined between 2 and 40 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 working. Fair at other times.

Discharge measurements of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 15	H. A. R. Austin	1.97	38	24.4
30	do	1.99	36	23.4
Oct. 3	R. D. Klise	1.45	21.7	14.0
Nov. 12	A. H. Wong	1.40	19.1	12.3
Jan. 10	Reid Jerman	1.03	11.1	7.2
Feb. 5	do	.79	5.8	3.7
Apr. 3	B. F. Rush	.89	7.9	5.1

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

Daily discharge, in million gallons, of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	11.5	21	20.0	8.8	5.4	3.8	25	4.5	7.4	8.2	4.5	8.2
2	24	19.0	21	17.0	5.4	3.7	24	4.4	4.1	6.0	2.6	8.9
3	8.6	19.0	23	13.0	4.8	3.7	18.9	4.4	3.5	5.0	2.7	15.4
4	6.1	23	15 0	13.5	4.9	5.3	12.8	4.1	3.2	4.4	2.6	10.4
5	4.2	25	14.0	37	4.8	5.0	12 0	3.9	3.2	5.7	2.5	5.0
6	3 0	24	14.0	29	4.6	4.1	10 4	3.8	3.1	4.9	3.8	4 5
7	2.3	25	14.0	12.1	5.7	3.8	9.0	3.8	3.4	8.8	7.0	3.8
8	1.7	24	4.2	7.7	7.0	3 7	8.1	3 7	6.3	17.8	6.6	3.5
9	1.5	24	.9	4.0	5.3	3.6	7.4	4.0	10.4	29	6.4	3.6
10	3.8	24	15.9	3.2	5.3	3.5	7.1	4.9	7.1	27	6.1	4.3
11	6.0	24	27	2.8	27	3.5	9.3	4 5	6.6	27	6.1	7.0
12	31	23	21	2 4	13.6	3.5	10.4	4.3	15.5	23	6.1	5.2
13	27	24	17.0	2.3	12.8	3.4	8.4	4 0	18.9	29	5.4	15.4
14	24	23	17.0	1.1	13 6	3.4	7.5	4.0	8.1	20.0	5.3	9.6
15	25	24	15 0	.6	15.4	3.4	7.0	5.4	6.3	17.1	5.2	16.2
16	24	23	12.8	.6	8 8	3.5	6 3	4.6	5.3	16.2	5.2	8.0
17	19.0	23	11.7	1.6	7 5	3 6	8.9	4 5	8.3	14.5	5.0	6.4
18	16.0	23	11.3	1.8	7.3	3.4	18.0	8.4	29	13.6	5 2	5.6
19	15 0	23	11.1	1 8	6.8	3.3	8.8	4.9	31	12 8	4.5	4.9
20	14.0	22	10 9	1.8	6.6	3.1	6.7	4 0	27	12 0	4.3	4.4
21	18.0	21	8.9	2 9	6.1	3 1	5.9	4.0	30	11.2	4.1	4.3
22	24	19.0	8 8	3.9	5.9	3 1	14.9	4.3	43	10.4	4.0	4.1
23	18.0	18 0	8 2	4 9	5 6	20.0	12 8	15 1	18.9	25	3 8	4.1
24	14.0	15 0	7.9	7.3	5.2	11.7	7.4	6 0	25	20.0	3.8	3.9
25	23	12 4	7.3	2.2	4 9	5.6	6.1	4.1	29	12 8	3.7	3.8
26	22	13 0	7.3	3.9	4.6	4 3	5.6	3.7	15.4	12.0	3.6	3.7
27	25	14 0	6.6	7.1	4.4	18 3	5 4	3 8	7 3	10.4	3 5	3.6
28	26	12.4	6.3	6 1	4.1	29	5.3	4 0	5 7	9 6	3.4	3.6
29	25	15 0	7.0	5 9	3.9	41	5.2	5 9	4.0	9.3	3 9	3.7
30	25	20.0	7.5	5.3	3.9	31	4.9	.....	10.5	8.4	3.4	4.1
31	24	22	.....	5.3	.....	31	4.6	.....	5.8	.....	3.6	.....

NOTE.—Nov. 17-30 paper supply ran out and graph was estimated by comparison with Waikamoi Stream near Huelo.

Monthly discharge of Spreckels ditch below Kaaiea Gulch, near Huela, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	31	1.5	16.5	25.5	512	1,570
August	25	12.4	20.7	32.0	642	1,970
September	27	.9	12.4	19.2	373	1,140
October	37	.6	7.00	10.8	217	666
November	27	3.9	7.37	11.4	221	679
December	41	3.1	8.79	13.6	272	836
January	25	4.6	9.81	15 2	304	933
February	15.1	3.7	4 86	7.52	141	433
March	43	3.1	13.0	20.1	402	1,240
April	29	4 4	14.4	22.3	431	1,330
May	7.0	2.5	4 45	6.89	138	423
June	16.2	3.5	6.31	9.76	189	581
The year	43	.6	10.5	16.2	3,840	11,800

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, 1920.

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.—1917–1920: Maximum stage recorded, 4.26 feet 6 p. m March 22, 1920 (discharge, 89 million gallons per day or 138 second-feet); minimum stage recorded, 0.03 foot 6.30 p. m. March 3, 1920 (discharge, 0.1 million gallons per day or 0.16 second-foot.)

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.

OBJECT OF STATION.—To determine amount of water diverted by ditch from areas involved under Territorial water license.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 70 million gallons per day. Operation of water-stage recorder satisfactory. Records excellent.

Daily discharge, in million gallons, of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.3	1.1	12.2	0.3	0.3	0.3	2.4	0.3	0.3	6.6	0.4	0.9
2	12.8	.9	6.3	.6	.3	.3	2.1	.3	.2	5.9	.4	.6
3	.7	1.0	30	.6	.3	.2	1.3	.3	.2	3.0	.4	.8
4	.4	5.0	8.0	.7	.3	.3	1.0	.3	.2	2.3	.4	.3
5	.4	15.4	4.0	10.9	.3	.3	1.0	.3	.2	9.1	.4	.2
6	.3	7.9	2.1	29	.3	.3	.7	.3	.2	8.1	.4	.2
7	.3	17.8	1.6	5.9	.3	.3	.7	.3	.2	7.2	.4	.2
8	.3	7.7	3.3	2.0	.3	.3	.7	.3	.4	2.7	.3	.2
9	.3	3.0	1.6	.9	.3	.3	.6	.3	.4	1.6	.3	.2
10	.3	2.0	4.1	.7	.3	.3	.6	.4	.4	1.3	.3	.2
11	.5	1.6	1.3	.7	7.4	.3.	.9	.5	.3	1.3	.3	.2
12	.....	1.5	.9	.6	.9	.3	.9	.3	7.2	1.2	.3	.2
13	.....	7.0	.7	.6	.8	3	.6	.3	2.7	1.6	.3	.5
14	8.8	2.0	.7	.5	.8	.2	.5	.2	.6	1.1	.3	.3
15	13.7	14.5	.6	.6	.9	.3	.4	.2	.4	.9	.3	.8
16	2.0	7.2	.5	.6	.6	.	.4	.2	.4	.7	.3	.3
17	.7	7.0	.5	.6	.5	.3	.6	.3	.3	.7	.3	.3
18	.6	3.4	.5	.5	.4	.3	.6	.6	13.2	.6	.3	.3
19	.6	3.9	.5	.5	.3	.3	.5	.3	30	.6	.2	.3
20	.5	1.3	.5	.5	.3	.2	.4	.2	48	.6	.2	.2
21	1.9	1.2	.4	.5	.3	.2	.4	.2	45	.5	.2	.2
22	1.9	1.1	.3	5	.3	.2	1.3	.2	57	.5	.2	.2
23	.6	.9	.3	.4	.3	4.4	.5	.4	35	1.7	.2	.2
24	.6	.8	.3	.4	.3	.6	.4	.2	40	.8	.2	.2
25	3.2	.7	.3	.4	.3	.3	.4	.2	58	.6	.2	.2
26	1.1	.7	.3	.4	.3	.3	.3	.3	29	.6	.2	.2
27	11.0	.6	.3	.5	.3	.3	.3	.2	8.8	.5	.2	.2
28	11.0	.6	.3	.4	.3	4.4	.3	.2	3.0	.4	.2	.2
29	3.8	1.6	.3	.4	.3	26	.3	.4	2.1	.4	.2	.2
30	1.7	6.3	.3	.4	.3	24	.3	.....	9.3	.4	.2	.2
31	1.3	29	.....	.3	.....	28	.3	.....	4.6	.....	.2	.....

NOTE.—Clock stopped July 12–13, and discharge estimated at 8 million gallons per day. Graph partly estimated July 11.

Monthly discharge of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	13.7	0.3	3.15	4.87	97.6	300
August	29	.6	4.99	7.72	155	475
September	30	.3	2.77	4.29	83.0	255
October	29	.3	2.00	3.09	61.9	190
November	7.4	.3	.63	.98	18.9	58
December	28	.2	3.05	4.72	94.4	290
January	2.4	.3	.70	1.08	21.7	67
February	.6	.2	.29	.45	8.5	26
March	58	.2	12.8	19.8	398	1,220
April	9.1	.4	2.12	3.28	63.5	195
May	.4	.2	.28	.43	8.7	27
June	.9	.2	.31	.48	9.2	28
The year	58	.2	2.79	4.32	1,020	3,130

CENTER DITCH AT WAIKAMOI, NEAR HUELO, MAUI.

LOCATION.—250 feet below intake in Waikamoi Stream and 4 miles by trail east of Huelo.

RECORDS AVAILABLE.—March 6, 1918, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Trapezoidal section of ditch; 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.—1918–1920: Maximum stage recorded, 3.26 feet at 4 a. m. September 3, 1919 (discharge, 74 million gallons per day, or 114 second-feet); minimum stage recorded, ditch dry December 4, 1918, and January 16, 1919; minimum stage recorded during the year, 0.11 foot at 1.40 p. m. February 28 (discharge, 0.2 million gallons per day or 0.3 second-foot).

DIVERSIONS.—Ditch diverts water that arises below or passes Spreckels ditch.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—The discharge at this station less the discharge at the Manuel Luis ditch station shows water diverted from Territorial lands under water license No. 974.

UTILIZATION.—Water used 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 unsatisfactory. Records excellent when water-stage recorder was working.

Discharge measurements of Center ditch at Waikamoi, near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 13	H. A. R. Austin	1.23	24.1	15.6
Oct. 4	R. D. Klise	.29	2.3	1.5
Jan. 13	Reid Jerman	.28	2.6	1.65
Mar. 30	do	1.16	23.0	14.9
Apr. 28	do	.30	1.6	1.05

Daily discharge, in million gallons, of Center ditch at Waikamoi, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	22	3.7	57	1.1	.....	0.4	16.9	0.6	0.6	42	4.4	3.1
2	29	3.2	28	1.9	.....	.4	7.8	.6	.4	45	5.8	1.3
3	1.8	3.2	53	1.8	.....	.4	3.1	.6	.4	42	5.7	4.0
4	1.5	28	42	.....	.....	1.0	2.4	.6	.4	42	5.6	1.3
5	1.5	63	32	.....	.....	.6	2.5	.4	.4	42	5.6	.8
6	1.4	54	14.5	.....	.....	.5	2.0	.4	.4	45	4.3	.7
7	1.3	47	8.1	.....	.....	.....	1.8	.4	.4	45	1.0	.7
8	1.2	54	20.0	.....	.....	.....	1.6	.4	.6	31	1.0	.7
9	1.1	22	14.2	.....	.....	.....	1.5	.5	.8	7.0	1.0	.8
10	1.6	7.4	26	.....	.....	.....	1.5	.9	.7	3.9	.9	1.0
11	.....	5.6	7.8	.....	.....	.....	.....	.8	.6	5.0	.9	1.0
12	.....	5.6	3.3	.....	.....	.....	.....	.5	17.9	3.4	.9	.9
13	.....	36	2.8	.....	.....	.....	.....	.5	11.2	7.9	.9	2.0
14	44	8.5	2.7	.....	.....	.....	1.3	.5	1.1	2.9	.8	1.3
15	58	57	2.4	.....	.....	.....	1.1	.4	.8	2.7	.8	2.2
16	12.9	44	2.3	.....	.....	.....	1.1	.5	.7	2.5	.8	1.3
17	2.7	48	2.1	.....	.....	.....	3.0	.4	.8	2.4	.8	1.2
18	2.3	24	2.0	.....	.....	.....	1.6	.9	55	2.0	.9	1.0
19	2.2	25	1.9	.....	.....	.....	1.2	.4	60	2.2	.8	.9
20	2.2	5.0	1.9	.....	.....	.....	1.0	.4	60	2.1	.8	.8
21	13.2	4.3	1.6	.....	.....	.....	.9	.4	60	1.9	.8	.8
22	14.0	3.8	1.5	.....	.....	.....	14.5	.4	54	1.9	.7	.7
23	2.4	3.6	1.4	.....	.....	.....	1.4	6.0	30	15.6	.7	.6
24	2.1	3.1	1.4	.....	.....	.....	1.0	.5	32	4.4	.8	.6
25	24	2.8	1.3	.....	.....	.....	.9	.4	21	1.9	.8	.6
26	3.6	2.9	1.3	.....	.....	.....	.8	.4	15.2	1.7	.7	.6
27	33	2.7	1.1	.....	.....	.....	.8	.4	14.5	1.6	.7	.5
28	60	2.3	1.1	.....	.....	.....	.8	.3	14.5	1.4	.6	.6
29	28	13.2	1.2	.....	.....	.....	.6	.7	14.3	1.4	.6	.6
30	7.0	38	1.2	.....	.4	.....	.7	.....	16.4	1.6	.6	.7
31	4.9	66	.....	.....	.....	59	.6	.....	32	.....	.8	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: July 11–13, 30; and Jan. 11–13, 1.4. Graph partly estimated, July 10.

Monthly discharge of Center ditch at Waikamoi, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	1.1	15.1	23.4	469	1,440
August	66	2.3	22.2	34.3	687	2,110
September	57	1.1	11.2	17.3	337	103
January	16.9	.6	2.54	3.93	78.6	242
February	6.0	.3	.70	1.08	20.2	62
March	60	.4	16.7	25.8	517	1,500
April	45	1.4	13.7	21.2	411	1,260
May	5.8	.6	1.66	2.57	51.5	158
June	4.0	.5	1.11	1.72	33.3	102

NAILIILIHAELE STREAM NEAR HUELO, MAUI.

LOCATION.—300 feet above New Hamakua ditch and 3 miles south of Huelo.

RECORDS AVAILABLE.—October 8, 1913, to June 30, 1918, and August 6, 1919, to June 30, 1920. Also at old staff-gage station below New Hamakua ditch from December 9, 1910, to December 31, 1912.

GAGE.—Stevens continuous water-stage recorder installed December 13, 1917, replacing original Barrett and Lawrence water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 150 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; stream bed very rough and steep; banks steep and high and covered with dense vegetation. Control concrete and large boulders; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.74 feet on March 25 (discharge, 824 million gallons per day or 1,270 second-feet); minimum stage recorded, −0.50 foot frequently between October 3 and November 27 and between January 30 and March 28 (discharge, 0.5 million gallons per day or 0.8 second-foot). Stage was probably lower between October 3 and November 27 and between January 30 and March 28 but instrument would not record below −0.50 foot.

1913–1920. Maximum stage recorded, 6.3 feet at 6.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, approximately 1,800 million gallons per day or 2,780 second-feet); minimum stage recorded (see preceding paragraph).

DIVERSIONS.—Low flow of left branch of stream diverted above station by Old Hamakua ditch since about March 1, 1918.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of additional diversions or flood storage. Also to assist valuation appraisers in relation to Territorial water license to ditch company.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 0.5 and 80 million gallons per day. Operation of water-stage recorder fairly satisfactory but for most of the time from October to March, water surface was below intake and record was meaningless. No estimate has been made for such periods or for when the clock was stopped. Records good when recorder was giving true water-surface elevation.

Discharge measurements of Nailiilihaele Stream near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 7	R. D. Klise	0.09	12.2	7.9
Dec. 28	Reid Jerman	.145	17.3	11.1
Jan. 24	do	−.26	2.8	1.8
Mar. 9	do	−.28	2.5	1.6
Apr. 8	do	.13	14.2	9.2

Daily discharge, in million gallons, of Nailiilihaele Stream near Huelo, Maui, for the year ending June 30, 1920.

Day.	Aug.	Sept.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1		25			11.2		1.5	26	3.0	2.3
2		6.7			12.6		1.4	17.2	3.0	2.2
3		152			7.6		1.2	12.1	2.9	3.8
4		17.8			4.8		.9	10.3	2.8	2.0
5		7.9			5.3		.9	19.4	2.6	1.3
6		5.8			4.5		.8	15.1	2.6	1.2
7	54	5.2	14.4		3.5		.8	18.3	2.4	.9
8	24	6.0	7.0		3.2		1.6	10.3	1.6	.8
9	13.5		5.3				2.5	9.0	1.6	1.0
10	11.2		3.7				1.7	7.3	1.5	1.0
11	10.3		3.3				1.7	8.2	1.4	1.5
12	9.4				2.8		28	7.3	1.4	1.3
13	22				2.6		8.5	9.8	1.3	3.2
14	11.2				2.5		3.0	7.3	1.2	2.1
15	42				2.3	1.3		5.8	1.2	2.8
16	20				2.3			5.5	1.1	1.3
17	18.3				4.0			5.2	1.0	1.3
18	12.1				4.0	2.8		4.3	1.0	1.2
19	12.1				2.3	1.3		4.3	.9	.9
20	7.9				2.0			3.8	.9	.9
21	6.7				1.2			3.7	.9	.8
22	5.3				2.1			3.5	.9	.7
23	4.8				2.5			30	.8	.7
24	4.3				1.7			5.8	.8	.8
25	3.7				1.4			5.0	.9	.8
26	3.3				1.3		48	4.8	.8	.8
27	3.5				1.4		22.	4.1	.8	.8
28	2.8				1.5		14.6	4.0	.9	.9
29	5.0			105	1.2	1.6	11.2	3.5	.9	.9
30	10.8			66			20.0	3.2	.8	1.0
31	50			64			12.1		1.0	

NOTE.—Graph partly estimated Sept. 8, Oct. 7, Jan. 11, Apr. 23–25, and June 24–27. Discharge interpolated Mar. 3. Clock stopped and discharge estimated in million gallons per day, by comparison with adjacent streams as follows: Jan. 9–11, 2.8, and Jan. 30–31, 1.1.

Monthly discharge of Nailiilihaele Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January	12.6		3.30	5.11	102	314
April	30	3.2	9.14	14.1	274	841
May	3.0	.8	1.45	2.24	44.9	138
June	3.8		1.37	2.12	41.2	126

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, 1920.

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 bridge. 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, 8.45 feet at 7.50 a. m. March 25, 1920 (discharge, 335 million gallons per day, or 518 second-feet); minimum stage recorded, 4.14 feet at 1 a. m. and 1.50 p. m. December 22, 1919 (discharge, 0.00.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and Territorial lands below.

UTILIZATION.—Water diverted below by East Maui Irrigation Co.'s ditches for irrigation of cane lands.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder unsatisfactory. Staff gage readings twice daily July 1–10. Records good July 1–10 and when water-stage recorder was working; poor at other times.

Discharge measurements of Kailua Stream at Haiku-uka boundary near Kailiili, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 10	A. H. Wong	4.23	0.15	0.10
Oct. 10	R. D. Klise	4.27	1.2	.75
Mar. 24	Reid Jerman	5.65	117	76
Apr. 12	.....do	4.30	1.2	.75

Daily discharge, in million gallons per day, of Kailua Stream at Haiku-uka boundary near Kailiili, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.9	.....	10.8	0.07	0.01	0.005	1.9	0.07	0.15	16.5	0.2	0.03
2	3.4	.....	1.4	.09	.01	.005	.6	.07	.09	4.4	.09	.03
3	.8	.....	25	.09	.01	.005	.6	.07	.05	2.1	.2	.05
4	.3	.....	2.6	.09	.01	.02	.4	.07	.03	1.1	.2	.09
5	.15	13.8	1.1	2.1	.005	.05	.4	.07	.05	.....	.15	.03
6	.15	2.6	.8	23	.01	.02	.5	.07	.07	.....	.15	.03
7	.07	13.6	.5	1.4	.02	.01	.4	.05	.05	4.0	.09	.02
8	.07	6.3	.8	.5	.05	.01	.3	.03	.07	1.2	.09	.02
9	.07	1.1	.6	.4	.03	.005	.15	.03	.3	.9	.09	.02
10	.07	.6	1.2	.3	.03	.005	.09	.05	.4	.8	.09	.03
11	.....	.6	.8	.15	1.0	.005	.09	.07	.2	.8	.07	.07
12	.....	.5	.4	.15	.3	.005	.15	.05	.....	.6	.09	.05
13	.....	.9	.4	.09	.15	.005	.2	.09	.....	1.1	.07	.3
14	.....	.6	.4	.09	.3	.005	.15	.09	.....	.6	.05	.15
15	.....	8.0	.3	.07	.2	.005	.09	.09	.....	.6	.03	.4
16	.....	2.6	.3	.05	.09	.01	.09	.09	.....	.8	.02	.4
17	.....	2.1	.2	.07	.07	.01	6.7	.15	.....	.6	.02	.09
18	.....	1.4	.2	.05	.03	.005	5.6	.4	.....	.6	.03	.07
19	.....	1.9	.15	.05	.03	.005	.9	.2	.....	.4	.03	.03
20	.....	.9	.15	.05	.02	.005	.4	.09	.....	.2	.03	.03
21	.....	.8	.2	.03	.02	.005	.4	.07	.....	.2	.02	.03
22	.....	.5	.09	.03	.01	.00	12.0	.09	.....	.09	.03	.03
23	.....	.5	.09	.02	.01	1.9	1.4	1.4	.....	3.3	.03	.02
24	.....	.4	.09	.03	.005	.3	.5	.5	.....	2.5	.03	.03
25	.....	.3	.09	.03	.005	.07	.3	.2	129	.6	.03	.03
26	.....	.3	.07	.01	.005	.07	.2	.15	19.2	.5	.03	.03
27	.....	.4	.07	.01	.005	7.1	.15	.07	5.1	.4	.15	.01
28	.....	.2	.07	.01	.005	7.6	.15	.09	2.6	.4	.7	.01
29	.....	.4	.07	.01	.005	23	.15	.07	1.6	.2	.03	.02
30	.....	3.5	.05	.01	.01	28	.15	.....	3.1	.2	.02	.03
31	.....	26	.....	.01	.....	43	.09	.....	2.6	.....	.02	.....

NOTE.—Record torn Apr. 5–6; clock stopped during other periods of no record. Discharge estimated in million gallons per day by comparison with adjacent streams as follows: Aug. 1–4, 0.8; Mar. 12–24, 14; and Apr. 5–6, 4.5. Staff gage readings twice a day, July 1–10.

Monthly discharge of Kailua Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	.....	1.77	2.74	[a] 55.0	168
August	26	0.2	3.03	4.69	94.0	288
September	25	.05	1.63	2.52	49.0	150
October	23	.01	.937	1.45	29.1	89
November	1.0	.005	.082	.127	2.46	8
December	43	.00	3.59	5.55	111	342
January	12.0	.09	1.14	1.76	35.2	108
February	1.4	.03	.157	.243	4.54	14
March	129	.03	11.2	17.3	347	1,070
April	16.5	.09	1.82	2.82	54.7	168
May	.7	.02	.093	.144	2.88	9
June	.4	.01	.073	.113	2.18	7
The year	129	.00	2.15	3.33	787	2,420

[a] Estimated by comparison with flow of adjacent streams.

KAILUA STREAM NEAR HUELO, MAUI.

LOCATION.—About 800 feet above New Hamakua ditch crossing and 1 mile south of Huelo.

RECORDS AVAILABLE.—December 8, 1910, to June 30, 1918, and July 1, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder installed March 7, 1918, replacing Barrett and Lawrence water-stage recorder installed October 8, 1913, 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 large, deep pool with high, sloping banks, at foot of low waterfall. Control at outlet of pool is solid rock ledge and large boulders; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.17 feet at 9.20 a. m. March 25 (discharge, 583 million gallons per day or 902 second-feet); minimum stage recorded, 0.6 foot frequently during the year (discharge, 0.1 million gallons per day or 0.16 second-foot).

1910–1920: Maximum stage recorded, 9.5 feet May 1, 1916 (discharge, computed from extension of the rating curve, approximately 1,000 million gallons per day or 1,550 second-feet); minimum stage recorded (see preceding paragraph).

DIVERSIONS.—Nearly all low-water flow diverted by Old Hamakua ditch above station after February 5, 1918.

REGULATION.—By diversion only.

OBJECT OF STATION.—Data valuable in connection with Territorial water leases to ditch company.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 250 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 Kailua Stream near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	H. A. R. Austin	2.91	116	75
28	do	1.96	45	29
Oct. 7	R. D. Klise	1.38	11.8	7.7
Jan. 8	Reid Jerman	.75	.65	.45
Feb. 18	do	.70	.4	.25
Apr. 2	do	1.59	21.9	14.2

Daily discharge, in million gallons, of Kailua Stream near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	0.8	41	0.3	0.3	0.2	14.5	0.2	0.2	18.3	0.2	0.3
2	.....	.4	25	.....	.3	.2	12.9	.2	.1	17.6	.2	.2
3	.....	.5	123	.....	.2	.1	6.6	.2	.1	10.7	.2	.2
4	.....	7.2	21	.....	.2	.....	2.9	.2	.1	7.1	.2	.2
5	.....	48	8.9	.....	.2	.....	3.6	.2	.2	14.9	.2	.1
6	.....	18.0	4.2	.....	.2	.....	2.0	.2	.2	18.8	.2	.1
7	.....	19.7	2.5	.....	.2	.....	1.3	.2	.2	17.0	.2	.1
8	.....	52	5.8	2.6	.2	.....	.4	.2	.2	8.3	.3	.1
9	.....	8.1	4.4	.9	.2	.....	.3	.2	.3	5.0	.2	.2
10	.....	3.2	11.8	.3	.3	.....	.3	.2	.3	3.3	.3	.2
11	.....	1.7	2.6	.3	6.6	.....	.3	.2	.3	4.2	.3	.2
12	.....	.6	.8	.3	.4	.....	.3	.2	21	3.3	.2	.2
13	7.6	13.4	.6	.3	.4	.....	.3	.2	5.0	7.6	.2	1.9
14	19.6	1.7	.6	.3	.4	.....	.3	.2	1.0	3.0	.2	.6
15	39	37	.5	.3	.4	.....	.3	.2	1.0	1.7	.2	2.7
16	5.7	20	.5	.3	.3	.....	.3	.2	1.0	1.3	.2	.3
17	1.0	13.5	.5	.3	.3	.....	6.0	.2	.4	1.5	.2	.3
18	.3	8.4	.5	.3	.2	.....	11.6	.2	23	1.3	.2	.2
19	.3	8.8	.5	.3	.2	.....	.5	.2	123	1.2	.2	.2
20	.3	2.5	.4	.3	.3	.....	.1	.2	190	1.3	.2	.2
21	3.6	1.2	.4	.3	.2	.....	.1	.2	142	.8	.2	.2
22	8.2	.6	.4	.3	.2	.....	14.0	.2	270	1.3	.2	.2
23	.6	.6	.4	.3	.3	.....	2.5	.3	89	30	.2	.2
24	.2	.5	.4	.3	.3	.....	.3	.3	113	10.2	.2	.1
25	11.1	.5	.4	.3	.2	.....	.2	.2	293	1.5	.2	.1
26	2.5	.5	.4	.3	.3	.....	.2	.2	70	.4	.2	.1
27	32	.5	.3	.4	.3	.....	.2	.2	24	.3	.2	.1
28	41	.4	.3	.3	.2	.....	.2	.2	13.5	.3	.2	.2
29	9.8	4.3	.3	.3	.2	125	.2	.2	9.2	.3	.2	.2
30	4.0	18.7	.3	.3	.2	101	.2	.....	15.9	.2	.2	.2
31	2.6	94	.....	.3	.....	125	.2	.....	13.2	.....	.2	.....

NOTE.—July 1–12, no record; discharge estimated at 2.0 million gallons per day. Recorder not working properly and discharge estimated in million gallons per day as follows: Oct. 2–4, 0.3; 5–7, 20; Dec. 4–22, 0.1; and 23–28, 10. Estimated by comparison with flow of adjacent streams.

Monthly discharge of Kailua Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	41	0.2	6.88	10.6	213	655
August	94	.4	12.5	19.3	387	1,190
September	123	.3	8.62	13.3	259	794
October	.....	.....	2.30	3.56	71.4	219
November	6.6	.2	.47	.73	14.2	43
December	125	.....	13.3	20.6	413	1,270
January	14.5	.1	2.68	4.15	83.1	255
February	.3	.2	.21	.32	6.0	19
March	293	.1	45.8	70.9	1,420	4,360
April	30	.2	6.42	9.93	193	591
May	.3	.2	.21	.32	6.5	20
June	2.7	.1	.34	.53	10.1	31
The year	293	.1	8.41	13.0	3,080	9,450

OLD HAMAKUA DITCH AT KAILUA, NEAR HUELO, MAUI.

LOCATION.—250 yards above intake of penstock to hydroelectric plant on Old Hamakua ditch, 1¼ miles southwest of Kailua, on left side of valley, 83 feet above bed of Kailua Stream.

RECORDS AVAILABLE.—July 22, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

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

CHANNEL AND CONTROL.—Channel ditch section in gravel and hardpan; straight for 10 feet above and 75 feet below station. Control ditch bottom fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.18 feet at 6 a. m. Sept. 3, 1919 (discharge, 15.3 million gallons per day or 24 second-feet); minimum stage recorded 0.30 foot from December 13 to 15, 1919 (discharge, 0.2 million gallons per day or 0.3 second-foot).

DIVERSIONS.—None.

REGULATIONS.—By head gates.

OBJECT OF STATION.—In conjunction with the two stream stations, this station gives the total flow of the Kailua and Nailiilihaele streams.

UTILIZATION.—Water used for power, domestic and other purposes, at Wailoa ditch camp.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined except when unknown condition for an unknown, but short, length of time apparently affected stage-discharge relation about 10 per cent. Operation of water-stage recorder unsatisfactory. Record generally good when water-stage recorder was operating.

Discharge measurements of Old Hamakua ditch at Kailua, near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 16	H. A. R. Austin	1.60	14.9	9.6
Oct. 4	R. D. Klise	1.03	7.9	5.1
Dec. 28	Reid Jerman	1.61	14.6	9.5
Jan. 23	do	1.36	11.2	7.2
Mar. 9	do	1.07	7.4	4.8
Apr. 2	do	1.27	10.1	6.5

Daily discharge, in million gallons, of Old Hamakua ditch at Kailua, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	9.0	11.0	.....	3.4	1.7	7.6	2.8	2.4	6.7	4.2	2.6
2	.....	9.0	10.5	.....	3.2	1.5	7.6	2.7	1.8	6.7	3.9	2.5
3	.....	9.0	12.5	.....	2.7	1.4	7.2	2.5	1.8	6.2	3.6	3.5
4	.....	9.5	10.5	.....	2.7	2.6	7.2	2.4	1.6	6.2	3.5	2.8
5	.....	10.5	10.5	6.7	2.6	1.8	7.2	2.5	1.7	6.2	3.5	1.8
6	.....	10.0	10.5	7.2	2.4	1.2	7.2	2.5	1.5	6.2	3.3	1.6
7	.....	10.5	10.0	5.8	3.1	1.1	7.2	2.3	1.3	6.2	3.3	1.5
8	.....	10.0	10.5	7.2	3.4	1.1	7.2	2.3	4.4	6.2	3.2	1.5
9	.....	10.0	10.0	7.2	2.9	1.1	6.2	2.4	4.7	6.2	3.2	1.9
10	.....	9.5	10.5	6.7	2.7	1.0	.....	2.4	4.2	6.2	3.1	2.1
11	.....	9.5	10.0	6.2	9.0	1.0	.....	2.3	3.1	6.2	3.4	3.6
12	.....	9.5	.....	5.6	7.2	.....	.....	2.2	1.4	6.2	3.3	3.4
13	.....	10.0	.....	5.3	7.2	.....	.....	2.2	3.1	6.7	3.1	7.2
14	.....	10.0	.....	4.7	7.2	.....	.....	2.2	3.1	6.2	3.1	6.2
15	.....	10.5	.....	4.4	8.0	.....	.....	3.2	7.6	6.2	2.9	7.2
16	.....	10.5	.....	4.1	5.7	1.4	.....	2.6	9.0	6.2	2.7	4.4
17	.....	10.5	.....	3.9	4.4	1.3	6.7	3.0	10.0	5.7	2.8	3.9
18	.....	10.5	.....	3.9	3.6	1.1	7.6	6.2	9.0	5.2	2.7	3.1
19	.....	10.0	.....	3.7	3.2	1.0	6.7	3.3	.....	5.0	2.4	1.8
20	.....	10.0	.....	3.6	3.1	.....	5.3	2.5	.....	6.7	2.2	.....
21	.....	10.0	.....	3.9	2.8	.....	4.7	2.1	.....	6.7	1.9	.....
22	.....	9.0	.....	3.4	2.7	.....	6.7	1.9	.....	6.7	1.9	.....
23	9.0	9.0	.....	3.5	2.7	.....	7.2	4.7	.....	6.7	1.8	.....
24	7.6	8.0	.....	3.6	2.4	7.6	5.7	3.3	.....	6.7	1.7	.....
25	9.5	7.6	.....	3.4	2.2	4.1	4.8	2.4	.....	6.7	1.6	.....
26	9.5	7.6	.....	3.5	2.2	2.9	4.4	1.9	.....	6.2	1.3	1.7
27	10.0	7.2	.....	3.8	2.4	7.2	4.0	1.9	.....	5.8	1.3	1.4
28	10.5	6.7	.....	3.3	2.4	9.5	3.9	1.8	6.7	5.2	1.3	1.7
29	9.5	7.6	.....	3.1	1.8	9.5	3.6	2.1	6.7	4.8	1.3	1.7
30	9.0	10.5	.....	2.7	1.9	9.5	3.4	.....	6.7	4.6	1.2	1.8
31	9.0	12.5	.....	3.0	.....	9.5	3.0	.....	6.7	.....	1.5	.....

NOTE.—No record July 1 to 22. Discharge estimated in million gallons per day as follows: July 1-11, 4.0; July 12-16, 9.5; July 17-22, 8. Clock stopped and graph partly estimated July 25, 26, August 22, 23, Oct. 24, 25, 31, Nov. 1, 8, Dec. 5, 6, Jan. 9, 17, 31, Feb. 1-4, 7, 14, 27, Apr. 10, 21-24, and June 19. Recorder not working properly and discharge estimated in million gallons per day as follows: Sept. 12-23, 6; Sept. 24-30, 3.6; Oct. 1-4, 4.1; Dec. 12-15, 1.0; Dec. 20-22, 1.0; Dec. 23, 10; Jan. 10-16, 6; Mar. 19-27, 10; and June 20-25, 1.6. Estimates made by comparison with records of discharge of Nailiilihaele, Kailua, and other adjacent streams. Discharge June 26 and 27 determined from discharge through power house.

Monthly discharge of Old Hamakua ditch at Kailua, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	.....	.....	7.20	11.1	223	685
August	12.5	6.7	9.47	14.7	294	901
September	12.5	.....	7.12	11.0	214	656
October	7.2	2.7	4.51	6.98	140	429
November	9.0	1.8	3.71	5.74	111	342
December	.....	.....	3.13	4.84	97.1	298
January	7.6	3.0	5.95	9.21	184	566
February	6.2	1.8	2.64	4.08	76.6	235
March	.....	1.3	6.08	9.41	188	578
April	6.7	4.6	6.11	9.45	183	563
May	4.2	1.2	2.59	4.01	80.2	246
June	7.2	1.4	2.68	4.15	80.5	247
The year	12.5	.....	5.12	7.92	1,870	5,750

HOOLAWALIILII STREAM NEAR HUELO, MAUI.

LOCATION.—400 feet above New Hamakua ditch crossing and 4 miles by trail west of Huelo.

RECORDS AVAILABLE.—April 6, 1911, to June 30, 1920.

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, 2.87 feet at 1 a. m. March 22 (discharge, 443 million gallons per day or 685 second-feet); minimum stage recorded, 0.02 foot 9 p. m. December 11 (discharge, 0.5 million gallons per day or 0.8 second-foot).

1911–1920: Maximum stage recorded, 3.4 feet at 8.15 a. m. April 3, 1918 (discharge, computed from extension of rating curve 800 million gallons per day or 1,240 second-feet); minimum stage recorded in December, 1919.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

UTILIZATION.—All water during low and medium stages diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 0.5 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records excellent.

Discharge measurements of Hoolawaliilii Stream near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 9	H. A. R. Austin	0.08	1.65	1.1
Oct. 2	R. D. Klise	.10	2.4	1.5
Jan. 8	Reid Jerman	.17	3.4	2.2
Feb. 3	do	.10	1.85	1.2
Apr. 9	do	.22	5.2	3.3

Daily discharge, in million gallons, of Hoolawaliilii Stream near Huela, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.6	2.4	4.9	1.1	1.0	0.9	4.9	1.3	0.9	9.2	2.0	1.6
2	1.8	2.4	23	1.1	.9	.8	5.9	1.3	.9	7.2	2.0	1.1
3	1.3	2.4	69	1.1	.9	.7	4.6	1.0	.9	5.5	2.0	1.3
4	1.1	2.2	11.4	1.3	1.0	.9	3.2	1.1	.9	5.2	2.0	1.1
5	1.1	5.1	7.2	2.8	.9	.8	3.6	1.3	.9	5.2	1.8	1.0
6	1.1	3.2	5.5	32	.9	.8	3.2	1.1	.9	4.9	1.6	1.0
7	1.0	7.4	4.6	4.6	1.0	.7	2.7	1.0	.9	5.2	1.6	1.0
8	1.0	5.2	4.2	2.9	.9	.8	2.5	1.1	.9	3.9	1.6	1.0
9	.9	3.6	3.9	2.4	.9	.8	2.4	1.1	.9	3.6	1.6	.9
10	1.0	3.2	4.2	2.2	.9	.7	2.4	1.1	.9	2.9	1.6	.9
11	.9	2.9	3.9	2.2	1.9	.6	2.4	1.1	.9	3.2	1.6	.9
12	2.0	2.7	2.9	2.0	1.3	.7	2.2	1.3	2.8	2.9	1.6	.9
13	2.0	4.2	2.7	2.0	1.1	.8	2.0	1.1	1.6	3.2	1.5	1.1
14	2.1	2.4	2.4	1.8	1.0	.6	2.0	1.3	1.3	2.9	1.5	1.0
15	4.2	8.2	2.2	1.8	1.1	.7	1.6	1.3	1.1	2.7	1.3	1.3
16	2.0	4.6	1.6	1.8	1.1	.8	1.8	1.1	1.0	2.5	1.3	1.1
17	1.8	4.6	1.1	1.8	1.1	.7	2.2	1.1	1.0	2.2	1.3	1.0
18	1.6	3.9	.....	1.6	1.1	.7	2.0	1.1	1.8	2.2	1.3	1.0
19	1.5	3.9	.....	1.6	1.0	.7	1.8	.9	8.7	2.2	1.3	.9
20	1.5	3.2	.....	1.6	1.0	.7	1.6	1.0	34	2.2	1.3	.9
21	1.5	2.9	.....	1.5	1.0	.7	1.6	1.0	42	2.0	1.3	.9
22	1.8	2.7	.....	1.3	.9	.6	2.2	.9	172	2.0	1.3	.9
23	1.6	2.7	.....	1.5	.9	1.1	1.8	1.0	41	7.1	1.3	.9
24	1.3	2.4	.....	1.5	.9	.9	1.8	1.1	53	2.9	1.1	.9
25	2.2	2.2	.....	1.3	.9	.9	1.6	1.1	99	2.5	1.1	.9
26	1.8	2.2	.....	1.1	.9	.9	1.6	1.0	40	2.4	1.1	.9
27	3.3	2.0	.....	1.0	.9	1.0	1.5	1.0	14.2	2.4	1.1	.9
28	5.2	2.0	.....	1.1	.9	1.3	1.3	1.0	8.3	2.4	1.1	.8
29	3.2	2.0	.....	1.0	.9	20	1.3	.9	6.2	2.2	1.1	.8
30	2.9	2.5	.....	1.0	.9	14.9	1.5	.....	7.5	2.0	1.1	.8
31	2.5	10.2	.....	1.1	.....	18.0	1.5	.....	5.9	.....	1.3	.....

NOTE.—Clock stopped by kink in weight chain, Sept. 18–30. Discharge estimated in million gallons per day by comparison with Hoolawanui Stream as follows: Sept. 18–24, 2.3 and 25–30, 1.6.

Monthly discharge of Hoolawaliilii Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.2	0.9	1.90	2.94	58.8	181
August	10.2	2.0	3.60	5.57	112	342
September	69	1.1	6.01	9.30	180	553
October	32	1.0	2.68	4.15	83.1	255
November	1.9	.9	1.00	1.55	30.1	92
December	20	.6	2.43	3.76	75.2	231
January	5.9	1.3	2.35	3.64	72.7	224
February	1.3	.9	1.09	1.69	31.7	97
March	172	.9	17.8	27.5	553	1,690
April	9.2	2.0	3.56	5.51	107	328
May	2.0	1.1	1.44	2.23	44.7	137
June	1.6	.8	.99	1.53	29.7	91
The year	172	.6	3.76	5.82	1,380	4,220

HOOLAWANUI STREAM NEAR HUELO, MAUI.

LOCATION.—500 feet above crossing of New Hamakua ditch and 5 miles by trail west of Huelo.

RECORDS AVAILABLE.—December 12, 1910, to June 30, 1920.

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, 4.17 feet at 5 p. m. March 22 (discharge, 288 millions gallons per day, or 446 second-feet); minimum stage recorded, —0.15 foot at 6.45 p. m. December 22 (discharge, 0.4 million gallons per day or 0.6 second-foot).

1910–1920: 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.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

UTILIZATION.—All water during low and medium stages 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 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 14	H. A. R. Austin	0.32	6.0	3.8
Oct. 2	R. D. Klise	.07	2.0	1.3
Jan. 7	Reid Jerman	.23	2.9	1.85
Feb. 3	do	.00	1.9	1.25
Mar. 29	B. F. Rush	.62	13.8	8.9
Apr. 24	Reid Jerman	.32	6.4	4.1

Daily discharge, in million gallons, of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.3	2.6	9.1	1.5	1.0	0.6	6.0	.....	0.9	9.1	2.2	1.5
2	2.5	2.5	12.5	1.6	1.0	.6	5.9	.....	.7	8.6	2.2	1.1
3	1.2	2.4	66	1.4	.9	.6	4.1	1.1	.7	6.0	2.0	1.2
4	1.0	3.6	13.6	1.4	1.0	1.1	3.4	1.1	.6	5.1	2.0	1.0
5	1.0	8.0	9.1	3.8	.9	.8	3.6	1.1	.6	6.1	1.9	.8
6	1.0	4.2	7.0	36	.9	.6	3.0	1.1	.6	5.7	1.8	.8
7	.9	10.5	5.7	4.1	1.0	.6	2.9	1.0	.6	5.9	1.7	.8
8	.8	8.0	5.7	3.1	.9	.6	2.7	1.0	.8	4.4	1.8	.8
9	.8	4.8	5.3	2.9	.9	.6	2.6	1.0	.8	4.1	1.6	.9
10	1.0	4.0	5.7	2.5	.9	.6	2.4	1.1	.8	4.0	1.5	1.0
11	.9	3.8	4.4	2.3	2.1	.6	2.4	1.1	.6	4.0	1.6	1.0
12	6.3	3.6	3.9	2.2	1.3	.5	2.2	1.2	5.1	3.8	1.5	1.0
13	2.3	6.1	3.6	2.1	1.3	.6	2.0	1.2	1.8	4.0	1.4	1.4
14	3.6	4.0	3.4	2.1	1.2	.6	1.9	1.0	1.0	3.4	1.4	1.2
15	6.6	12.6	3.1	2.0	1.1	.6	1.8	1.2	.8	3.3	1.4	1.5
16	2.7	7.0	3.1	1.8	1.0	.9	1.7	1.0	.7	3.2	1.4	1.2
17	2.2	7.0	2.9	1.9	.8	.6	2.3	1.0	.8	2.9	1.4	1.1
18	1.7	5.7	2.8	1.7	.8	.6	2.5	1.1	2.4	2.7	1.3	1.0
19	1.7	5.5	2.6	1.6	.8	.5	1.8	1.0	32	2.8	1.2	1.0
20	1.6	4.5	2.5	1.4	.8	.5	1.6	1.0	54	2.7	1.2	1.0
21	1.9	3.9	2.4	1.4	.8	.5	1.4	.8	45	2.7	1.3	1.0
22	2.4	3.8	2.4	1.4	.8	.5	2.6	.9	143	2.6	1.2	1.0
23	1.8	3.4	2.3	1.4	.7	1.6	1.8	1.0	44	11.7	1.2	1.0
24	1.6	3.1	2.2	1.4	.7	1.0	1.6	1.0	46	4.4	1.0	1.0
25	3.6	2.8	1.9	1.2	.7	.6	1.5	.9	122	3.1	1.0	.9
26	2.4	2.9	1.8	1.2	.7	.5	1.4	.8	44	2.8	1.0	.8
27	6.5	2.7	1.7	1.4	.6	1.0	1.4	.8	20	2.6	1.0	.8
28	7.4	2.5	1.6	1.2	.6	2.7	.....	.8	12.8	2.5	1.0	.8
29	3.8	2.9	1.6	1.1	.7	30	.....	1.0	9.1	2.4	1.0	.8
30	3.2	4.2	1.5	1.0	.7	24	.....	.....	9.8	2.3	1.0	.8
31	3.0	21	.....	1.0	.....	29	.....	.....	7.6	.....	1.0	.....

NOTE.—Jan. 28 to Feb. 2, clock stopped and discharge estimated in million gallons per day, by comparison with records of discharge of Hoolawaliili Stream as follows: Jan. 28–31, 1.7, and Feb. 1–2, 1.4.

Monthly discharge of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.4	0.8	2.54	3.93	78.7	242
August	21	2.4	5.28	8.17	164	502
September	66	1.5	6.38	9.87	191	587
October	36	1.0	2.94	4.55	91.1	280
November	2.1	.6	.92	1.42	27.6	85
December	30	.5	3.36	5.20	104	320
January	6.0	1.4	2.43	3.76	75.3	231
February	.....	.8	1.04	1.61	30.1	93
March	143	.6	19.7	30.5	610	1,870
April	11.7	2.3	4.30	6.65	129	396
May	2.2	1.0	1.43	2.21	44.2	136
June	1.5	.8	1.01	1.56	30.2	93
The year	143	.5	4.30	6.65	1,580	4,840

HONOPOU STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above New Hamakua ditch crossing and 6 miles west of Huelo.

RECORDS AVAILABLE.—December 12, 1910, to June 30, 1920.

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; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.66 feet at 1 a. m. September 3 (discharge, 93 million gallons per day or 144 second-feet); minimum stage recorded, 0.06 foot 12.30 p. m. November 27 and 3.20 a. m. February 22 (discharge, 0.2 million gallons per day or 0.3 second-foot).

1910–1920: Maximum stage recorded, 3.7 feet at 10 p. m. May 1, 1916 (discharge, based on curve applicable from January 19, 1917, 247 million [13] gallons per day 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.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

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. Records fair when water-stage recorder was not operating.

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

Discharge measurements of Honopou Stream near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 14	H. A. R. Austin	0.22	1.8	1.15
Oct. 2	R. D. Klise	.16	1.1	.7
Dec. 27	J. E. Stewart	.10	.4	.25
Jan. 22	Reid Jerman	.27	3.0	1.9
Mar. 29	do	.59	9.2	6.0
Apr. 24	do	.25	2.5	1.6

Daily discharge, in million gallons, of Honopou Stream near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.0	1.3	2.9	0.9	0.5	0.4	2.6	0.9	0.4	3.5	1.2	1.0
2	1.5	1.2	5.3	.9	.5	.4	3.0	.7	.4	2.2	1.2	.8
3	.8	1.1	32	.9	.5	.4	2.2	.6	.4	2.2	1.1	.8
4	.7	1.5	8.3	.9	.4	.7	2.0	.6	.6	2.6	1.1	.8
5	.7	2.8	5.6	1.7	.5	.5	2.0	.5	.6	2.5	1.1	.7
6	.6	1.6	4.6	11.2	.4	.5	1.8	.6	.5	2.6	1.0	.6
7	.4	3.4	4.0	2.0	.5	.5	1.4	.6	.5	2.8	1.0	.6
8	.4	2.4	4.0	1.7	.4	.6	1.5	.6	.5	2.6	1.0	.5
9	.4	2.1	3.6	1.6	.4	.5	1.4	.6	.5	2.2	1.0	.5
10	.4	1.9	3.3	1.5	.4	.5	1.3	.5	.5	2.2	.8	.5
11	.5	1.7	2.8	1.3	1.0	.5	1.3	.5	.6	2.3	.8	.5
12	1.7	1.7	2.5	1.8	.7	.4	1.3	.5	.6	2.4	.8	.5
13	1.1	2.5	2.3	1.2	.7	.4	1.2	.6	.....	2.5	.8	.5
14	1.7	1.9	2.1	1.1	.7	.4	1.0	.5	.....	2.2	.8	.5
15	2.5	4.7	1.9	1.1	.6	.4	1.0	.4	.....	2.1	.7	.4
16	1.1	2.6	1.8	1.0	.6	.6	1.0	.4	.....	2.1	.6	.5
17	1.0	2.6	1.6	1.0	.6	.4	1.5	.4	.....	1.9	.6	.4
18	1.0	2.9	1.6	.9	.6	.4	1.3	.4	.....	1.7	.6	.4
19	.9	2.1	1.5	.9	.5	.4	1.1	.4	.....	1.7	.6	.4
20	.9	1.9	1.3	.9	.4	.4	1.0	.4	.....	1.7	.6	.4
21	1.0	1.9	1.3	.8	.5	.4	1.0	.4	.....	1.7	.6	.4
22	1.1	1.8	1.1	.7	.4	.4	1.8	.3	.....	1.6	.6	.4
23	1.0	1.7	1.1	.7	.4	1.0	1.7	.5	.....	5.3	.6	.4
24	.9	1.6	1.0	.6	.4	.6	1.0	.5	.....	2.0	.6	.4
25	1.6	1.6	1.0	.6	.4	.5	1.0	.5	.....	1.6	.5	.4
26	1.0	1.5	1.0	.5	.4	.4	1.0	.5	.....	1.4	.5	.4
27	2.8	1.3	.9	.6	.4	.4	1.0	.5	.....	1.4	.5	.3
28	2.9	1.2	.8	.6	.4	1.0	1.0	.5	.....	1.1	.5	.4
29	1.6	1.4	.8	.5	.4	8.7	1.0	.4	.....	1.2	.4	.3
30	1.3	1.9	.9	.6	.4	5.9	1.0	.....	6.6	1.2	.4	.3
31	1.3	6.1	.....	.5	.....	7.8	.9	.....	4.6	.....	.5	.....

NOTE.—Mar. 13–29, clock weight caught on shelter floor. Discharge estimated in million gallons per day as follows: Mar. 13–15, 0.6; 16–20, 8.5; 21–25, 38; and 26–29, 10. Estimated by comparison with records of discharge of adjacent streams.

Monthly discharge of Honopou Stream near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.9	0.4	1.15	1.78	35.8	109
August	6.1	1.1	2.13	3.30	65.9	203
September	32	.8	3.43	5.31	103	316
October	11.2	.5	1.31	2.03	40.7	125
November	1.0	.4	.50	.77	15.0	46
December	8.7	.4	1.17	1.81	36.4	111
January	3.0	.9	1.40	2.17	43.3	133
February	.9	.3	.51	.79	14.8	45
March	.....	.4	9.41	14.6	292	895
April	5.3	1.1	2.15	3.33	64.5	198
May	1.2	.4	.75	1.16	23.1	71
June	1.0	.3	.50	.77	15.0	46
The year	.....	.3	2.05	3.17	750	2,300

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, 1920.

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.—Maximum stage recorded during year 4.47 feet at 2.20 a. m. and 1.30 p. m. March 22 (discharge, 93 million gallons per day or 144 second-feet); minimum stage recorded during year, 1.01 feet at 1.40 a. m. December 23 (discharge, 12.7 million gallons per day or 19.6 second-feet).

1918–1920: Maximum stage recorded in March, 1920; 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).

DIVERSIONS.—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.

OBJECT OF STATION.—To determine amount of water diverted from Territorial lands above to fee simple lands below.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed June 16 by débris sliding into ditch. Rating curve used July 1 to June 15 well defined above and fairly well defined below 20 million gallons per day. Rating curve used June 16–30 fairly well defined below and poorly defined above 20 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 working prior to June 15 and fair afterwards.

Discharge measurements of New Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 14	H. A. R. Austin	3.75	119	77
30	do	3.62	109	70
Oct. 2	R. D. Klise	2.95	81	52
Jan. 7	Reid Jerman	2.92	100	65
Feb. 2	do	1.60	38	24.7
Mar. 29	do	3.51	107	69
Apr. 24	do	3.36	97	62

Daily discharge, in million gallons, of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	39	67	78	40	28	26	.....	24	30	70	38	31
2	67	67	75	52	27	26	.....	23	20	67	36	26
3	57	67	83	50	25	20.0	.....	22	18.3	67	34	42
4	50	65	80	47	25	24	.....	22	17.4	70	34	32
5	45	52	80	65	23	20.0	.....	21	17.4	73	32	21
6	40	52	78	78	23	17.4	.....	21	16.6	73	30	19.0
7	36	58	78	62	25	16.6	52	20.0	17.4	73	29	16.1
8	33	75	78	59	26	15.8	47	20.0	22	67	28	15.2
9	31	75	78	59	23	15.0	45	21	40	64	26	15.2
10	40	72	78	59	23	15.0	40	23	31	64	25	17.0
11	42	70	75	57	57	15.0	47	23	24	64	25	24
12	69	70	70	54	52	14.2	50	22	45	64	25	19.0
13	67	75	67	50	50	14.2	42	20.0	59	64	24	42
14	72	72	67	47	50	14.2	38	20.0	42	61	23	35
15	75	78	65	45	52	14.2	34	24	32	58	22	44
16	67	78	62	42	38	15.8	33	22	28	58	23	30
17	65	78	59	40	31	15.0	40	21	29	58	22	25
18	59	78	59	38	29	14.2	57	33	62	55	22	23
19	59	75	57	36	26	13.4	42	23	75	52	20.0	20.0
20	59	72	54	34	25	13.4	34	19.2	83	52	20.0	18.0
21	59	70	50	38	24	13.4	31	19.2	83	50	19.0	17.0
22	65	70	47	33	23	13.4	50	19.2	91	47	19.0	17.0
23	62	70	45	32	23	39	50	40	82	73	18.0	17.0
24	57	67	45	34	24	38	36	26	85	64	18.0	16.1
25	70	62	42	31	24	22	32	21	91	55	17.0	16.1
26	55	62	42	29	24	18.3	30	18.3	88	52	17.0	15.2
27	72	62	40	33	24	41	29	19.2	82	47	16.1	14.4
28	80	59	38	30	24	.....	28	18.3	76	44	16.1	15.2
29	72	59	38	30	25	.....	27	23	67	42	16.1	15.2
30	70	70	40	27	26	.....	26	.....	76	39	15.2	16.1
31	70	80	.....	26	.....	.....	25	.....	67	.....	16.1	.....

NOTE.—Recorder not working properly Dec. 28 to Jan. 7. Discharge estimated, by comparison with record for New Hamakua ditch at Halehaku weir, at 75 million gallons per day.

Monthly discharge of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	80	31	58.2	90.0	1,800	5,540
August	80	52	68.6	106	2,130	6,530
September	83	38	61.6	95.3	1,850	5,670
October	78	26	43.8	67.8	1,360	4,170
November	57	23	30.0	46.4	899	2,760
December	.....	13.4	26.6	41.2	824	2,530
January	.....	25	45.6	70.6	1,420	4,340
February	40	18.3	22.4	34.7	648	1,990
March	91	16.6	51.5	79.7	1,600	4,900
April	73	39	59.6	92.2	1,790	5,490
May	38	15.2	23.4	36.2	726	2,230
June	44	14.4	22.5	34.8	674	2,070
The year	91	13.4	42.9	66.4	15,700	48,200

NEW HAMAKUA DITCH AT HALEHAKU WEIR, NEAR HUELO, MAUI.

LOCATION.—Just above crossing of Halehaku Stream and 7 miles by trail west of Huelo.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1920.

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.

OBJECT OF STATION.—Halehaku weir is one of four weirs which measure water diverted from Territorial lands by the Old and New Hamakua, Lowrie, and Haiku ditches, by the East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Record of daily discharge 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, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	25.5	66.9	69.1	25.3	19.9	.....	69.2	15.7	20.4	70.6	27.5	28.8
2	66.9	22.8	69.1	34.9	19.7	.....	69.6	15.2	13.3	69.5	27.2	25.3
3	49.4	.....	69.1	37.1	19.2	.....	68.8	14.6	10.5	69.4	25.9	41.6
4	44.2	.....	69.1	31.9	18.0	.....	68.6	14.2	9.5	67.5	25.1	32.0
5	31.6	.....	69.1	60.4	17.9	.....	66.2	14.1	9.3	68.8	24.2	17.6
6	25.2	.....	69.0	69.2	17.2	.....	50.2	13.7	9.2	69.0	23.6	14.4
7	22.2	.....	68.6	68.3	17.1	.....	36.9	13.2	9.3	67.5	22.1	13.1
8	20.1	64.1	69.0	65.5	19.3	.....	33.2	13.1	10.7	68.2	21.1	12.0
9	18.5	68.8	69.2	60.9	17.5	4.3	30.2	12.9	28.8	69.2	20.2	11.3
10	21.2	68.3	69.3	64.4	17.1	.4	27.5	14.0	21.8	68.3	19.2	13.7
11	29.5	69.3	68.8	63.6	52.1	.....	29.4	14.4	14.8	68.0	18.8	17.3
12	62.1	68.6	68.9	59.3	47.4	.....	33.3	13.5	30.3	68.9	18.5	17.4
13	67.9	66.4	65.3	42.5	41.7	.....	28.9	12.9	58.5	68.4	18.0	30.6
14	70.6	68.6	56.5	37.0	36.6	.....	25.9	12.3	41.1	67.2	17.3	34.2
15	70.0	59.1	50.0	34.0	42.0	.....	23.0	14.5	25.9	64.0	17.2	36.7
16	68.2	67.8	45.0	32.2	31.0	.....	21.9	14.7	20.7	56.1	17.3	31.0
17	66.6	68.9	41.8	29.8	22.3	.....	23.2	13.5	21.2	53.4	17.3	18.8
18	55.8	64.2	39.9	29.0	20.1	.....	48.4	20.9	53.4	47.1	16.8	17.7
19	30.7	63.2	38.5	27.5	18.4	.....	29.3	18.8	72.4	48.3	15.7	15.6
20	37.5	68.0	38.0	25.7	17.6	.....	23.9	12.8	71.8	38.6	14.6	13.7
21	39.9	68.6	34.2	26.9	16.2	.....	21.0	11.4	42.3	34.9	14.6	12.7
22	67.3	63.1	31.3	26.3	15.5	.....	39.0	11.3	74.5	34.3	14.3	13.1
23	58.1	52.9	29.5	22.7	15.5	6.8	50.8	25.0	67.7	53.0	14.3	13.1
24	47.2	49.8	29.2	23.6	11.5	36.9	28.2	23.8	68.9	66.4	13.3	12.7
25	48.4	43.2	28.6	23.4	.....	23.8	21.8	13.8	69.7	55.0	12.8	11.5
26	36.6	39.2	27.5	20.7	.....	15.1	19.6	12.1	66.2	46.0	13.0	11.6
27	62.6	44.6	26.1	23.1	.....	22.0	18.9	11.2	68.9	36.7	11.8	11.2
28	68.9	39.5	25.6	24.0	.....	57.7	18.3	11.8	68.7	32.0	11.6	10.5
29	68.4	42.4	25.2	22.0	.....	66.9	17.9	11.3	67.6	30.6	12.0	10.9
30	68.4	46.1	26.9	20.9	.....	69.1	16.8	.....	68.9	29.2	11.6	10.9
31	68.9	69.1	.....	19.2	.....	68	16.8	.....	68.3	.....	11.3	.....

NOTE.—No flow on days for which discharge is not given.

Monthly discharge of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	70.6	18.5	49.0	75.8	1,520	4,660
August (26 days)	69.3	22.8	58.2	90.0	1,510	4,640
September	69.3	25.2	49.6	76.7	1,490	4,570
October	69.2	19.2	37.1	57.4	1,150	3,530
November 1–24	52.1	11.5	23.8	36.8	571	1,750
December (11 days)	69.1	.4	33.7	52.1	371	1,140
January	69.6	16.8	34.7	53.7	1,080	3,300
February	25.0	11.3	14.5	22.4	421	1,290
March	74.5	9.2	41.4	64.1	1,280	3,940
April	70.6	29.2	56.2	87.0	1,690	5,170
May	27.5	11.3	17.7	27.4	548	1,680
June	41.6	10.5	18.7	28.9	561	1,720
The period (335 days)	74.5	.4	36.4	56.3	12,200	37,460

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, 1920.

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.—Maximum stage recorded during the year 3.07 feet at 4.30 a. m. September 3 (discharge, 52 million gallons per day, or 80 second-feet); minimum stage recorded during year, 0.29 foot at 5 p. m. February 21 (discharge, 0.03 million gallons per day or 0.05 second-foot).

1918–1920: 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 in February, 1920.

DIVERSIONS.—Ditch heads at Nailiilihaele Stream and picks up water from streams west of that point.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—To determine amount of water diverted from Territorial lands.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 0.4 million gallons per day. Operation of water-stage recorder unsatisfactory. 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, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 14	H. A. R. Austin	0.775	3.8	2.5
28	do	1.66	24.3	15.7
Oct. 2	R. D. Klise	.52	.65	.4
Dec. 27	J. E. Stewart	.52	.65	.4
Mar. 29	B. F. Rush	.63	1.65	1.05
Apr. 23	Reid Jerman	1.42	18.4	11.9

Daily discharge, in million gallons, of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.3	1.2	16.7	0.1	.....	0.2	1.2	0.1	0.05	.....	0.1	.....
2	1.3	1.1	3.3	.2	.....	.2	2.7	.1	.05	.....	.1	.....
3	.2	1.0	32	.2	.....	.2	.8	.1	.05	.....	.1	.....
4	.....	8.4	28	.....	.....	.2	.6	.1	.05	.....	.1	.....
5	.....	28	15.3	.....	.....	.1	.6	.1	.05	.....	.1	.....
6	.....	24	7.7	.....	.....	.2	.3	.1	.05	.....	.05	.....
7	.....	27	4.6	.....	.....	.2	.2	.1	.05	.....	.05	.....
8	.....	14.5	5.9	.....	.....	.2	.2	.1	.05	.....	.05	.....
9	.5	2.9	2.6	.....	.....	.2	.2	.1	.05	.....	.05	.....
10	.3	2.2	4.5	.....	.....	.2	.2	.1	.05	0.9	.05	.....
11	.2	2.0	2.4	.....	0.3	.2	.2	.1	.05	1.0	.05	.....
12	6.9	1.9	1.4	.....	.2	.2	.2	.1	4.5	.9	.05	.....
13	2.1	6.4	1.2	.....	.1	.2	.2	.1	.4	1.0	.05	.....
14	3.4	2.4	1.0	.....	.1	.2	.2	.1	.05	.8	.05	.....
15	10.5	20.0	1.0	.....	.1	.2	.2	.1	.05	.7	.05	.....
16	1.0	7.5	.8	.....	.1	.3	.2	.1	.05	.6	.05	.....
17	.6	8.3	.7	.....	.1	.2	.2	.1	.05	.6	.05	.....
18	.3	4.0	.7	.....	.05	.2	.2	.1	.6	.6	.05	.....
19	.3	3.1	.6	.....	.05	.2	.1	.1	.....	.5	.05	.....
20	.5	2.3	.6	.....	.1	.2	.1	.00	.....	.4	.05	.....
21	.5	2.0	.5	.....	.1	.2	.1	.00	.....	.4	.05	.....
22	1.1	1.9	.4	.....	.1	.2	.4	.05	.....	.4	.05	.....
23	.6	1.8	.4	.....	.1	.4	.2	.1	.....	6.7	.05	.....
24	.3	1.5	.3	.....	.1	.2	.1	.05	.....	.8	.....	.....
25	2.2	1.0	.3	.....	.1	.1	.1	.05	.....	.6	.....	.....
26	11.2	.6	.2	.....	.1	.1	.1	.05	.....	.4	.....	.....
27	12.5	.9	.2	.....	.1	.3	.1	.05	.....	.4	.....	.....
28	14.3	.6	.2	.....	.2	.7	.1	.05	.....	.2	.....	.....
29	2.1	.5	.2	.....	.2	35	.05	.05	1.1	.2	.....	.....
30	1.6	2.0	.2	.....	.2	24	.1	.....	2.8	.1	.....	.....
31	1.5	28	.....	.....	.....	26	.1	.....	1.5	.....	.....	.....

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: July 4–8, 0.3; Oct. 4–9, 7.5; 10–15, 0.5; 16–20, 0.4; 21–25, 0.3; 26–31, 0.2; Nov. 1–10, 0.2; Mar. 19–28, 30; Apr. 1–9, 1.0; May 24–31, 0.05; June 1–5, 0.2; and 6–30, 0.05. Low water estimated by comparison with flow of Honopou Stream. Floods estimated by comparison with sum of discharge of Honopou Stream and Old Hamakua ditch at Kailua.

Monthly discharge of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	14.3	.....	2.55	3.95	79.2	243
August	28	0.5	6.74	10.4	209	641
September	32	.2	4.46	6.90	134	411
October	.....	.....	1.72	2.66	53.2	164
November	.....	.05	.150	.232	4.50	14
December	35	.1	2.94	4.55	91.2	280
January	2.7	.05	.331	.512	10.2	32
February	.1	.0	.081	.125	2.35	7
March	.....	.05	10.1	15.6	312	961
April	6.7	.1	.91	1.41	27.2	84
May	.1	.05	.058	.090	1.80	6
June	.....	.....	.075	.116	2.25	7
The year	.....	.0	2.53	3.91	927	2,850

KAUHIKOA DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance below crossing of Opana Stream, 8 miles by road west of Huelo.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1920.

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.

OBJECT OF STATION.—Opana weir is one of four weirs which measure water diverted from Territorial lands by the Old and New Hamakua, Lowrie, and Haiku ditches, by the East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

The following discharge measurement was made by Lieut. A. R. Austin:

July 16, gage height, 0.24 feet, discharge, 8.0 million gallons per day or 12.4 second-feet.

Daily discharge, in million gallons, of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.1	0.5	22.2	.....	.....	11.6	19.7	.....	0.4	15.8	0.4	0.4
2	6.6	32.2	11.5	.....	.....	11.3	17.8	.....	.4	15.3	.4	.4
3	.3	49.8	57.3	.....	.....	10.9	12.2	.....	.4	12.4	.4	.4
4	.....	49.9	45.7	.....	.....	14.6	2.2	.....	.4	12.8	.4	.4
5	.....	75.8	32.4	1.3	0.2	15.6	.....	.....	.4	12.5	.4	.5
6	.....	75.3	23.2	42.4	.2	11.7	.....	.....	.4	12.4	.4	.4
7	.....	79.1	18.6	10.1	.2	10.3	.....	.....	.4	12.0	.4	.4
8	.....	56.7	19.6	3.8	.2	9.9	.....	.....	.4	10.1	.4	.4
9	.....	14.6	15.9	2.4	.2	8.0	.....	.....	.4	8.6	.4	.4
10	.....	11.3	18.0	2.1	.2	8.6	.....	.....	.4	7.0	.4	.4
11	.....	7.9	14.0	1.9	.4	9.6	.....	.....	.4	6.2	.4	.4
12	6.2	1.4	6.3	1.2	.2	9.0	.....	.....	6.0	5.0	.4	.4
13	1.3	7.2	.5	.....	.....	5.9	.....	.....	3.1	5.6	.4	.4
14	5.5	3.1	.....	.....	.....	8.4	.....	.....	.4	4.5	.4	.4
15	17.3	19.4	.....	.....	.....	7.8	.....	.....	.4	3.1	.4	.4
16	6.3	10.9	.....	.....	.....	13.1	.....	.....	.4	.4	.4	.4
17	.1	10.5	.....	.....	.....	10.5	.....	.....	.4	.4	.4	.4
18	.....	7.9	.....	.....	.....	7.9	.....	.....	2.1	.4	.4	.4
19	10.1	8.1	.....	.....	.....	7.8	.....	.....	28.1	.4	.4	.4
20	.....	11.0	.....	.....	.....	7.7	.....	0.2	69.3	.4	.4	.4
21	.3	4.1	.....	.....	.....	7.7	.....	.4	58.2	.4	.4	.4
22	3.2	.5	.....	.....	.....	7.3	1.0	.4	85.4	.4	.4	.4
23	.....	.....	.....	.....	.....	26.7	1.1	.4	49.9	14.8	.4	.4
24	.....	.....	.....	.....	3.2	8.2	.....	.4	54.8	9.5	.4	.4
25	1.6	.....	.....	.....	14.0	.....	.....	.4	66.3	1.5	.4	.4
26	26.3	.....	.....	.....	12.6	.....	.....	.4	63.4	.4	.4	.4
27	8.5	.....	.....	.....	12.5	.....	.....	.4	52.0	.4	.4	.4
28	24.1	.....	.....	.....	12.2	4.5	.....	.4	31.3	.4	.4	.4
29	11.7	.4	.....	.....	12.2	36.0	.....	.4	19.9	.4	.4	.4
30	6.5	.4	.....	.....	11.7	54.1	.....	.....	22.2	.4	.4	.4
31	4.8	27.5	.....	.....	.....	6.9	.....	.....	17.7	.....	.4	.....

NOTE.—No flow for days for which discharge is not given.

Monthly discharge of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (19 days)	26.3	0.1	7.46	11.5	142	435
August (25 days)	79.1	.4	22.6	35.0	566	1,740
September 1–13	57.3	.5	21.9	33.9	285	875
October 5–12	42.4	1.2	8.15	12.6	65.2	200
November (15 days)	14.0	.2	5.35	8.28	80.2	246
December (28 days)	54.1	4.5	12.6	19.5	352	1,080
January (6 days)	19.7	1.0	9.00	13.9	54.0	166
February 20–29	.4	.2	.38	.59	3.8	12
March	85.4	.4	20.5	31.7	636	1,950
April	15.8	.4	5.80	8.97	174	534
May	.4	.4	.40	.62	12.4	38
June	.5	.4	.40	.62	12.1	37
The year (246 days)	85.4	.1	9.68	15.0	2,380	7,310

LOWRIE DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance west of Halehaku Gulch and 8 miles by road northwest of Huelo.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1920.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir 16½ 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.

OBJECT OF STATION.—Opana weir is one of four weirs which measure water diverted from Territorial lands by the Old and New Hamakua, Lowrie, and Haiku ditches, by the East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

The following discharge measurements were made by R. D. Klise and H. A. R. Austin, respectively:

Oct. 11, 1919: Gage height, 1.28 feet; discharge, 68 second-feet or 57 million gallons per day.

July 19: Gage height, 1.12 feet; discharge 52 million gallons per day or 80 second-feet.

Daily discharge, in million gallons, of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	27.5	51	54.6	29.8	24.0	12.6	55.9	18.2	21.6	56.0	30.2	41.9
2	51.2	55	55.5	47.8	22.5	12.4	55.7	18.0	12.4	56.1	31.8	19.4
3	43.2	52.2	57.5	37.8	19.6	12.1	53.9	16.7	11.3	55.8	29.1	40.8
4	40.3	53.2	55.8	38.7	20.9	18.3	51.8	16.9	11.1	55.4	28.4	30.8
5	26.2	54.8	56.2	54.3	19.7	12.5	53.4	16.3	11.4	55.5	27.5	15.7
6	27.1	55.1	55.9	59.0	19.8	11.2	39.0	15.8	10.5	55.6	26.2	16.1
7	24.0	55.0	55.7	55.4	21.9	11.3	40.2	15.3	10.2	55.3	24.4	14.1
8	22.6	55.7	55.6	55.7	23.6	11.0	35.6	15.2	15.4	55.2	23.5	13.1
9	22.0	54.7	55.5	54.2	19.5	10.8	32.9	16.0	31.0	55.2	22.8	13.0
10	29.1	54.2	55.7	53.2	19.4	10.1	30.8	18.4	22.0	55.1	21.8	15.9
11	31.6	53.8	55.4	49.9	48.5	9.8	37.1	16.6	14.6	55.0	21.8	21.7
12	47.6	55.2	55.4	39.7	42.6	9.5	40.7	14.9	41.2	53.4	21.6	14.1
13	52.7	55.7	56.1	38.2	42.3	12.1	34.2	14.2	50.2	55.0	19.9	40.4
14	54.2	55.3	53.6	39.4	37.3	9.1	28.2	14.2	33.7	52.5	20.3	23.9
15	54.0	56.0	54.1	37.6	44.5	8.9	26.0	19.3	20.9	52.6	19.8	42.1
16	53.9	55.8	49.2	35.0	25.2	10.5	24.4	15.6	21.7	55.1	20.5	19.5
17	49.6	55.9	47.6	34.2	23.4	7.8	32.6	15.2	14.3	53.4	19.6	20.9
18	47.6	55.6	45.1	31.5	21.5	8.7	50.7	28.1	54.4	50.4	19.4	18.7
19	42.4	55.2	43.7	29.1	21.1	8.3	31.4	13.9	55.2	46.8	17.1	16.8
20	44.0	53.7	43.8	29.2	19.9	8.2	25.8	13.7	55.2	42.5	17.0	15.5
21	42.2	54.2	36.5	32.7	18.9	7.7	23.4	13.7	56.8	40.8	16.1	15.3
22	42.5	53.3	34.7	25.4	18.5	7.6	44.0	13.4	60.7	37.1	16.1	16.1
23	49.4	55.3	37.0	26.3	17.8	29.1	41.2	40.1	56.1	48.9	15.3	15.4
24	43.6	51.0	35.4	29.1	17.4	36.7	28.4	13.9	56.8	51.7	15.5	13.6
25	51.0	47.2	32.0	23.8	13.3	19.4	24.2	14.2	57.5	48.5	14.7	13.7
26	53.3	45.5	32.0	23.7	14.2	12.3	22.5	13.6	56.9	46.5	13.7	13.2
27	56.2	48.3	30.2	29.4	13.5	34.9	21.8	14.5	56.4	36.3	13.2	12.5
28	56.1	43.9	29.4	24.6	13.6	53.7	21.5	14.3	56.2	36.1	13.7	12.3
29	54.9	43.8	29.0	25.0	13.1	54.4	20.6	17.6	56.2	34.5	14.4	12.7
30	53.6	55.4	32.7	21.6	13.1	53.0	19.6	.....	56.2	32.3	12.9	13.8
31	53.1	56.4	.....	21.7	.....	56.6	19.3	.....	56.2	.....	14.8	.....

Monthly discharge of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	56.2	22.0	43.4	67.1	1,350	4,130
August	56.4	43.8	53.1	82.2	1,650	5,050
September	57.5	29.0	46.4	71.8	1,390	4,270
October	59.0	21.6	36.5	56.5	1,130	3,470
November	48.5	13.1	23.0	35.6	691	2,120
December	56.6	7.6	18.7	28.9	580	1,780
January	55.9	19.3	34.4	53.2	1,070	3,270
February	40.1	13.4	16.8	26.0	488	1,500
March	60.7	10.2	36.9	57.1	1,140	3,510
April	56.1	32.3	49.5	76.6	1,480	4,560
May	31.8	12.9	20.1	31.1	623	1,910
June	42.1	12.3	19.8	30.6	593	1,820
The year	60.7	7.6	33.3	51.5	12,200	37,400

HAIKU DITCH AT MANAWAI GULCH, NEAR PEAHI, MAUI.[14]

LOCATION.—In bottom of western branch of Manawai Gulch just west of Keaaula-Opana boundary.

RECORDS AVAILABLE.—October 7, 1914, to June 30, 1920, at present site and from January 1, 1910, to October 7, 1914, at Peahi weir, on old Haiku ditch.

GAGE.—Friez water-stage recorder installed about October 21, 1914. Daily staff gage readings prior to that date.

DISCHARGE MEASUREMENTS.—Made from concrete footbridge across ditch.

CHANNEL AND CONTROL.—Control is submerged concrete weir across ditch, installed between October 21 and November 18, 1914, rated by engineers of East Maui Irrigation Co. Shifts slightly on account of gradual accumulation of tunnel débris on upstream side of control.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—To determine amount of water diverted from Territorial lands by East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

[14] Records published under the name "Haiku ditch at Peahi weir, near Huelo, Maui," after Oct. 7, 1914, in Water-Supply Papers 430, 445, 465, 485, and 515 were really obtained at this station.

Daily discharge, in million gallons, of Haiku ditch at Manawai Gulch, near Peahi, Maui, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	9.0	16.2	62.6	1.8	2.2	1.5	35.8	1.1	1.1	87.7	3.5	8.1
2	42.3	13.7	54.1	2.7	2.2	1.5	47.3	1.1	1.1	88.8	3.4	2.5
3	5.3	6.9	82.1	2.0	2.2	1.5	29.9	1.1	1.1	83.0	3.3	9.7
4	4.2	33.9	82.0	2.1	2.2	2.1	30.1	1.1	1.1	63.2	3.2	2.6
5	8.1	67.8	79.6	47.3	2.2	1.5	23.1	1.1	1.1	61.2	3.1	2.0
6	1.7	58.5	59.1	86.0	2.2	1.5	3.3	1.1	1.1	71.0	3.0	2.0
7	1.6	63.6	50.7	78.7	2.2	1.4	2.7	1.1	1.1	74.2	3.0	2.0
8	1.5	71.2	61.3	69.6	2.2	1.4	2.2	1.1	1.1	64.9	2.8	2.0
9	1.4	54.7	54.5	24.2	2.0	1.4	2.0	1.1	1.1	52.7	2.8	2.0
10	1.5	47.3	60.4	20.6	2.0	1.4	1.8	1.1	1.1	41.9	2.8	2.0
11	1.6	38.5	45.4	30.2	30.2	1.4	2.3	1.1	1.1	43.6	2.6	2.0
12	36.7	29.7	29.7	21.8	6.6	1.4	2.1	1.1	10.1	33.8	2.6	2.0
13	39.2	57.9	17.9	4.9	2.6	1.4	2.0	1.1	26.4	51.2	2.4	5.2
14	45.6	38.5	8.0	4.2	2.4	1.4	1.9	1.1	2.5	32.8	2.4	2.1
15	57.1	73.5	6.5	3.6	11.2	1.4	1.7	1.1	1.5	13.5	2.4	6.4
16	42.1	64.4	3.7	3.3	2.2	1.7	1.5	1.1	4.7	13.8	2.2	2.2
17	28.9	65.6	3.3	3.1	2.0	1.0	1.9	1.1	10.0	7.9	2.2	2.0
18	7.3	57.2	3.1	3.1	2.0	1.0	12.2	1.1	46.4	5.7	2.2	2.0
19	3.0	57.6	2.8	3.0	1.9	1.0	1.7	1.1	65.4	5.2	2.1	1.8
20	2.8	43.6	3.7	2.9	1.9	1.5	1.4	1.1	81.4	4.8	2.0	1.8
21	11.7	29.0	2.4	2.8	1.8	1.0	1.3	1.1	74.6	4.4	2.0	1.8
22	34.4	11.5	2.1	2.8	1.8	1.0	22.1	1.1	86.6	4.2	2.0	1.7
23	9.1	8.1	2.0	2.7	1.7	18.1	6.8	7.7	88.1	43.6	2.0	1.6
24	3.9	4.5	1.9	2.6	1.7	9.1	1.6	1.2	88.8	35.8	1.9	1.6
25	31.2	3.2	1.9	2.5	1.6	1.5	1.4	1.1	88.8	8.4	1.8	1.6
26	17.5	2.6	1.8	2.3	1.6	1.4	1.4	1.1	88.1	5.1	1.8	1.6
27	38.2	6.4	1.8	2.5	1.6	6.6	1.2	1.1	86.4	4.0	1.8	1.5
28	66.1	2.5	1.8	2.5	1.5	48.1	1.2	1.1	88.1	3.7	1.7	1.5
29	54.4	8.7	1.8	2.4	1.5	72.3	1.1	1.1	78.3	3.6	1.6	1.5
30	48.7	43.7	1.8	2.4	1.5	77.9	1.0	.....	86.0	3.6	1.6	1.5
31	30.7	79.4	.....	2.4	.....	75.3	1.0	.....	87.4	.....	2.3	.....

Monthly discharge of Haiku ditch at Manawai Gulch, near Peahi, Maui, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	66.1	1.4	22.2	34.3	687	2,110
August	79.4	2.5	37.4	57.9	1,160	3,560
September	82.1	1.8	26.3	40.7	790	2,420
October	86.0	1.8	14.3	22.1	443	1,360
November	30.2	1.5	3.36	5.20	101	309
December	77.9	1.0	11.0	17.0	340	1,050
January	47.3	1.0	7.97	12.3	247	758
February	7.7	1.1	1.33	2.06	38.6	118
March	88.8	1.1	38.7	59.9	1,200	3,680
April	88.8	3.6	33.9	52.5	1,020	3,120
May	3.5	1.6	2.40	3.71	74.5	228
June	9.7	1.5	2.61	4.04	78.3	240
The year	88.8	1.0	16.9	26.1	6,180	19,000

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, 1920.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
July 17	Spreckels ditch	Haipuaena weir, near Huelo, Maui	7 1/16 in.	9.7	6.3
Oct. 6	Koolau ditch	Alo division weir, near Huelo, Maui	2.02	171	111
Jan. 10	do	Alo division weir, near Huelo, Maui	.80	39.5	25.5
Mar. 6	Kailua Stream	Elevation 330 feet, near Huelo, Maui		.01	.005
6	Nailiilihaele Stream	Elevation 335 feet, near Huelo, Maui			.005
6	Pa Stream	Elevation 330 feet, near Huelo, Maui		.04	.03
6	Papaaea Stream	Elevation 335 feet, near Huelo, Maui		.02	.01
6	Koaiea Stream	Elevation 330 feet, near Huelo, Maui		.15	.09
7	West Punaluu Stream	Elevation 340 feet, near Huelo, Maui		.08	.05
7	Punaluu East Spring	Near Huelo, Maui		.06	.04
7	Kolea Stream	Elevation 370 feet, near Huelo, Maui		.1	.08
7	Wahinepe Stream	Near Huelo, Maui		.2	.1
7	Waikamoi Stream	Elevation 440 feet, near Huelo, Maui		.15	.1
7	Haipuaena Stream	Elevation 360 feet, near Huelo, Maui		.05	.03
7	Puohakamoa Stream	Near Huelo, Maui		.25	.15
8	Honomanu Stream	Near Keanae, Maui		1.8	1.15
27	Waihee ditch	Below spillway into lower ditch, near Wailuku, Maui.		37.5	24.4
27	do	Above all laterals, near Wailuku, Maui		38	24.7
Apr. 7	Koolau ditch	Nahiku weir, near Nahiku, Maui	1.22	57	37
18	Waihee ditch	Waihee flume, near Wailuku, Maui	1.19	33.5	21.6
18	do	Near Wailuku, Maui	1.54	28	18.0
18	do	do	1.52	27	17.5

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 schoolhouse.

RECORDS AVAILABLE.—August 28, 1917, to June 30, 1920.

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 9.75 feet, 8.15 a. m. January 17 (discharge, 1,070 million gallons per day or 1,660 second-feet). Minimum stage recorded during year 0.02 foot, from 4 p. m. October 27 to 7 a. m. October 28, and 7 a. m. February 29 (discharge, 1 million gallons per day, or 1.6 second-feet).

1917–1920: Maximum stage recorded in January, 1920. 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.

OBJECT OF STATION.—To determine feasibility of water-supply project for Halawa village

UTILIZATION.—For irrigation of taro and for domestic supply.

ACCURACY.—Stage-discharge relation permanent throughout the year. Rating curve well defined below 80 million gallons per day. Operation of water-stage recorder unsatisfactory. Records good when recorder was operating and fair for estimated periods.

Discharge measurements of Halawa Stream near Halawa, Molokai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 6	A. H. Wong	1.04	24.1	15.6
Nov. 5	do	.02	1.15	.75
Dec. 9	J. E. Stewart	1.63	61	39.5
26	B. F. Rush	.26	5.6	3.6
Feb. 11	do	.26	4.0	2.6
22	do	.11	3.2	2.1
Mar. 19	do	1.12	22	14.2
May 2	do	.35	3.6	2.3

Daily discharge, in million gallons, of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16.8	24	95		1.1	4.2		1.9		3.2	6.8
2	18.5	18.6	17.4		1.1	3.0		1.4		3.0	11.9
3	6.2	13.7	134		1.1	2.8		1.1		8.0	10.1
4	6.2	18.0	25		14.2	4.9		1.1		2.8	7.2
5	5.5	36	15.3		2.2	3.9		1.6		2.8	4.5
6	5.2	14.8	12.4	4.8	1.0	37		1.2		2.6	3.5
7	4.8	63	14.5	9.0	1.1	9.9		1.1		2.4	2.7
8	4.4	43	15.0	1.1	1.1	4.0		16.3	5.6	2.2	2.0
9	4.5	17.7	16.2	1.1		2.8		5.8	4.8	2.7	1.8
10	18.3	26	16.2	1.1		2.6		3.7	4.4	2.5	3.1
11	9.3	14.5	16.2	2.2		2.7		88	3.9	2.2	2.5
12	7.2	11.0	9.1	1.3		2.7		122	5.4	4.6	2.3
13	7.4	28	7.4	4.6		2.7		26	7.2	2.7	9.6
14	7.4	18.6	7.1	2.3		2.5		8.9	4.4	2.2	4.3
15	15.0	14.8	6.5	50		2.8		5.5	3.8	3.4	15.2
16	7.4	11.0	5.9	3.5		2.6		6.1	7.8	3.2	8.6
17	5.9	12.2	5.6	1.3		107	2.0	6.9	4.5	2.9	14.4
18	4.7	8.9		1.1		16.0	2.1	39	3.9	6.1	6.8
19	5.0	7.4		1.1		18.1	1.7	30	38	2.7	6.9
20	42	6.6		1.1		5.4	1.7	36	17.5	3.7	3.8
21	38	8.0		1.1		3.7	1.4	71	5.4	2.5	2.9
22	14.8	9.7		1.1		12.8	1.4	108	4.2	2.7	3.2
23	8.2	14.9		1.0		5.3	1.4	68	97	2.8	3.9
24	7.1	8.7		1.0		4.4	1.3		14.0	2.9	2.9
25	46	6.9		1.0		3.4	1.3		7.1	2.5	2.7
26	13.4	16.4		1.0	2.3	2.8	1.2		5.8	2.1	2.3
27	45	12.6		1.0	2.5	3.2	1.1		5.4	1.9	2.8
28	31	12.0		1.0	5.2	2.8	1.1		4.4	1.8	3.0
29	11.7	7.9		1.1	43	2.4	1.0		4.1	1.8	3.4
30	27	8.0		1.1	20.0	2.5			3.6	1.7	9.9
31	18.6	134			8.9	2.7				1.7	

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: Sept. 18-25, 3.; Sept. 26-30, 2.6; Oct. 1-10, 26; Oct. 11-25, 2.1; Oct. 26-31, 2.6; Nov. 1-5, 3.3; Mar. 24-26, 40; Mar. 27-31, 3.8; and Apr. 1-7, 11. Estimates made by comparison with records of discharge of other Molokai streams. Feb. 17-23 discharge computed from daily staff gage readings.

Monthly discharge of Haldwa Stream near Halawa, Molokai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	46	4.4	14.8	22.9	458	1,410
August	134	6.3	20.8	32.2	646	1,980
September	134	.....	15.2	23.5	456	1,400
October	.....	.....	9.90	15.3	307	942
November	50	1.0	3.75	5.80	112	345
December	.....	.....	8.39	13.0	[a] 260	798
January	107	2.4	9.15	14.2	284	870
February	.....	.....	2.66	4.12	[a] 77	237
March	122	1.1	25.3	39.1	785	2,410
April	97	3.6	11.3	17.5	339	1,040
May	6.1	1.7	2.75	4.25	85.3	262
June	15.2	1.8	5.50	8.51	165	506
The year	134	1.0	10.9	16.9	3,970	12,200

[a] Estimated by comparison with records of discharge of Honokahau Stream, Maui.

PAPALAUA STREAM NEAR WAILAU, MOLOKAI.

LOCATION.—A quarter of a mile above mouth of stream, 2 miles east of Wailau landing, 5 miles by foot trail west of Halawa Village, and 6½ miles due north of Pukoo Village.

RECORDS AVAILABLE.—September 17, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder installed May 22, 1920. Prior to this Gurley printing water-stage recorder used.

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

CHANNEL AND CONTROL.—Rocky and boulder strewn bed and high rocky banks. Control large boulders and gravel. Shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.89 feet at 1 a. m. October 6 (discharge, 630 million gallons per day or 975 second-feet); minimum stage recorded, 1.02 feet February 26 and 27 (discharge, 1.0 million gallons per day or 1.6 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water in stream available for irrigation of leeward side of island.

UTILIZATION.—Entire flow now wastes into sea.

ACCURACY.—Stage-discharge relation shifts during heavy floods. Rating curve used September 17 to October 5 not well defined. Rating curve used October 6 to June 30 well defined below 25 million gallons per day and fairly well defined up to 200 million gallons per day. Operation of water-stage recorder unsatisfactory from November 7 to March 22 and May 7–22. Records good when recorder was operating.

Discharge measurements of Papalaua Stream near Wailau, Molokai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 14	A. H. Wong	0.85	5.1	3.3
17	do	.77	4.8	3.1
Feb. 25	B. F. Rush	1.07	1.7	1.1
Mar. 20	do	1.98	38.5	24.8
21	Reid Jerman	1.74	22.5	14.5
22	B. F. Rush	3.33	262	169
Apr. 11	do	1.95	39	25
May 9	do	1.24	3.9	2.5

Daily discharge, in million gallons, of Papalaua Stream near Wailau, Molokai, for the year ending June 30, 1920.

Day.	Sept.	Oct.	Nov.	Mar.	Apr.	May.	June.
1		2.2	2.1		22	1.6	8.8
2		3.2	5.0		30	1.5	6.4
3		2.8	1.9		11	1.4	6.9
4		3.6	1.5		10.1	1.4	4.2
5		64			8.0	1.4	3.2
6		126			5.0	1.3	2.4
7		9.4			6.2		2.0
8		8.5			3.0		1.7
9		3.1			2.5		1.7
10		2.4			2.2		3.0
11		2.1			2.0		2.0
12		1.8			5.2		3.0
13		1.7			3.7		10.4
14		1.6			2.3		3.4
15		1.6			2.1		18.4
16		1.5			3.1		6.7
17		1.5			1.9		17.4
18	2.8	1.4			1.8		6.0
19	2.7	1.4			43		8.4
20	2.5	1.4			6.9		3.2
21	2.5	1.8			2.4		2.5
22	2.2	1.5		95	1.9		3.4
23	2.2	1.4		47	100	2.0	2.5
24	3.4	1.8		42	5.0	2.3	2.3
25	2.2	1.5		56	3.0	1.8	2.2
26	2.1	1.4		18.4	2.4	1.7	2.2
27	2.0	1.6		5.2	2.1	1.6	3.0
28	2.1	1.6		3.5	1.9	1.6	3.1
29	2.1	1.6		2.8	1.8	1.6	2.6
30	2.0	1.8		2.6	1.6	1.4	8.6
31		2.2		3.5		1.8	

NOTE.—May 7-22, recorder injured by blasting; discharge estimated in million gallons per day as follows: May 6-10, 1.3, and May 11-22, 2.7. Estimates made by comparison with records of discharge of other Molokai streams.

Monthly discharge of Papalaua Stream near Wailau, Molokai, for the year ending June 30. 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
September 18-30	3.4	2.0	2.37	3.67	30.8	95
October	126	1.4	8.37	13.0	259	796
March 22-31	95	2.6	27.6	42.7	276	847
April	100	1.6	9.80	15.2	294	902
May			2.32	3.59	72.0	221
June	18.4	1.7	5.05	7.81	152	465

WAIAKEAKUA STREAM NEAR WAILAU, MOLOKAI.

LOCATION.—Half a mile above confluence with Pulena Stream 3 miles south of Wailau landing, and 6 miles northwest of Pukoo Village.

RECORDS AVAILABLE.—October 30, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

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

CHANNEL AND CONTROL.—Stream bed rocky and boulder strewn. Banks steep, high, and covered with vegetation. Control formed of boulders, cobblestones, and gravel. Not likely to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.00 feet at 9.40 p. m. March 11 (discharge, 144 million gallons per day or 223 second-feet); minimum stage recorded, 0.92 foot at 6 p. m. March 7 (discharge, 1.3 million gallons per day or 2.0 second-feet).

DIVERSION.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigation of west end of Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation shifts during severe floods. Rating curve used October 30 to January 16 well defined below 30 million gallons per day. Rating curve used January 17 to June 30 fairly well defined below 20 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Waiakeakua Stream near Wailau, Molokai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 14	A. H. Wong	1.10	6.0	3.9
19	do	1.05	5.0	3.2
Dec. 3	B. F. Rush	.98	3.2	2.1
22	do	.95	2.6	1.7
23	do	2.02	31	20.1
23	do	2.27	39.5	25.5
23	do	1.80	21.8	14.1
23	do	1.49	13.1	8.4
23	do	1.29	8.8	5.7
Feb. 13	do	1.10	4.0	2.6
Mar. 16	do	1.32	5.2	3.4
Apr. 21	do	1.22	4.9	3.2
May 15	do	1.08	3.4	2.2

Daily discharge, in million gallons, of Waiakeakua Stream near Wailau, Molokai, for the year ending June 30, 1920.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	2.6	4.8	1.8	1.7	13.8	2.5	4.5
2	.....	2.7	4.4	1.7	1.6	11.1	2.5	2.8
3	.....	2.7	4.4	1.6	1.5	9.7	2.3	3.8
4	2.8	5.0	5.2	1.6	1.6	9.5	2.4	2.5
5	3.4	3.0	4.5	1.8	1.5	9.0	2.4	2.2
6	4.8	2.9	9.2	1.9	1.4	8.8	2.2	2.1
7	4.3	2.6	5.4	1.6	1.4	6.0	2.1	1.9
8	3.0	2.6	4.5	1.6	4.8	6.0	2.1	1.8
9	3.1	4.2	4.1	1.8	2.3	5.4	2.3	1.9
10	2.9	2.8	3.9	2.0	2.2	5.0	2.1	1.9
11	3.3	2.6	3.8	.....	32	4.8	2.1	1.8
12	3.6	2.6	3.7	.....	31	5.4	2.2	1.9
13	4.7	2.6	3.5	2.4	34	4.7	2.1	2.5
14	3.6	2.5	3.4	2.0	7.8	4.2	2.3	2.0
15	15.5	2.5	3.4	1.9	5.6	4.1	2.4	3.8
16	4.0	2.6	3.2	1.9	4.9	4.3	2.3	2.4
17	3.5	2.5	15.4	2.0	6.5	3.8	2.2	5.6
18	3.3	2.5	4.0	1.9	17.3	4.1	2.6	3.0
19	3.1	2.4	3.1	1.8	22	5.5	2.1	3.2
20	3.1	2.4	2.8	1.8	21	4.4	2.2	2.3
21	3.0	2.4	2.6	1.8	26	3.4	2.0	2.2
22	2.8	2.4	7.8	1.9	49	3.1	2.1	2.4
23	2.8	11.3	3.6	1.9	31	8.6	2.1	2.2
24	2.7	3.5	2.6	1.8	46	3.7	2.1	2.1
25	2.7	3.2	2.5	1.7	48	3.3	1.9	2.0
26	2.7	3.4	2.3	1.6	17.4	3.1	1.9	1.9
27	2.7	3.9	2.2	1.6	11.3	2.9	1.9	2.0
28	2.7	4.1	2.1	1.6	9.0	2.8	1.8	1.9
29	2.8	18.1	1.9	2.2	7.5	2.7	1.8	1.9
30	2.6	11.5	1.8	.....	6.9	2.6	1.7	2.0
31	.....	6.4	1.8	.....	7.0	.....	2.1	.....

NOTE.—Clock stopped Feb. 11-12; discharge estimated at 2.6 million gallons per day.

Monthly discharge of Waiakeakua Stream near Wailau, Molokai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
November 4-30	15.5	2.6	3.69	5.71	99.5	306
December	18.1	2.4	4.08	6.31	127	388
January	15.4	1.8	4.11	6.36	127	391
February	.....	1.6	1.88	2.91	54.4	167
March	49	1.4	14.9	23.1	461	1,420
April	13.8	2.6	5.58	8.63	167	514
May	2.6	1.7	2.15	3.33	66.8	205
June	5.6	1.8	2.55	3.95	76.5	235
The period	.....	.....	.....	.....	1,090	3,350

PULENA STREAM NEAR WAILAU, MOLOKAI.

LOCATION.—Half a mile above confluence with Waiakeakua Stream, 3 miles south of Wailau landing, and 4 miles northwest of Pukoo Village.

RECORDS AVAILABLE.—October 30, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge near station.

CHANNEL AND CONTROL.—Channel rocky and boulder strewn. Banks steep, high, and fairly clean. Control boulders and gravel, fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.75 feet at 1.15 a. m. March 24 (discharge, 590 million gallons per day or 913 second-feet); minimum stage recorded, 0.89 foot at 7 a. m. June 28 (discharge, 3.0 million gallons per day or 4.6 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigation of west end of Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation shifts during floods. Rating curve used October 30 to January 16 fairly well defined below 150 million gallons per day. Rating curve used January 17 to June 30 fairly well defined below 30 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Pulena Stream near Wailau, Molokai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 24	A. H. Wong	1.28	11.8	7.6
Dec. 5	B. F. Rush	1.22	10	6.5
18	do	1.07	5.6	3.6
23	do	3.16	194	125
23	do	2.24	69	44.5
23	do	1.96	43	27.5
24	do	1.45	16.4	10.6
Feb. 12	do	1.38	17.8	11.5
15	do	1.06	7.2	4.7
Mar. 16	Reid Jerman	1.18	9.5	6.2
Apr. 21	B. F. Rush	1.23	10.9	7.1
May 15	do	1.09	9.0	5.8

Daily discharge, in million gallons, of Pulena Stream near Wailau, Molokai, for the year ending June 30, 1920.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	6.8	4.1	16.2	6.0	5.1	34	6.1	12.2
2	11.0	4.9	13.4	5.6	4.0	29	6.1	6.5
3	6.5	4.3	10.7	5.4	3.9	26	5.8	5.2
4	6.7	19.1	11.0	5.2	4.0	23	5.6	4.6
5	6.0	6.2	13.8	5.6	4.0	23	5.4	5.1
6	9.2	6.3	51	5.5	3.6	19.5	5.1	4.1
7	16.3	5.0	20.0	5.1	3.4	18.0	4.8	3.5
8	7.0	4.7	13.4	5.5	13.9	13.2	4.7	3.3
9	6.8	4.6	10.7	6.1	6.6	11.8	5.5	3.5
10	6.0	5.1	9.5	7.8	4.8	10.6	4.6	5.9
11	6.7	4.6	8.7	9.7	28	10.2	4.6	3.4
12	11.3	4.1	9.8	9.5	31	12.9	4.6	4.1
13	16.3	4.0	8.3	6.6	38	11.6	4.3	10.0
14	8.3	3.9	7.3	6.1	10.6	9.0	4.7	4.5
15	10.4	4.1	7.0	5.1	7.8	8.4	5.2	15.9
16	7.1	7.4	6.8	5.0	8.3	7.8	5.2	7.0
17	6.3	4.7	64.0	5.4	12.9	7.2	4.5	17.0
18	6.2	4.1	19.1	5.4	29	12.0	4.5	8.2
19	5.7	3.9	12.9	4.6	65	18.4	3.9	6.0
20	5.9	3.9	10.4	4.5	58	11.8	4.1	4.6
21	5.6	3.8	9.2	4.6	47	8.2	3.9	4.2
22	5.3	3.8	21	4.7	137	7.2	4.2	4.3
23	5.0	72	10.2	5.8	95	37.0	3.8	4.1
24	5.0	10.0	9.0	4.3	121	12.4	3.8	3.9
25	4.7	7.3	8.0	4.1	126	9.7	4.0	3.6
26	4.7	11.0	7.6	4.1	61	8.4	3.8	3.3
27	4.7	16.4	8.0	4.0	34	7.6	3.6	3.4
28	4.4	12.8	7.4	3.9	24	7.8	3.4	3.3
29	4.4	44	6.7	7.8	18.7	6.8	3.3	3.3
30	4.3	37	6.6	.....	16.6	6.4	3.3	9.4
31	.....	34	6.0	.....	16.2	.....	14.5	.....

Monthly discharge of Pulena Stream near Wailau, Molokai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
November	16.3	4.3	7.15	11.1	215	658
December	72	3.8	11.6	17.9	361	1,100
January	64	6.0	13.7	21.2	424	1,300
February	9.7	3.9	5.62	8.70	163	500
March	137	3.4	33.5	51.8	1,040	3,190
April	37	6.4	14.3	22.1	429	1,320
May	14.5	3.3	4.87	7.54	151	463
June	17.4	3.3	5.90	9.13	177	543
The period					2,960	9,070

PELEKUNU STREAM NEAR PELEKUNU, MOLOKAI.

LOCATION.—Half a mile above confluence with Lanipuni Stream, 2 miles south of Pelekunu landing, 6 miles north of Kamalo Village, and 12 miles by trail northwest of Pukoo.

RECORDS AVAILABLE.—December 1, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 1,000 feet below station.

CHANNEL AND CONTROL.—Stream bed rocky with scattered boulders. Banks steep and rocky. Control large boulders wedged into cleft in rock ledge, seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.67 feet at 4 p. m. March 22 (discharge, 290 million gallons per day or 449 second-feet); minimum stage recorded, 1.65 feet at 10 p. m. March 7 (discharge, 1.8 million gallons per day or 2.8 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigating West Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation permanent during the year. Rating curve well defined below 30 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Pelekunu Stream near Pelekunu, Molokai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Dec. 4	B. F. Rush	2.41	21.5	13.9
4	J. E. Stewart	2.07	7.3	4.7
5	do	1.89	4.2	2.7
13	B. F. Rush	1.80	4.0	2.6
15	do	1.78	3.9	2.5
Feb. 14	do	1.84	5.1	3.3
Mar. 17	do	1.92	5.9	3.8
Apr. 22	do	2.00	6.9	4.5
May 18	do	1.78	4.0	2.6

Daily discharge, in million gallons, of Pelekunu Stream near Pelekunu, Molokai, for the year ending June 30, 1920.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.3	9.3	3.6	2.1	7.4	4.1	5.1
2	2.3	7.8	3.5	2.0	6.5	3.8	3.5
3	2.3	6.2	3.4	2.0	6.2	3.6	3.2
4	9.5	6.8	3.3	2.0	6.2	3.5	2.9
5	3.6	8.5	3.3	2.0	6.9	3.4	3.3
6	3.8	25	3.1	2.0	6.4	3.3	2.6
7	3.1	10.5	3.1	2.0	5.4	3.1	2.4
8	3.0	7.4	3.2	4.5	4.6	3.0	2.3
9	2.9	6.4	3.2	3.0	4.3	3.3	2.5
10	3.3	6.0	3.4	2.3	4.2	2.9	3.3
11	3.2	5.6	.....	16.3	4.2	3.1	2.3
12	2.9	8.3	.....	5.0	5.6	2.9	2.9
13	2.7	5.8	.....	21	5.7	2.8	6.2
14	2.6	5.0	3.0	5.0	4.1	3.0	3.1
15	.....	4.6	2.5	3.9	3.7	3.0	9.4
16	.....	4.5	2.4	3.5	3.5	3.0	4.8
17	.....	28	2.6	4.1	3.3	2.9	8.7
18	.....	10.5	2.6	7.3	7.7	2.7	4.6
19	.....	7.4	2.3	24	18.6	2.6	3.3
20	2.5	6.4	2.3	27	8.0	2.6	2.7
21	2.5	5.7	2.3	14.4	5.4	2.5	2.5
22	2.5	8.5	2.8	55	4.5	2.5	2.5
23	61	5.7	3.5	37	17.5	2.5	2.4
24	7.4	5.2	2.4	33	8.7	2.5	2.3
25	5.2	4.8	2.2	34	6.4	2.5	2.3
26	7.1	4.5	2.2	20.0	5.7	2.4	2.2
27	9.3	4.8	2.1	12.6	5.1	2.3	2.2
28	7.3	4.2	2.2	9.8	5.4	2.3	2.2
29	13.6	4.0	2.3	8.0	4.6	2.3	2.2
30	11.6	3.9	.....	7.6	4.2	2.3	3.3
31	18.3	3.7	.....	6.4	.....	6.4	.....

NOTE.—Dec. 15–19, recorder not working properly; discharge estimated at 2.7 million gallons per day. Feb. 11–13 clock was run down; discharge estimated at 4.2 million gallons per day by comparison with records of discharge for other Molokai streams.

Monthly discharge of Pelekunu Stream near Pelekunu, Molokai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
December	61	2.3	6.75	10.4	209	642
January	28	3.7	7.58	11.7	235	721
February	.....	2.1	2.94	4.55	85.4	262
March	55	2.0	12.2	18.9	379	1,160
April	18.6	3.3	6.33	9.79	190	583
May	6.4	2.3	3.00	4.64	93.1	285
June	9.4	2.2	3.44	5.32	103	317
The period	.....	.....	.....	.....	1,290	3,970

LANIPUNI STREAM NEAR PELEKUNU, MOLOKAI.

LOCATION.—Half a mile above confluence with Pelekunu Stream, 2 miles south of Pelekunu landing, 6 miles north of Kamalo Village, and 13 miles by trail northwest of Pukoo.

RECORDS AVAILABLE.—December 1, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 200 feet below gage.

CHANNEL AND CONTROL.—Channel rocky and boulder strewn, banks high and rocky. Control boulders and gravel. Shifts during extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.00 feet at 6.15 a. m. March 13 (discharge, 312 million gallons per day or 483 second-feet); minimum stage recorded, 0.69 foot at 11.30 p. m. December 22 (discharge, 2.0 million gallons per day or 3.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigating West Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined between 2 and 10 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Lanipuni Stream near Pelekunu, Molokai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Dec. 1	B. F. Rush	0.75	3.0	1.95
4	do	.82	6.0	3.9
5	J. E. Stewart	.74	3.8	2.4
12	B. F. Rush	.72	3.6	2.3
14	do	.71	3.4	2.2
Feb. 14	do	.75	3.8	2.4
Mar. 17	Reid Jerman	.78	3.6	2.3
Apr. 22	B. F. Rush	.78	4.2	2.7
May 18	do	.72	2.9	1.9

Daily discharge, in million gallons, of Lanipuni Stream near Pelekunu, Molokai, for the year ending June 30, 1920.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.8	7.2	2.8	2.4	4.5	3.0	3.3
2	3.0	5.4	2.8	2.4	4.3	3.0	2.7
3	2.8	4.5	2.7	2.4	4.1	3.0	2.8
4	8.1	4.5	2.6	2.6	4.3	3.0	2.6
5	2.8	4.3	2.7	2.4	6.8	2.8	2.6
6	2.6	14.2	2.7	2.4	5.0	2.7	2.2
7	2.6	5.9	2.6	2.2	4.9	2.6	2.2
8	2.6	4.5	2.6	4.8	3.8	2.6	2.4
9	2.7	4.0	2.7	3.0	3.6	2.7	2.6
10	2.7	3.6	2.8	2.7	3.3	2.6	3.0
11	2.6	3.4	.....	3.6	3.3	2.7	2.2
12	2.6	3.6	.....	3.4	4.3	2.7	2.8
13	2.6	3.2	.....	24	3.8	2.6	4.9
14	2.6	3.2	2.7	4.0	3.2	2.7	2.8
15	2.4	3.2	2.7	3.6	3.0	3.0	6.2
16	2.7	3.2	2.6	3.3	2.8	2.8	4.0
17	2.4	15.7	2.7	4.0	2.8	2.7	7.6
18	2.4	4.7	2.8	6.1	3.2	2.7	3.8
19	2.2	4.3	2.6	68	13.0	2.6	3.2
20	2.1	3.6	2.6	61	5.0	2.6	2.8
21	2.1	3.4	2.6	17.2	3.4	2.4	2 7
22	2.1	4.1	3.7	77	3.4	2.4	2.6
23	85	3.4	3.4	42	36	2.2	2.4
24	7.3	3.6	2.7	33	6.2	2.1	2.6
25	3.4	3.3	2.4	39	4.7	2.1	2.4
26	4.0	3.0	2.4	14.8	4.0	2.1	2.2
27	7.5	3.0	2.6	7.9	3.6	2.2	2.4
28	6.3	3.0	2.6	6.2	3.4	2.2	2.6
29	25	3.2	2.8	5.2	3.3	2.2	2.2
30	18.6	3.0	.....	4.9	3.2	2.4	3.4
31	27	3.0	.....	4.5	.....	2.7	.....

NOTE.—Feb. 11-13 clock run down; discharge estimated by comparison with records of discharge for other Molokai streams, at 3.0 million gallons per day.

Monthly discharge of Lanipunu Stream near Pelekunu, Molokai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
December	85	2.1	7.92	12.3	246	753
January	15.7	3.0	4.59	7.10	142	437
February	3.7	2.4	2.76	4.27	79.9	246
March	77	2.2	14.8	22.9	460	1,410
April	36	2.8	5.34	8.26	160	492
May	3.0	2.1	2.58	3.99	80.1	245
June	7.6	2.2	3.07	4.75	92.2	283
The period					1,260	3,870

WAIKOLU STREAM AT PIPE-LINE CROSSING, NEAR KALAUPAPA, MOLOKAI.

LOCATION.—At elevation of 300 feet, 1 mile above mouth of stream and 5 miles southeast of Kalaupapa.

RECORDS AVAILABLE.—June 2, 1919, to June 30, 1920.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading

CHANNEL AND CONTROL.—Stream bed sand, gravel, and boulders. Right bank steep and rocky. Left bank is overflowed at high stages. Control is concrete casing to 8-inch water main and is permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 7.61 feet at 6.10 p. m. April 19 (discharge, 538 million gallons per day or 832 second-feet); minimum stage recorded, 3.91 feet at 10 p. m. June 9, 1920 (discharge, 3.8 million gallons per day or 5.9 second-feet).

DIVERSIONS.—Intake ditch to Kalaupapa water supply diverts about 2.5 million gallons per day at elevation of about 500 feet. Some of this water returns to the stream just below the station.

REGULATION.—By diversion only.

OBJECT OF STATION.—To determine amount of water available for proposed power and irrigation project for leper settlement.

UTILIZATION.—Part of water used for irrigation of taro. Remainder wastes into sea.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 4 and 50 million gallons per day. Operation of water-stage recorder unsatisfactory until March 3. Records good when recorder was operating.

Discharge measurements of Waikolu Stream at pipe-line crossing, near Kalaupapa, Molokai, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 10	A. H. Wong	3.97	8.9	5.8
Nov. 3	B. F. Rush	3.94	7.4	4.8
Dec. 8	do	3.94	5.3	3.4
Mar. 6	do	3.92	6.7	4.3
13	do	4.70	68	44
Apr. 2	do	3.96	7.5	4.9
28	do	3.96	7.2	4.6
June 30	do	3.93	6.6	4.3

Daily discharge, in million gallons, of Waikolu Stream at pipe-line crossing, near Kalaupapa, Molokai, for the year ending June 30, 1920.

Day.	July.	Aug.	Mar.	Apr.	May.	June.	Day.	July.	Aug.	Mar.	Apr.	May.	June.
1	6.4	8.6	.....	5.7	5.7	6.1	16	6.4	.....	6.7	5.4	5.7	8.3
2	6.4	8.3	.....	5.4	5.4	6.1	17	5.7	.....	5.4	5.1	5.7	8.3
3	7.9	.....	4.5	5.4	5.4	5.4	18	5.7	.....	6.1	5.1	5.7	6.7
4	6.4	.....	4.5	5.4	5.4	5.1	19	6.4	.....	58	73	5.7	5.1
5	6.4	.....	4.5	5.7	5.7	5.1	20	7.1	.....	47	12.8	5.1	4.8
6	5.7	.....	4.1	6.4	5.4	4.8	21	9.0	.....	14.1	6.7	5.1	4.5
7	6.1	.....	4.1	5.7	5.4	4.8	22	8.6	.....	43	5.7	5.1	4.5
8	5.7	.....	4.8	5.4	5.4	4.5	23	6.1	.....	24	33	5.1	4.5
9	5.7	.....	5.1	5.4	5.4	4.1	24	6.1	.....	27	8.3	4.8	4.5
10	5.4	.....	4.8	5.1	5.4	4.5	25	6.7	.....	20	6.7	4.8	4.5
11	5.4	.....	5.4	5.1	5.4	4.8	26	7.1	.....	12.4	5.7	4.8	4.5
12	9.4	.....	6.7	5.1	5.4	4.5	27	10.2	.....	7.9	5.4	5.1	4.5
13	7.1	.....	64	6.4	5.1	7.9	28	11.9	.....	7.1	5.4	4.8	4.5
14	7.1	.....	6.4	5.7	5.4	5.1	29	6.4	.....	6.7	5.4	4.8	4.5
15	10.6	.....	12.8	5.4	5.4	8.3	30	10.2	.....	6.1	5.7	4.5	4.8
							31	9.0	.....	5.7	.....	5.1	.....

NOTE.—Mar. 1-2, recorder not working and discharge estimated at 4.5 million gallons per day.

Monthly discharge of Waikolu Stream at pipe-line crossing, near Kalaupapa, Molokai, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	11.9	5.4	7.24	11.2	224	689
August	.....	.....	8.00	12.4	a 248	761
September	.....	.....	6.00	9.28	a 180	552
October	.....	.....	6.50	10.1	a 202	618
November	.....	.....	5.50	8.51	a 165	506
December	.....	.....	6.00	9.28	a 186	517
January	.....	.....	8.00	12.4	a 248	761
February	.....	.....	6.50	10.1	a 188	578
March	64	4.1	14.1	21.8	438	1,340
April	73	5.1	9.09	14.1	273	837
May	5.7	4.5	5.26	8.14	163	500
June	8.3	4.1	5.32	8.23	160	490
The year	.....	.....	7.31	11.3	2,680	8,200

a Estimated from rainfall data and comparison with records of discharge of adjacent streams.

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, 1920.

Date.	Stream.	Locality.	Discharge.	
			Second-feet	Million gallons per day.
Aug. 7	Waialana	Elevation, 1,300 feet, near Halawa	0.15	0.09
7	Pipiwai	Elevation, 1,200 feet, near Halawa	.03	.02
7	Lelemaku	At Puahaunui, near Wailau	.04	.03
7	Kahaakea	At Hakaano, near Wailau	.09	.06
7	Wailewa	do	.09	.06
7	Papalaua	At mouth, near Wailau	47.5	31
9	do	400 feet above junction with Pohakuloa, near Wailau	13.5	8.7
9	Pohakuloa	125 feet above junction with Papalaua, near Wailau	1.9	1.2

Miscellaneous measurements on Molokai during the year ending June 30, 1920—Contd.

Date.	Stream.	Locality.	Discharge.	
			Second-feet	Million gallons per day.
Aug. 9	Wailau	1½ miles above mouth, near Wailau	67	43.5
9	do	Above confluence with Kahawaiki Stream, at Wailau.	42.5	27.5
9	Tributary of Wailau from left.	Near mouth and about 1 mile from Wailau landing.	.85	.55
9	Kahawaiki	1 mile above confluence with Wailau Stream	3.2	2.0
9	Upper taro ditch on Kahawaiki.	Near Wailau	.4	.25
10	Waikolu	300 feet below a right branch at elevation 900 feet near Kalaupapa.	7.7	5.0
10	do	Elevation 600 feet, near Kalaupapa	7.2	4.7
10	do	Elevation 450 feet and above upper taro patches, near Kalaupapa.	8.6	5.6
10	do	100 feet below Big Springs branch and 1,000 feet from mouth, near Kalaupapa.	18.2	11.8
10	Kalaupapa water supply intake ditch.	Near Kalaupapa	4.2	2.7
10	Kalaupapa water supply wasteway.	Pipe-line intake near Kalaupapa	1.55	1.0
10	Big Springs Branch of Waikolu Stream.	Near Kalaupapa	2.6	1.65
11	Pelekunu	Elevation 580 feet and 500 feet below junction of Kanaha and Kuikuiakea streams, near Pelekunu.	13.0	8.4
11	do	Elevation 460 feet and 100 feet above mouth of Pilipilau Stream, near Kalaupapa.	9.9	6.4
11	do	Below Big Springs Branch and above all taro ditches, near Pelekunu.	23.2	15.0
11	Pelekunu tributary from right.	Midway between Kanaha and Pilipilau streams, near Pelekunu.	.10	.06
11	Pilipilau	300 feet above mouth, near Pelekunu	1.4	.9
11	Lanipuni	200 feet below junction of two branches, near Pelekunu.	6.6	4.2
11	do	300 feet above mouth, near Pelekunu	8.4	5.4
11	Pelekunu tributary from left.	Opposite Lanipuni, near Pelekunu	.07	.05
11	Big Springs Branch of Pelekunu.	50 feet above mouth, near Pelekunu	2.0	1.3
11	Little Springs Branch of Pelekunu.	Mouth, near Pelekunu	.40	.25
11	Pelekunu tributary from right.	Below Big Springs Branch, near Pelekunu	.10	.06
11	Papalina	Mouth, at Pelekunu	.35	.25
12	Right Branch of Weweai	Trail crossing, near Pelekunu	.12	.08
12	Left Branch of Weweai	Opposite old taro patches, near Pelekunu	1.75	1.1
Nov. 1	Pelekunu	Elevation 580 feet and 600 feet below junction of Kanaha and Kuikuiakea streams, near Pelekunu.	4.6	2.9
1	do	25 feet above mouth of Lanipuni, near Pelekunu	6.0	3.9
1	Pilipilau	Mouth, near Pelekunu	.95	.6
1	Lanipuni	do	4.1	2.6
1	Pelekunu tributary from left.	Opposite Lanipuni, near Pelekunu	.2	.15
4	Kalaupapa water supply wasteway at pipe-line intake.	Near Kalaupapa	1.2	.8
Dec. 8	Waikolu	Elevation 600 feet, near Kalaupapa	4.7	3.0
8	Kalaupapa water supply intake ditch.	Near Kalaupapa	3.4	2.2
8	Kalaupapa water-supply wasteway at pipe-line intake.	do	.9	.6
Mar. 6	Kalaupapa water supply intake ditch.	do	2.8	1.85
6	Kalaupapa water supply wasteway at pipe-line intake.	do	.8	.5
Apr. 2	Waikolu	Elevation 650 feet, near Kalaupapa	5.5	3.55
2	do	Elevation 600 feet, near Kalaupapa	4.4	2.8
2	Kalaupapa water supply intake ditch.	Near Kalaupapa	2.9	1.9
2	Kalaupapa water supply wasteway at pipe-line intake.	do	1.15	.75
3	Waikolu	Below Big Springs Branch, near Kalaupapa	14.4	9.3
28	do	Elevation 650 feet, near Kalaupapa	4.8	3.1
28	Kalaupapa water supply wasteway at pipe-line intake.	Near Kalaupapa	1.1	.7
June 30	do	do	1.0	.65

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 2, 1917, to April 18, 1920. Station discontinued November 24, 1920, but record unreliable after April 18, 1920.

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 year, 1.77 feet at 6 a. m. August 11 (discharge, 16.3 million gallons per day or 25.2 second-feet); minimum stage recorded during year, 0.57 foot at 6 p. m. January 23 (discharge, 1.1 million gallons per day or 1.7 second-feet).

1917–1920: Maximum stage recorded, 1.77 feet at 1 p. m. April 3, 1918, and August 11, 1919 (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 head gates.

OBJECT OF STATION.—To determine amount of water diverted by flume.

UTILIZATION.—For fluming cane to Olaa Sugar Co.'s mill and for water supply for mill.

ACCURACY.—Stage-discharge relation practically permanent during year. Rating curve fairly well defined above 1 million gallons per day. Operation of water-stage recorder unsatisfactory. Records fair when recorder was operating.

Discharge measurements of Olaa flume at Kaumana, near Hilo, Hawaii, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Feb. 22	Reid Jerman	0.66	2.4	1.55
26	do	.62	1.9	1.2

Daily discharge, in million gallons, of Olaa flume at Kaumana, near Hilo, Hawaii, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Jan.	Feb.	Mar.	Apr.
1	4.3	8.9	12.4	3.0	.....	.....	1.6	13.4
2	4.2	8.4	13.6	3.0	.....	.....	1.8	13.0
3	4.7	8.1	13.0	2.7	.....	.....	1.6	12.6
4	4.8	7.6	13.0	2.5	.....	.....	1.5	12.6
5	4.4	7.8	13.0	2.2	.....	.....	1.4	13.2
6	4.1	8.8	11.2	2.1	.....	.....	1.3	11.6
7	3.8	9.8	10.6	2.3	.....	.....	1.3	9.3
8	3.4	10.4	11.6	8.6	.....	.....	1.2	8.9
9	3.2	12.8	12.8	11.6	.....	.....	1.2	9.1
10	3.0	16.0	12.0	7.1	.....	.....	1.2	9.1
11	2.7	13.8	11.4	10.6	.....	.....	1.3	11.2
12	2.5	11.6	11.4	9.3	.....	.....	1.6	12.0
13	2.3	11.0	11.4	9.8	.....	.....	1.9	11.8
14	2.2	11.8	10.2	9.8	.....	.....	1.7	12.4
15	2.4	11.6	10.2	8.6	2.4	.....	1.6	11.8
16	2.9	10.6	9.8	7.6	2.3	.....	1.5	11.0
17	3.2	10.0	9.1	6.7	2.3	.....	1.6	10.2
18	3.2	10.4	8.2	.....	2.1	.....	1.8	9.8
19	3.0	10.8	7.4	.....	1.9	.....	2.5	.....
20	2.9	10.0	6.8	.....	1.9	.....	4.4	.....
21	2.8	10.8	6.4	.....	7.6	.....	12.2	.....
22	3.0	10.8	5.7	.....	1.1	.....	14.2	.....
23	4.1	10.2	5.3	.....	1.1	.....	13.4	.....
24	4.1	12.2	4.7	.....	.....	.....	13.0	.....
25	4.0	13.0	4.3	.....	.....	.....	12.0	.....
26	4.3	12.0	4.0	.....	.....	.....	11.0	.....
27	4.6	11.2	3.5	.....	.....	1.2	10.6	.....
28	5.1	12.4	3.2	.....	.....	1.3	10.0	.....
29	7.0	12.2	3.1	.....	.....	1.4	10.2	.....
30	8.8	11.4	3.0	.....	.....	.....	12.0	.....
31	8.8	10.6	.....	.....	.....	.....	13.6	.....

Monthly discharge of Olaa flume at Kaumana, near Hilo, Hawaii, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	8.8	2.2	3.99	6.17	124	380
August	16.0	7.6	10.9	16.9	337	1,040
September	13.6	3.0	8.76	13.6	263	807
March	14.2	1.2	5.36	8.29	166	510

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, 1918, to October 19, 1919. Station discontinued February 26, 1920, but no rating after October 19.

GAGE.—Stevens continuous water-stage recorder. March 21, 1911, to July 31, 1913, Barret 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, 16.15 feet at 3.30 p. m. October 7 (discharge, 4,120 million gallons per day or 6,370 second-feet); minimum stage, 5.56 feet at 10.20 a. m. October 7 (discharge, 31 million gallons per day or 48 second-feet).

1911–1913; 1918–1919: 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.

OBJECT OF STATION.—To determine amount of water flowing from Territorial lands.

UTILIZATION.—For power, fluming sugar cane, and irrigation of taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory. Records good.

The following discharge measurement was made by Reid Jerman:

February 23, 1920: Gage height, 6.96 feet; discharge, 24.8 second-feet or 16.0 million gallons per day.

Daily discharge, in million gallons, of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	96	957	45	17	57	178	80	57
2	.....	90	274	40	18	54	154	72	54
3	.....	90	2,140	40	19	50	166	68	54
4	.....	96	809	36	20	50	132	64	.....
5	.....	132	535	34	21	50	116	60	.....
6	.....	154	356	38	22	90	108	57	.....
7	.....	132	254	436	23	68	179	57	.....
8	54	142	274	146	24	57	178	54	.....
9	54	655	190	85	25	81	132	50	.....
10	54	1,010	166	85	26	96	116	47	.....
11	54	565	154	76	27	85	166	45	.....
12	50	334	132	68	28	161	154	45	.....
13	50	294	116	64	29	142	124	60	.....
14	60	222	116	60	30	108	132	50	.....
15	68	206	102	57	31	124	147	.....	.....
16	72	190	85	57					

NOTE.—July 1–7 no record, paper not feeding properly on recorder. Discharge estimated at 60 million gallons per day.

Monthly discharge of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	161	50	71.3	110	2,210	6,780
August	1,010	90	213	330	6,590	20,300
September	2,140	45	249	385	7,470	22,900
October 1–19	436	34	80.6	125	1,530	4,700
The period	.....	.....	.....	.....	17,800	54,700

HILO BOARDING SCHOOL DITCH NEAR HILO, HAWAII.

LOCATION.—200 feet below upper crossing of county road at Piihonua and 3½ miles west of Hilo.

RECORDS AVAILABLE.—February 23, 1918, to November 30, 1919. Station discontinued February 26, 1920, but no records of value after November 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 during year, 1.20 feet at 6 a. m. October 21 (discharge, 7.8 million gallons per day or 12.1 second-feet); minimum stage recorded during year, 0.27 foot at 2 p. m. October 7 (discharge, 0.9 million gallons per day or 1.4 second-feet).

1918–1919: Maximum stage recorded, 1.25 feet at 6.45 p. m. April 24, 1919, weir overflowed (discharge, approximately 8.3 million gallons or 12.8 second-feet); minimum stage recorded, 0.04 foot at 5 p. m. July 12, 1918 (discharge, 0.05 million gallons per day or 0.08 second-feet).

DIVERSIONS.—Ditch diverts from Wailuku River. One small diversion above station used rarely for fluming cane.

REGULATION.—By spillways and check gate for diversion.

OBJECT OF STATION.—To determine amount of water diverted by ditch from Wailuku River, Territorial water.

UTILIZATION.—For irrigation and for domestic supply.

ACCURACY.—Stage-discharge relation permanent. Conditions at weir are good below a discharge of 2.2. million gallons per day. Above that point there is a slight velocity of approach. Operation of water-stage recorder satisfactory. Records good.

The following discharge measurement was made by Reid Jerman:

February 26, 1920: Gage height, 0.50 foot; discharge 3.5 second-feet or 2.2 million gallons per day.

Daily discharge, in million gallons, of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	1.6	1.4	3.1	1.1	2.1	16	1.6	2.0	1.9	1.6	2.4
2	1.8	1.4	3.0	1.0	1.9	17	1.6	2.0	1.7	1.6	2.1
3	1.6	1.4	3.5	1.0	1.7	18	1.6	2.0	1.7	1.5	1.9
4	1.5	1.4	3.0	1.0	1.5	19	1.5	1.9	1.7	1.5	1.7
5	1.4	1.6	3.0	1.0	1.4	20	1.4	1.8	1.6	3.0	2.6
6	1.3	1.7	2.9	1.0	1.5	21	1.1	1.7	1.5	6.0	2.7
7	1.2	1.7	2.8	1.5	1.5	22	1.5	1.7	1.5	4.1	2.5
8	1.2	1.7	2.7	2.1	1.2	23	1.2	2.0	1.5	3.8	2.4
9	1.1	2.2	2.6	1.8	1.2	24	1.1	2.1	1.4	4.0	2.3
10	1.2	2.7	2.5	1.7	1.2	25	1.2	2.0	1.3	3.5	2.3
11	1.4	2.5	2.5	1.5	1.2	26	1.2	1.9	1.2	3.0	2.2
12	1.4	2.3	2.4	1.4	1.2	27	1.1	2.0	1.1	3.0	2.2
13	1.4	2.2	2.3	1.3	1.9	28	1.5	2.1	1.1	3.0	2.5
14	1.4	2.0	2.2	1.2	3.8	29	1.7	2.0	1.4	2.7	2.4
15	1.6	2.0	2.1	1.3	3.5	30	1.5	2.0	1.2	2.4	2.3
						31	1.6	2.4	.....	2.4	.....

Monthly discharge of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.8	1.1	1.40	2.17	43.5	133
August	2.7	1.4	1.93	2.99	59.8	184
September	3.5	1.1	2.08	3.22	62.4	191
October	6.0	1.0	2.16	3.34	67.0	205
November	3.8	1.2	2.04	3.16	61.3	188
The period					294	901

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. The ditch diverts all ordinary run-off from headwaters of Waipio basin below Upper Hamakua ditch.

RECORDS AVAILABLE.—July 18, 1910, to June 30, 1920.

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.

ACCURACY.—Records good.

COOPERATION.—Records furnished by the Hawaiian Irrigation Co.

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

OBJECT OF STATION.—To determine amount of water diverted by ditch from the Waipio basin below the Upper Hamakua ditch.

Daily discharge, in million gallons, of Lower Hamakua ditch at main weir, near Kukuihaele, Hawaii, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	35.5	32.7	39.6	28.4	26.3	23.7	44.1	24.4	29.5	30.0	25.2	21.4
2	47.6	41.1	40.2	28.7	26.6	23.5	43.7	24.2	25.2	32.8	25.5	21.5
3	34.6	38.1	51.2	28.4	29.1	23.5	41.5	24.1	23.9	33.2	24.4	21.1
4	36.1	40.4	40.0	28.1	26.3	29.4	34.9	24.1	22.7	33.6	24.3	21.8
5	44.3	41.7	38.9	28.1	25.8	31.1	32.1	23.5	23.3	33.2	24.1	21.3
6	32.3	42.0	34.9	27.3	25.8	28.1	32.2	23.5	30.6	33.7	23.8	21.3
7	29.3	40.1	34.8	28.1	26.1	26.9	35.3	23.5	34.6	34.0	23.9	21.4
8	28.7	46.3	35.9	27.7	25.8	25.6	33.4	23.5	27.5	33.8	24.5	21.4
9	28.7	37.6	34.2	27.5	25.8	25.4	29.9	23.1	25.2	33.9	26.0	21.4
10	33.8	37.7	35.6	27.5	25.5	24.6	28.9	22.9	24.4	33.1	25.2	21.8
11	37.9	48.2	35.9	27.1	34.2	24.3	29.3	23.0	23.7	33.7	24.2	30.8
12	30.5	42.9	33.0	27.2	31.3	24.1	29.5	26.4	23.3	32.1	23.2	27.9
13	30.5	45.5	32.9	26.5	29.3	24.1	28.7	24.6	24.5	30.8	23.6	26.4
14	39.2	36.5	32.3	26.3	28.3	24.1	28.4	30.1	22.9	33.3	23.2	35.5
15	42.0	42.7	31.5	26.3	29.9	23.5	27.9	25.6	22.5	33.7	23.1	26.0
16	37.0	32.7	29.9	26.3	29.9	23.5	26.9	24.2	22.4	32.1	23.2	22.9
17	31.7	43.4	29.9	25.8	27.1	23.5	26.9	24.1	21.8	31.1	22.9	26.5
18	28.9	38.1	29.9	25.8	26.5	23.5	28.1	34.9	27.9	29.5	22.6	36.8
19	28.9	47.5	29.9	25.8	25.9	23.5	27.9	27.9	39.7	28.3	22.6	30.4
20	29.1	40.0	29.9	26.5	25.2	23.5	26.2	23.7	40.5	27.4	22.9	25.3
21	33.1	35.1	29.9	27.2	25.2	23.2	25.2	29.1	34.3	26.8	22.6	24.2
22	42.0	32.8	29.5	27.2	25.2	22.9	30.0	35.8	32.0	26.3	22.4	26.8
23	36.3	48.2	29.3	26.5	25.2	31.6	34.6	31.0	34.2	28.8	22.1	24.5
24	32.2	45.7	29.3	25.8	24.6	54.9	32.8	26.9	33.5	32.7	21.8	23.2
25	39.2	39.3	29.3	25.8	24.6	36.2	29.0	24.8	33.6	29.4	21.8	22.6
26	39.0	39.4	29.3	26.3	24.3	28.1	27.3	24.2	32.3	27.8	21.8	22.6
27	37.8	41.1	28.7	25.2	24.2	37.0	26.3	28.1	33.6	26.7	21.8	23.4
28	40.3	38.7	28.7	25.2	24.6	47.6	25.4	25.6	32.1	26.1	21.5	22.4
29	39.9	43.2	29.1	25.2	24.1	42.0	25.2	26.7	28.4	25.8	21.5	22.4
30	36.1	53.2	28.7	25.2	24.1	42.0	25.2	.....	28.3	25.5	21.5	30.7
31	42.0	50.3	.....	25.2	.....	42.0	24.9	.....	29.2	.....	21.3	.....

Monthly discharge of Lower Hamakua at main weir, near Kukuihaele, Hawaii, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	47.6	28.7	35.6	55.1	1,100	3,390
August	53.2	32.7	41.4	64.1	1,280	3,940
September	51.2	28.7	33.1	51.2	992	3,050
October	28.7	25.2	26.7	41.3	828	2,540
November	34.2	24.1	26.6	41.2	797	2,450
December	54.9	22.9	29.3	45.3	907	2,790
January	44.1	24.9	30.4	47.0	942	2,890
February	35.8	22.9	26.0	40.2	754	2,310
March	40.5	21.8	28.6	44.3	888	2,720
April	34.0	25.5	30.6	47.3	919	2,820
May	26.0	21.3	23.2	35.9	718	2,210
June	36.8	21.1	24.9	38.5	746	2,290
The year	54.9	21.1	29.7	46.0	10,900	33,400

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, about 1 mile south of Puualala or main weir.

RECORDS AVAILABLE.—January 1, 1913, to June 30, 1920. 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.

OBJECT OF STATION.—To determine amount of water diverted by ditch from Territorial lands.

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

ACCURACY.—Records good.

COOPERATION.—Records furnished by 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, 1920.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16.9	9.8	21.6	0.7	.....	.....	26.7	0.8	4.8	5.9	0.9	.....
2	33.7	30.8	16.7	.7	.....	.....	28.2	.5	3.3	22.2	.9	.....
3	9.3	22.7	22.4	.6	2.5	.....	8.7	.5	1.9	22.8	.7	.....
4	14.8	31.9	14.2	.6	3.0	.....	9.0	.5	1.3	35.7	.4	.....
5	19.0	23.1	13.7	.5	.....	.....	5.4	.4	1.3	35.5	.3	.....
6	8.7	20.4	7.5	.4	.....	.....	3.2	.4	27.5	26.8	.4	.....
7	7.2	22.6	4.1	.4	.....	.....	6.2	.3	22.8	29.7	.4	.....
8	4.3	21.2	9.0	.2	.....	.....	4.0	.2	6.8	51.3	1.3	.....
9	3.8	8.3	5.1	.....	.....	.....	3.0	.2	1.9	20.6	2.8	.....
10	18.7	21.1	6.6	.....	.....	.....	2.0	.2	2.3	7.3	1.3	1.4
11	14.5	37.7	7.6	.....	4.5	.....	4.8	.2	1.6	21.0	1.2	22.2
12	7.7	25.2	3.5	.....	8.1	.....	5.2	.3	1.3	11.7	1.2	9.1
13	6.7	27.7	2.6	.....	5.2	.....	4.2	.5	1.1	23.1	1.4	6.1
14	36.5	9.7	2.0	.....	5.0	.....	2.3	3.8	.9	42.3	1.1	26.3
15	32.7	32.1	1.9	.....	2.8	.....	1.6	1.6	.7	24.3	1.0	11.1
16	14.2	20.5	1.6	.....	2.8	.....	2.1	.8	.6	9.4	.9	4.1
17	7.2	22.2	1.5	.....	2.0	.....	2.5	1.3	.5	6.8	.9	11.4
18	6.1	21.6	1.3	.....	.....	.....	19.3	16.2	4.5	3.9	.8	15.0
19	4.5	31.4	1.2	.....	.....	.....	5.3	5.2	23.3	2.2	.8	10.6
20	2.7	13.6	1.2	.....	.....	.....	2.4	3.8	35.4	1.9	.7	3.6
21	21.5	7.0	1.1	.....	.....	.....	1.5	10.0	39.1	1.6	.6	3.1
22	28.4	6.9	.9	.....	.....	.....	24.1	19.8	14.6	1.4	.6	5.0
23	10.7	31.0	.9	.....	.....	.....	37.0	14.7	18.9	9.3	.6	2.7
24	5.6	26.9	.9	.....	.....	.....	17.9	10.4	32.9	11.4	.4	1.4
25	23.8	12.7	.8	.....	.....	.....	6.3	3.7	53.3	6.5	.4	.6
26	23.6	19.5	.8	.....	.....	.....	3.0	1.7	29.7	3.6	.4	.2
27	26.1	20.3	.8	.....	.....	18.5	2.2	6.1	10.3	2.3	.4	.1
28	33.8	15.6	.8	.....	.....	34.5	3.1	4.5	5.6	1.7	.4	.4
29	17.7	25.4	.8	.....	.....	40.2	1.1	3.5	3.0	1.7	.4	.5
30	21.1	32.2	.8	.....	.....	45.1	.7	.....	2.2	1.5	.3	9.2
31	22.5	27.3	.....	.....	.....	40.0	.8	.....	4.1	.....	.1	.....

NOTE.—No discharge on days for which discharge is not given.

Monthly discharge of Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, Hawaii, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	36.5	2.7	16.3	25.2	504	1,550
August	37.7	6.9	21.9	33.9	678	2,080
September	22.4	.8	5.13	7.94	154	472
October (8 days)	.7	.2	.51	.79	4.1	13
November (9 days)	8.1	2.0	3.99	6.17	35.9	110
December (5 days)	45.1	18.5	35.7	55.2	178	547
January	37.0	.7	7.86	12.2	244	748
February	19.8	.2	3.87	5.99	112	344
March	53.3	.5	11.5	17.8	358	1,090
April	51.3	1.4	14.8	22.9	445	1,360
May	2.8	.1	.77	1.19	24.0	73
June (21 days)	26.3	.1	6.86	10.6	144	442
The year (287 days)	53.3	.1	10.0	15.5	2,880	8,830

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 November 30, 1919. Station discontinued February 25, 1920, but no record of value after November 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 sharpcrested.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.40 feet at 9.40 p. m. August 31 (discharge, 64 million gallons per day or 99 second-feet); minimum stage recorded, ditch frequently dry.

1917–1920: 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) minimum stage recorded, ditch frequently dry.

DIVERSIONS.—Ditch diverts water from about 22 small streams.

REGULATION.—By head gates.

OBJECT OF STATION.—To determine amount of water diverted from Territorial lands.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 0.5 million gallons per day. Operation of water-stage recorder fairly satisfactory, but observer failed to note gage height when changing records after September 28, and neglected to keep recorder going from October 4 to December 26. Staff gage readings used September 28 to November 30. As ditch was dry during much of this time, records are good as far as published.

Discharge measurements of Kehena ditch near Kohala, Hawaii, during the year ending June 30, 1920.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 3	H. A. R. Austin	0.27	7.1	4.6
Feb. 25	J. E. Stewart	.13	1.9	1.25

Daily discharge, in million gallons, of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1920.

Day.	July.	Aug.	Sept.	Nov.	Day.	July.	Aug.	Sept.	Nov.
1	6.6	5.0	26	.....	16	5.5	15.8	.7	0.1
2	14.9	8.8	10.1	.....	17	2.2	17.7	.4	.....
3	4.5	8.4	22	.....	18	.8	10.1	.4	.....
4	5.5	18.4	8.1	.....	19	.4	22	.3	.....
5	8.1	11.8	7.5	.....	20	.8	7.8	.2	.....
6	3.0	10.4	4.2	.....	21	21	5.2	.2	.....
7	2.0	9.0	3.0	.....	22	30	4.0	.1	.....
8	1.1	9.8	9.6	.....	23	4.7	9.0	.05	.....
9	.7	4.5	4.2	.....	24	2.4	8.8	.05	.....
10	5.7	13.2	2.6	.....	25	24	4.2	.05	.....
11	5.8	21	2.6	.....	26	15.9	6.4	.....	.....
12	2.0	12.9	1.8	1.3	27	24	9.4	.....	.....
13	4.4	27	1.3	.7	28	23	7.8	.....	.....
14	28	6.6	.9	.4	29	10.2	26	.....	.....
15	22	29	.7	.2	30	14.0	25	.....	.....
					31	11.6	36	.....	.....

NOTE.—No flow Sept. 26 to Nov. 11 or Nov. 17–30.

Monthly discharge of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1920.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	30	0.4	9.83	15.2	305	935
August	36	4.0	13.3	20.6	411	1,270
September (25 days	26	.05	4.28	6.62	107	329
October	0	.0	0	0	0	0
November (5 days)	1.3	.1	.54	.84	2.7	8
The period					826	2,540

MISCELLANEOUS MEASUREMENTS.

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

Miscellaneous measurements in Hawaii, during the period ending June 30, 1920.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
Sept. 12	Kohala ditch	Above Honokane Gulch, near Kohala	0.86	11.3	7.3
1918.					
12	do	do	.85	11.8	7.6
Nov. 8	do	do	1.01	13.1	8.5
Jan. 3	do	do	2.38	35.5	22.8
1919.					
Mar. 25	do	do	2.22	33	21.4
May 3	do	do	1.34	18.5	12.0
July 5	do	do	1.37	19.9	12.9
Feb. 24	do	do	.76	9.0	5.8
1920.					
July 2	Left Branch of Holualoa	300 feet above reservoir, near Holualoa in Kona.		.03	.02
2	Right Branch of Holualoa	400 feet above reservoir		.02	.01
2	Small tributary	1 mile northeast of reservoir near Holualoa, in Kona.		.02	.01
2	do	do		.05	.03

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